The elbow: Review of anatomy and common pathology using different imaging techniques

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Authors: I. A. Matos-Rojas, C. Martin Hervás, M. Tapia Viñé, D. Bernabeu Taboada, R. Barco Laakso, S. Antuña Antuña; Madrid/ES
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Learning objectives

To illustrate the anatomy of the elbow.

To know the more common non-tumor and tumor pathology of the elbow using the different imaging techniques.
Background

The elbow is a joint complex and poorly studied despite the wide variety of pathology.

The pathology of the elbow is classified as: a) Congenital b) traumatic: fractures of the distal humerus, proximal radius and ulna, bone contusions, osteochondritis dissecans, loose bodies, dislocations, instabilities and ligament injuries and tendon c) inflammatory, degenerative, epicondylitis, epitrocleitis, synovitis, bursitis, arthritis, osteoarthritis d) Infectious septic arthritis and soft tissue infection e) tumor: benign and malignant by nature as neural, vascular, bone or soft tissue.

We will a review of the anatomy of the elbow joint, as well as the most common hospital pathology by different imaging techniques, and comparisons as appropriate radio-pathological correlation and surgical findings.
Imaging findings OR Procedure details

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ANATOMY OF THE ELBOW

The elbow is a complex synovial joint formed by the articulation between the humerus, radius and ulna, which allows to have wide ranges of motion with little instability.

It includes:
- Ulnar humeral joint
- Radio humerus join
- Radio ulnar joint proximal

Bone and joint anatomy

The distal humerus has a joint surface formed by the trochlea and capitulum, which articulate with the ulna and radius respectively Fig. 1 on page 14. It also has two peripheral epicondyles, medial and lateral, which are extra-articular. The condyle is almost spherical and allows rotation of the radial head. The medial epicondyle, the most prominent, serves as the origin of the anterior and posterior bands of the ulnar collateral ligament complex and more common superficial flexor tendon. The lateral epicondyle serves as insertion site for portions of the lateral collateral ligament complex, and more superficially common extensor tendon.

The distal humerus has three graves, which are sites for intraarticular accumulation of foreign bodies. Radial fossa is a shallow depression just proximal to the condyle. The coroinoidea fossa is more medial and the olecranon fossa is posterior.
The ulna proximal is formed by the confluence of the olecranon with the coronoid process, the greater sigmoid notch or trochlear, the lesser sigmoid notch or radial and ulnar tuberosity. The trochlear notch is a concave configuration in eight, which articulates with the humeral trochlea. The back surface of the olecranon serves as insertion of the triceps muscle and has predominantly fatty marrow with poor trabeculation that predisposes to fractures. The radial notch is a shallow cavity in the lateral aspect of the coronoid and radial head articulates and their edges are inserted the radial annular ligament Fig. 2 on page 14 . The coronoid process prevents posterior translation of the humero ulnar joint. On its surface is inserted the tendon of the brachialis muscle. In extreme flexion the coronoid enters into coronoid fossa of humerus and the olecranon in extreme extension enters into the olecranon fossa.

Important parts of the proximal radius are the head, neck and the radial tuberosity. The radial head is rounded with a central depression and articulates with the condyle. The radial tuberosity is distal to the neck and it is inserted the tendon of the biceps brachii.

**Capsular and ligamentous anatomy**

The joint capsule covering the three joints and is composed of two layers: a synovial and a fibrous. Between the two layers there are three fat pads, so they are intra-articular but extrasynovial, two anterior in the capitellum fossa and trochlear and one posterior in the olecranon fossa. When exists effusion there are mobilized forming the visible fat pad sign posterior and the sail sign before. The capsule is inserted above the humerus along the upper margin of the coronoid fossa and radial and ulna at the coronoid process. subsequently inserted above the olecranon fossa. Medially to the medial margin of the olecranon and trochlear notch and laterally along the lateral margin of the trochlear notch and the annular ligament. It consists of five recess, which are the anterior humeral recess, olecranon recess, the annular recess and the recess of the collateral ligaments.

