The diagnosis in our hands

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Learning objectives

There are many pathologies, except tumoral and traumatic causes, affecting hand and wrist. Several imaging techniques contribute normally, with clinical and laboratory probes, sufficient information for diagnostic orientation.

In this presentation images of several pathologies are compiled (arthropaties mainly), emphasizing differential characteristics of every one. Special attention focus on conventional RX so it is broadly available, normally first used, and nowadays valid technique, not only for the diagnosis but to control evolution and treatment response as well.
Background

In this presentation there are compiled images of several pathologies affecting hand and wrist, emphasizing differential characteristics of every one. We will approach to arthropathies mainly so they are so much frequent and also we will pay attention on X-ray so it is the main broadly used technique.

1. **OSTEOARTHRITIS (OA).**

It’s a very common disorder in clinical practice. Conventional Rx is normally the first technique employed and nothing else is necessary so it has characteristic radiographic picture.

- Typical distribution affecting trapezoid-metacarpian articulation (rhisarthrosis), proximal interphalangeal articulations (PIP) and distal interphalangeal articulations (DIP) (Fig. 1 and 2).

- Asymmetric joint space narrowing, subchondral bone sclerosis, osteophytes and subchondral cysts (Fig. 3).

- Erosive/inflammatory osteoarthritis is a particular subset of OA. Radiographically it is defined by subchondral central erosions and a distribution similar to OA. It affects almost exclusively medium age female and presents rapidly progression. As well as OA we can find sclerosis and marginal osteophytes (Fig.4 and 5).

2. **RHEUMATOID ARTHRITIS (RA).**

It is a common disease (0,5-1% of adult population). It is more frequent in women. Disease of unknown etiology is described as autoimmune sinovytis affecting articular sinovial, tendon sheaths and bursae, mainly in apendicular skeleton.

- Osteoporosis is unequivocal characteristic.

- Generally we find a bilateral, poliarticualr and relatively symmetric presentation. Homogeneous loss of articular space appears soon and marginal joint erosions with loss of the bare area cortex in radial side is typical (Fig.6).

- In the wrist erosions at the distal ulnar and ulnar process is typical. In the hand erosions appear at the second and third metacarpal-phalangeal (MCP) and third interphalangeal articulations (Fig7).

- As the arthritis progress luxations and subluxations in wrist and fingers may appear (ZIG-ZAG deformity is typical) and finally ankylosis (Fig.8).
- Although x-Ray is the most widely employed imaging technique, computed tomography (CT) and magnetic resonance (MR) or even ultrasonography are emerging as alternative techniques with more sensibility to detect early inflammatory and destructive manifestations (Fig.9 and 10).

3. **PSORIATIC ARTHRITIS (PA).**

PA normally affects patients with a large history of cutaneous psoriasis, especially those with nail changes. It is a destructive arthritis that can affect joints, and sites of tendon and ligaments attachment.

- Bone mineralization is preserved.

- "Sausage-like" swelling of entire digits is frequent (Fig. 11 and 12).

- Erosions are very characteristics. They predominate at the marginal areas ("mouse ears" shape)(Fig.13) but rapidly proceed centrally ("pencil-and cup" deformity)(Fig.14).

- Proliferation of bone is a striking feature that helps to differentiate from RA and we can find it as irregular excrescences, periostitis in the diaphyses ("ivory phalanx") (Fig.13) or at sites where tendons and ligaments insert on bones (Fig.15).

- Distribution may be mono, oligo or poliarticular, bilateral but asymmetrical. Interphalangeal joints are preferentially affected (Fig.16).

4. **GOUT.**

Gout is a disorder with deposition of monosodium urate crystals preferentially in the articular cartilage, sinovial, subchondral bone, capsular and periarticular tissues.

X-Ray findings occur late, because of that diagnosis is clinic. Imaging procedures are used to document extension, severity and treatment response.

Characteristics are:

- Soft-tissue nodular shape opacifications which can be calcificated or not (thophi) (Fig.17).

- Articular space is normally preserved.

- We can find erosions intra, pararticular or at distance (Fig.18). They are well-marginated and surrounded by sclerotic borders ("punched out" lesions) (Fig.19) and we can observe bone proliferation at the margin of the thophi or erosions ("overhanging edges") (Fig.20).

- Intraosseus and soft-tissue calcifications or chondrocalcinosis (fibrocartilage only).
- It is an arthropathy poliarticular, asymmetrical and predominant at interphalangeal joints and less at MCP (Fig.21).

5. **CPPD crystal deposition disease.**

Calcium pyrophosphate dihydrate crystals can be deposited within the cartilage (chondrocalcinosis), synovium, joint capsule, bursae and tendons. Chondrocalcinosis may involve hyaline cartilage (Fig.22) and fibrocartilage (Fig.23). In the synovium appears "cloud-like" shape (Fig.24). Tendinous calcifications are more lineal (Fig.25).

Chondrocalcinosis may be absent on X-ray in patients with arthropathy.

Simulate degenerative joint disease but:

- Different distribution target on radiocarpal articulation, triscaphe joint (Fig.26) and MCP joints (second and third above all).

- Prominent subchondral cysts and osteophytes (Fig.27).

- Scapholunate advanced collapse (SLAC), also seen after trauma, is the most common form of structural joint damage in the wrist.

- Computed tomography (CT) can demonstrate chondrocalcinosis but it is not frequently used (Fig.28).