Ligamentous structures of the elbow are focal condensation of the fibrous joint capsule, thus forming a complex capsular ligament. The ulnar collateral ligament originates from the lower edge of the medial epicondyle. The lateral collateral ligament complex originates from the lateral epicondyle and is in constant tension. The ulnar collateral ligament has three branches: anterior, posterior and transverse. The most important component is the long branch that arises from the lower margin of the medial epicondyle and go to ulnar tubercle Fig. 3 on page 15 . The posterior branch also originates from the inferior aspect of the medial epicondyle and inserts into the margin of the trochlear notch postrolateral forming the floor of the cubital tunnel. Transverse branch or Cooper’s ligament lies between the ulnar insertion of the anterior and posterior branches.

The lateral collateral ligament complex consists of the radial collateral ligament (RCL), the lateral ulnar collateral ligament (LUCL) and the annular ligament. The RLC and LUCL are contiguous in its origin in the lateral epicondyle. The annular ligament originates from
the anterior and posterior margins of the radial groove and surrounds the radial head Fig. 4 on page 16.

**Muscle Anatomy**

At the elbow there are four muscle groups:

Anterior group: Formed by the biceps and brachialis.
Posterior group: Here are the triceps and anconeus Fig. 5 on page 17.
Medial group: formed by the pronator teres and superficial flexor muscles, that are the flexor carpi radialis, the flexor palmaris longus, flexor carpi ulnaris and superficial flexor of the fingers.
Lateral group: subdivision into superficial, extensor and supinator. The superficial muscles of the lateral group are: brachioradialis and the extensor carpi radialis Fig. 6 on page 18. And the extensor muscles are the extensor carpi radialis brevis, extensor digitorum, extensor digitorum brevis and extensor carpi.

**FRACTURES**

**Fractures of the distal humerus:**

Distal humerus fractures are classified as extra-articular and intra-articular by Müller. The extra-articular fractures are divided into supracondylar, transcondylar, epitrochlear and epicondylar. Intra-articular fractures are classified as:
Type I Bicondylar fracture without comminution.
Type II. Bicondylar fracture with conminución articular
Type III Bicondylar fractures with conminución and supracondylar bone column.

On plain radiography and CT the fracture lines are seen as an oblique or transverse lucency. The fat pad sign on a lateral radiograph suggests it is an intracapsular fracture. The complications that may occur include neurovascular involvement, Volkmann ischemic contracture and bad consolidation.

**Fractures of the olecranon:**

It is caused by a fall directly on the elbow flexed.
It is classified into 3 types, the most frequent type II:
Type I: IA: oblique, extraarticular the tip of the acromion.
IB: transverse intraarticular, which originate in the proximal articular surface of the olecranon fossa.
Type II: transverse and oblique fractures that originate in the middle third of the olecranon articular surface. They are subdivided into IIA if they are unique and IIB if there is a double line of fracture.
Type III: This involves the distal third of the olecranon fossa and may be transverse or oblique.
It shows the sign of the fat pad. *

Fractures of the head of radio:

It is a common injury is usually caused by a fall with an outstretched arm. Mason was classified according to:
Type I: No displaced.
Type II: Fracture displacement marginal impaction include depression and angulation.
Type III: comminuted fractures with full involvement of the head.
If there is a dislocation of the elbow also could be considered a type IV.

Coronoid fracture:

The coronoid process is an important structure for stability of the elbow. It is associated with posterior elbow dislocation and predispose to recurrent posterior instability. Often common flexor and extensor tendons may rupture during a posterior dislocation. They are classified into three types according to Regan and Morrey:
Type I: small fracture that will not disrupt the joint.
Type II: involves less than 50% of the coronoid.
Type III: involves more than 50% of the coronoid and the prognosis is poor.

PATHOLOGY INFLAMMATORY AND DEGENERATIVE

Lateral epicondylitis or "tennis elbow":

It is a common disease and is ten times more common than medial epicondylitis. It is caused by repetitive forearm supination with the elbow extended. It affects both men and women in adulthood. It presents as pain in the lateral elbow and focal bulge in the common extensor tendon origin. The diagnosis is clinical but both the U.S. and CT can be useful when symptoms are unclear, to quantify the degree of injury, identify associated abnormalities and preoperative planning.
Ultrasound has a sensitivity of 80% and specificity of 50%. There is an enlarged tendon and heterogeneous is observed in the tendinosis and rupture if there are hypoechoic areas with discontinuity of the tendon Fig. 7 on page 19 Fig. 8 on page 20. There may be fluid and calcifications.
In the resonance is observed thickening and increased signal intensity in the common extensor tendon origin of the lateral epicondyle, in the T2-weighted sequences and proton density Fig. 9 on page 20. The short extensor carpi radialis is the one affected first. The partial-thickness ruptures are seen as an area of high signal that extends through thin tendon rupture and whether full-thickness is shown a signal intensity gap between the tendon proximal fluid and its insertion into the lateral epicondyle. May be associated with degeneration or rupture of the lateral collateral ligament complex.

**Medial epicondylitis or "golfer's elbow":**

It is seen in golfers or athletes doing releases. It manifests as medial elbow insidious pain, muscle weakness and bulging at the insertion site of the mass flexo-pronator. It's usually due to repetitive stress medial elbow during pronation of the arm and wrist in flexion. The pronator teres and flexor carpi radialis are the most commonly injured followed by the palmaris longus.

As with lateral epicondylitis, the diagnosis is clinical, but the various imaging techniques, such as the U.S. and MRI may be useful when the clinic is unclear, there is refractory to treatment, signs of instability medial ulnar neuritis.

Can be seen on ultrasound thickening, heterogeneous echogenicity with fluid collection adjacent intra tendinous calcifications Fig. 10 on page 22. The rupture is observed as hypoechoic region with adjacent tendon discontinuity.

Tendinosis of the common flexor tendon on MRI is seen as a thickening and increased signal intratendinous T2-weighted sequences and proton density. The rupture of this tendon is seen as a gap in signal intensity fluid between the tendon and the medial epicondyle or by the intermingling of fluid with tendons or muscle fibers. It could be associated with medial collateral ligament involvement and ulnar neuritis.

**Distal biceps tendon rupture:**

It is a rare entity. The distal tendon of the biceps attaches to the medial aspect of the radial tuberosity. The complete rupture of the distal biceps tendon is associated with a single traumatic event like trying to lift too much weight on one elbow flexed to 90°, while the partial tear can be seen without a history of trauma in a previously degenerated tendon usually occur 1 to 2 cm above the radial tuberosity, as this area rather hypovascular and histologic structural transition. When the break is complete the patient will feel breakage, severe pain and the defect can be felt.

An ultrasound will observe a muscle contraction produces a defect, which will be filled by fluid or hematoma when the break is complete. If it were a partial tear of the tendon will appear thick, wavy and hyperechoic.
The study of choice is MRI. We observe the proximal tendon thickening with increased signal intensity on T2 and STIR sequences and if the rupture is complete, you will appreciate the discontinuity of the tendon with or without retraction.

**Rheumatoid Arthritis**

It is a very common disease that affects 0.8% of the population. Usually seen in the age range 25 to 55 years, but can occur at any age. It's three times more common in women than in men. The diagnosis is mainly clinical and requires at least four of the seven criteria for a period longer than 6 weeks. Joint involvement is characterized by pain, increased soft tissue stiffness and limited movement. The elbow is usually committed, although most commonly affected joints are the proximal interphalangeal, metacarpophalangeal, knees, shoulders and ankles. Usually symmetrical. Rheumatoid nodules can be seen in areas of pressure or juxta-articular, and cause weakness and muscle atrophy.

On plain radiographs and CT scans can be seen in the joint narrowing, periarticular osteoporosis or regional, stroke, bone erosions and synovial cysts and joint destruction occurs late causing disability by limiting flexion and extension. Also on CT with contrast enhancement can be seen in the inflamed synovium. If synovial cysts are located in front of the ulna, they can compress adjacent nerves. Erosions are typical in the elbow to the head of the radius, ulna and coronoid process of the distal humerus. It also may be associated with olecranon bursitis.

MRI is the most sensitive in early stages. It's very good at detecting joint effusion, capsular distention, edema of bone marrow and by dynamic studies can assess disease activity. MRI reveals synovitis manifestations that include increased signal on fluid sensitive sequences such as T2 and STIR, and in later stages synovial hypertrophy can, suffer villous transformation and joint invasion, starting in bare areas or marginal joints. Also been reported that increased synovial volume and bone marrow edema can predict the location and subsequent development of bone erosions and used to assess therapeutic response. You can also identify tenosynovitis of the tendon sheaths of the extensor carpi ulnaris.

**Osteoartritis:**

It is a degenerative joint disease that affects both men and women. The most common locations are in the hip, the medial compartment of the knee, spine and hand. The typical findings are decreased joint space loss of articular cartilage, sclerosis, cyst formation, and osteophytosis.
Osteoarthritis of the elbow is typically seen in people over 40 years with a history of work or sports that predispose to overuse of the joint. They have rigidity, decreased mobility and pain. On plain radiographs and CT displayed osteophytes on the anterior margin of coronoid and posterior margin of the olecranon. The MRI shows loss of articular cartilage, chondromalacia and chondral defects in the posterolateral aspect of the trochlear notch. In later stages progresses causing degeneration that primarily affects the radial head and capitellum. May be associated with enthesitis at the junction of the triceps to the olecranon.

**Gout:**

It is a common metabolic disease that affects predominantly men with a range of 7 to 9: 1, compared to women. The age range is from 50 to 70 years. The metatarsophalangeal joint is almost invariably affected. Other common places are: hands, wrists, elbows and knees. Gout is characterized by hyperuricemia and crystal deposits of monosodium urato crystals in the joint space. It has three phase: Acute, subacute and chronic.

The findings on plain radiographs are well-defined erosions with sclerotic borders, soft tissue nodules (tophi) that can calcify if associated with renal failure.

The tofu is a soft tissue mass Fig. 11 on page 22 around a joint and may be associated with juxta or intraarticular bone erosion. This consists of crystals, hemosiderin, fibrous proteins and so the MRI signal intensity is variable. They are usually isointense to muscle on T1 and intermediate signal on T2, enhance intensely after gadolinium administration.

In the elbow is more common olecranon bursitis. Osteoporosis and joint space narrowing are present only in advanced stages of disease.

**Hemophilic arthropathy:**

It's caused by hemophilia type A and B, which produce recurrent bleeding in synovial joints such as knees, ankles, elbows and shoulders bilaterally.

Repeated bleeding causes inflammation, chronic articular fibrosis, siderosis and synovial hyperplasiaFig. 12 on page 23.

On MRI hypointense areas are seen on all sequences, especially in gradient echo due to the presence of hemosiderin. It also identifies synovial hyperplasiaFig. 13 on page 24.

**INFECTIOUS DISEASES**

**Septic arthritis:**
It's a radiological emergency occurs due to irreversible joint damage, if not diagnosed within the first 48 hours.

Septic arthritis of the elbow is seen in the 3 to 13% of all cases. The germ most frequently involved is S aureus (31.3% of all cases) followed by the gonococcus, S viridans, S pneumoniae, group B streptococci, and gram negative bacteria.

The susceptible population are children and elderly, immunocompromised patients, or chronic synovitis. Other predisposing factors include diabetes mellitus, corticosteroid therapy, debilitating diseases, joint prostheses and the use of intravenous drugs. The patient will experience pain, swelling, fever, and functional limitation. In the arthrocentesis will get a purulent fluid.

On plain radiographs and CT shows joint effusion, cartilage destruction and bone erosions. The MRI also appreciate subchondral edema and synovitis that is hypointense on T1 and hyperintense on T2.

**Osteomyelitis:**

It's the bone infection. It is classified as direct or hematogenous. Osteomyelitis secondary to direct inoculation is associated with direct trauma, open fracture or surgery, while hematogenous osteomyelitis is more common in children and elderly and predisposing factors are: immunosuppression, diabetes, sickle cell disease, intravenous drug use and alcoholism.

The symptoms are insidious in hematogenous osteomyelitis and local signs are prominent in osteomyelitis secondary to direct inoculation. The bones most often affected are the tibia, wrist, femur, ribs and the lumbar vertebral column.

Cultures are positive only 50% of patients, being the most frequently isolated germ S aureus.

Imaging techniques are quite useful in this condition because it can make the diagnosis with two of the four following criteria:
- Drainage of purulent material.
- Positive blood cultures or bone tissue.
- Clinic typical
- Radiological findings positive.

Plain film shows obvious changes from 14 to 21 day of the infection started. It can be seen osteopenia, periosteal reaction, bone destruction and permeative pattern Fig. 14 on page 25. In the CT can see soft tissue thickening with periosteal reaction, areas of low attenuation value and focal cortical erosions. The sign of fat fluid level on CT is highly specific for osteomyelitis.
MRI showed bone edema, periosteal elevation and focal cortical disruption. It is also useful in identifying abscess formation, involvement of adjacent soft tissue and areas of necrosis Fig. 15 on page 26 Fig. 16 on page 27 and Fig. 17 on page 28.

**TUMOR PATHOLOGY**

All tumors observed in the body can occur in the elbow.

*Neural sheath tumors:*

They are benign tumors and are divided into two groups: Schwannomas and neurofibromas. Both contain cells similar to Schwann cells. Each one of them is about 5% of all benign tumors of soft tissue and rarely become malignant transformation.

Schwannoma is commonly found in adults 20 to 60 years, with slight predominance in men. It is usually located in the lower extremities, upper trunk and retroperitoneum. It is a well-circumscribed mass, encapsulated, important contact with a nerve, but can be removed without causing side effects innervation Fig. 18 on page 29 Fig. 19 on page 31.

The schwannoma on MRI is isointense in T1 and slightly heterogeneous in T2 Fig. 20 on page 30 Fig. 21 on page 32.

Neurofibromas are solitary masses but may be multiple when associated with neurofibromatosis. These tumors have no capsule and originate from the nerve fascicles, so can not be separated without compromising the adjacent nerve. They are more frequent in the head, upper and lower extremities and torso Fig. 22 on page 33 Fig. 23 on page 34.

The target sign is described in neurogenic tumors, especially in neurofibromas and consist of a central area of low or intermediate signal intensity and hyperintense periphery in T2-weighted sequences; this is due to the central fibrous component and more myxoid tissue peripherally. The fascicular sign is the appearance of bundle branches observed in neurogenic tumors and normal nerves.

*Malignant tumors:*

Is observed both primary tumors and metastases Fig. 24 on page 35 Fig. 25 on page 36 in the elbow. Some malignant tumors Fig. 26 on page 37 Fig. 27 on page 38 Fig. 28 on page 38 most frequently observed are:
Malignant fibrous histiocytoma: is the most common soft tissue sarcoma and the more frequent in the thigh. These tumors can affect the subcutaneous tissue or spread to the fascia. Its subtypes are: myxoid, storiform, pleomorphic or inflammatory. The MRI shows a mass of intermediate signal on T1 and hyperintense and heterogeneous on T2 Fig. 29 on page 39. May calcify, or have cystic lesions.

10% of sarcomas are synovial sarcomas. They are observed in the extremities or adjacent to a joint. The average age of patients is 30 years. Subtypes are biphasic, monophasic epithelial, monophasic fibrous, and poorly differentiated. Calcifications were observed in 30% of cases. On MRI may have different types of signals because this tumor may have fluid, blood or septa Fig. 30 on page 40 Fig. 31 on page 41 Fig. 32 on page 42.

Bone lymphomas are rare malignant tumors and constitute less than 5% of them. It has a peak age of the 6th to the 7th decade of life. It is slightly more common in males. The femur is the bone most affected, but often follow in frequency the pelvis, humerus, bones of the head and neck and tibia. It is presents as a solitary mass metadiaphyseal with permeative pattern and periosteal reaction on plain radiographs. On MRI is hypointense on T1 and shows bright areas on T2 Fig. 33 on page 43. Peritumoral edema can coexist and reactive marrow changes; but, if any fibrosis exists, will be hypointense on T2 and enhances after contrast.
Fig. 1: Sagittal TC of elbow.

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**Fig. 2:** Fig. 2 Sagittal TC of elbow.

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**Fig. 3:** Fig 3. Coronal MRI of elbow.

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Fig. 4: Fig 4. Coronal MRI of elbow.

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**Fig. 5:** Fig 5. Axial T1 MRI of elbow.

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Fig. 6: Fig. 6. Axial MRI of elbow. Ulnar (U) and Radio (R).

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Fig. 7: Fig 7. Lateral epicondylitis ultrasound. 48 year old female patient with persistent pain right elbow. It is advisable to compare the ipsilateral
Fig. 8: Fig 8a. Lateral epicondylitis ultrasound. Common extensor tendon thickening (*) in the insertion of the lateral epicondyle (arrow) is globular, hypoechoic. Fig 8b. In the study Doppler hyperemia is seen (arrow) bordering the common extensor tendon.
**Fig. 9:** Fig 9. Lateral epicondylitis. 59 years female patient with persistent pain in his right elbow. Coronal fat suppressed T2 MRI, with shows marked thickening of the common extensor tendon (curved arrow) at its insertion on the medial epicondyle. Small piece of adjacent fluid (arrow).

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![Image of lateral epicondylitis MRI](image-url)

**Fig. 10:** Fig 10. Medial epicondylitis or "golfer's elbow". common flexor tendon with thickening and heterogeneous echogenicity on ultrasound.

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![Image of medial epicondylitis ultrasound](image-url)
Fig. 11: Gout. Patient with known history of gout, 78 year old, male. In ultrasound we see mass of 3.2 x 1.2 cm, encapsulated, solid, heterogeneous, predominantly hypoechoic without vascularization consistent with tophi.

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Fig. 12: Fig 12 Haemarthrosis. 57 years old male patient with known diagnosis of hemophilia and hemarthrosis of repetition. Plain radiography: disintegration and destruction of the elbow.

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**Fig. 13:** Fig 13. MRI shows a pseudotumoral mass (arrow) that exceeds the limits of the anterior compartment, also observed in the joint space synovial material, that is hypointense on T1 and T2 compatible with hemosiderin debris (*).
**Fig. 14:** Osteomyelitis. 24 year old male with pain in the anterolateral distal right arm, induration, and fever. The arm is swollen, with increased volume (*) . X ray also show periosteal reaction and permeative pattern (arrow).

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Fig. 15: Fig 15. Soft tissue abscess. Solid mass of soft tissue attached to the distal humerus in heterogeneous echogenicity and vascularity inside. Shifts within muscle bellies maintaining separation plane.

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Fig. 16: Axial and coronal T1 MRI. Around the humerus can be seen an area of high intensity and poorly defined bone edema.

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Fig. 17: Osteomyelitis. It's the same patient as in Fig. 15 and 16, three weeks later. New eco control biopsy of bone. No objective mass, but we see lymphadenopathy (red arrow), high flows, edematous muscle (blue arrows) and altered cortical bone (yellow arrows).

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**Fig. 18:** Fig 18. Schwannoma. 80 years old male patient with a tumor in his right elbow. Ultrasound shows a mass (*) of 8 x 4 cm, oval, well circumscribed, with peripheral capsule in intimate contact with the ulnar nerve (arrow), which is thickened proximally (curved arrow) and retrieves his caliber distally.

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Fig. 20: 61 years female patient with a mass in the distal right arm. MRI: fusiform mass 5x 3 x 3.4 cm, ulnar nerve dependent, hypointense on T1 (*) and highly hyperintense on T2 (arrow).

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**Fig. 19:** It is a heterogeneous mass, predominantly hypoechoic and prominent vascularity on Doppler study.

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Fig. 21: Fig 21. The surgeons were able to completely remove the tumor of the right elbow of the patient of fig. 18 -20. AP: Schwannoma.

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**Fig. 22:** Fig 22. Neurofibroma in patient with neurofibromatosis. In ultrasound there is a mass, heterogeneous, ill defined, without capsule.

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**Fig. 23:** Fig 23. Coronal MRI of elbow. The mass is heterogeneous, predominantly isodense with low signal areas.

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Fig. 24: Metastasis of breast cancer. Permeative pattern in the left humerus with lytic lesions.

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**Fig. 25:** Fig 25. Bone metastases of a gastric tumor, seen as a heterogeneous mass, predominantly hyperdense on axial STIR sequence of MRI that correlates with scintigraphy.

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**Fig. 26**: Fig 26 a. Leiomyosarcoma. 39 years old male patient with soft tissue mass (*) that has been growing steadily in recent months, with no neurological disorder. Fig 26 b. Simple RX: Mass (*) soft tissue approx 6 x 5 x 3 cm on the ulnar aspect of the elbow, nodular, is not fixed to deep planes.

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**Fig. 27**: Fig 27. Ultrasound: Mass solid, slightly heterogeneous hypoechoic (*), with central vascularization and in the periphery (arrow). AP: high-grade sarcoma malignidd (Leomiosarcoma).

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**Fig. 28:** Fig 28. Leiomyosarcoma. MRI: Mass (*) of soft tissue in the left elbow medial margin, which measures 6.4 x 3 x 3, 9 cm. It is hypointense on T1 and hyperintense on T2, with heterogeneous enhancement after gadolinium administration.

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Fig. 29: Malignant fibrous histiocytoma. 50 year old male patient with recurrent dermatofibrosarcoma protuberans with transformation to malignant fibrous histiocytoma. In MR shows a focal area (circles) hypointense on T1 (Fig 29 a) and hyperintense on T2 (Fig 29 b).

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**Fig. 30:** Fig 30. Synovial sarcoma near the elbow in a 35-year-old boy who has a mass with rapidly increased in size. Fig. 30 a. On ultrasound the mass is heterogeneous predominantly hypoechoic with some areas hyperechoic with posterior acoustic shadowing suggestive of calcification. Fig 30 b. Anteroposterior radiograph of the forearm shows a soft-tissue mass (*) below the elbow with focus of amorphous calcification superiorly (large arrow).

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**Fig. 31:** Fig 31. Synovial Sarcoma. Axial T1 weighted and Coronal T2 fat sat. MRI images reveal the soft-tissue mass (*) with intermediate signal intensity on the short TR image (Fig 31 a) and intermediate to high signal intensity on the long TR image (Fig 31 b)

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**Fig. 32:** Fig 32. AP: Synovial Sarcoma.

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**Fig. 33:** Fig 33. Bone lymphoma. Sagittal STIR image shows increased signal intensity primarily involving the olecranon (Fig 33 a) and the axial T1 image shows hypointensity.

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Conclusion

The imaging finding allows us appropriate diagnosis of the more common non-tumor and tumor pathology of the elbow.
Personal Information

I.A. Matos-Rojas, M. C. Martín - Hervás, M. Tapia - Viñé, D. Bernabeu- Taboada,
Department of radiology of La Paz University Hospital, Paseo de la Castellana 261
mail to: aracellymatos@yahoo.es

R. Barco - Laakso, S. Antuña - Antuña
Department of traumatology of La Paz University Hospital


5. Mark D. Murphey, MD # John F. Carroll, MD # Donald J. Flemming, CAPT, MC # Thomas L. Pope, MD # Francis H. Gannon, MD

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7. Disorders of the Distal Biceps Brachii Tendon


8. Superficial Soft Tissue Masses of the Extremities

Marcia F. Blacksin, MD # Doo-Hoe Ha, MD # Meera Hameed, MD

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