6. **CALCIUM HYDROXYAPATITE CRYSTAL DEPOSITION DISEASE.**

Similar to DPPC deposition disease.

The most common calcium deposits occur in or around tendons (Fig.29)(Flexor carpi ulnaris is typical)(Fig.30), in MCP joints and fingers.

7. **HEMOCROMATOSIS.**

Tisular damage caused by iron and DPPC deposit (30% chondrocalcinosis associated).

Similar to DPPC arthropathy but:

- Predilection for MCP joints (wrist can be preserved), fourth and fifth fingers mainly.

- Prominent osteophytes which are seen along the radial border of the metacarpal head ("dropping osteophytes").

- Joints narrowing is more uniform, progressive and more prominent that DPPC disease (Fig.31).
8. **SYSTEMIC LUPUS ERYTHEMATOSUS.**

Connective tissue disorder involvement of multiple organ systems. It is much more common in women and in blacks.

Manifestations are multiple, but more frequent and specific:

- Poliarthritis (75-90%).

- Deforming nonerosive arthropathy (5-40%) (Fig.32). Symmetrical involvement of the interphalangeal joints with "swan-neck" and Boutomnière deformities (Fig.33).

- Soft tissue calcifications.

9. **SCLERODERMIA.**

Connective tissue disease affecting multiple systems. In conventional radiography of the hand we can find:

- Amorphous calcium deposits (Fig.34).

- Soft tissue and tufts of distal phalanx resorption produce finger remodelation (Fig35).

10. **RENAL OSTEODYSTROPHY.**

It is a general term employed for call the disorders in the musculoskeletal system as consequence of calcium and phosphate metabolism disturbances. Nowadays it's less frequent as patients receive an strict control. The manifestations we can find are:

- Secondary hyperparathyroidism consequences: with increased osteoclastic activity bone resorption happens at subperiostio (typical lace-like appearance) (Fig.36), intracortical, endostal, trabecular, subchondral, and subligamentous and subtendinous sites.

- Osteoporosis.

- Soft tissue calcifications. Prevalence has been increased in the last years. We can find them at different organs, soft tissues and arterial wall (also peripheral small arteries) (Fig.37 y 38).

- Other complications in patients with long-term hemodialysis and/or after renal transplantation.
**Fig. 1:** Typical distribution of osteoarthritis in the fingers affecting DIP and PIP articulations.

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Fig. 2: Trapezoid-metacarpal advanced OA with severe articular space narrowing, subchondral sclerosis and pronounced marginal osteophites.

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Fig. 3: Enlargement of Fig.1 focused on fingers where we can appreciate characteristics of OA: asymmetrical joint space narrowing, subchondral sclerosis, marginal osteophites and subchondral cyst at of fourth medium phalangeal head.

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**Fig. 4:** Comparative both hands X-Ray where we can appreciate OA distribution (bilateral and symmetric of trapezoid-metacarpal, DIP and PIP joints) but we can identify central erosions in affected articulations.

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Fig. 5: Enlarged detail of interphalangeal joints of Fig.4 where we can appreciate better central erosions.

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Fig. 6: Enlarged image focus on MCP articulations where we can observe periarticular soft tissue increase of density showing synovitis, uniform loss of joint space and erosions in the radial aspect of the metacarpian head.

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**Fig. 7:** Both hands X-Ray. At the first point characteristic RA osteoporosis. Soft tissue increase of density in ulnar aspect of both wrists and erosions in the both ulnar processes. Erosive arthropaty affecting MCP joints of second and third fingers. It makes evident bilateral and symmetric distribution of these findings.

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Fig. 8: RA advanced. Severe osteopenia, extensive affected carpal and MCP joints, akylosis and typical ZIG-ZAg deformity.

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**Fig. 9:** CT image in axial plane acquired at third metacarpal head where we can indentificate erosion at radial border not seen in X-Ray.

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**Fig. 10:** STIR sequence image, coronal and axial plane respectively, of the wrist in which we can observe tenosynovitis signs in the ulnar extensor tendon (abundant fluid in the sheath and increase in sign intensity of the tendon), as well as joint effusion in different articular spaces of the hand and wrist. MR offers high tisular contrast and can detect precocious inflammation or bone edema (that seems to be intermediate step between articular inflammation and erosion).

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Fig. 11: In the second finger (red arrow) we can observe diffuse soft tissue swelling causing "sausage-like" finger.

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**Fig. 12:** Enlarged image of Fig.10 where we can not only find soft tissue increase of density but erosions at DIP joint as well.

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Fig. 13: PIP joint of the third finger. Periarticular soft tissue increase of density (synovitis) and marginal erosions "mouse ears" shape."Ivory phalanx" in proximal phalange at the same finger.

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Fig. 14: "Pencil and cup" deformity of the DIP of the fifth finger. It is originated by intermediate phalange’s head tapering and distal phalange base widening.

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**Fig. 15:** Bone proliferation at erosions in the thumb causing irregular bordes.

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**Fig. 16:** Advanced PA. We can find all of the characteristics of PA: distribution affecting mainly PIP and DIP joints, "sausage finger" (third finger), "pencil and cup" deformity at DIP of fist and fifth fingers, typical erosions and bone proliferation.

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Fig. 17: Soft tissue nodular shape opacifications (red circles) at the radial aspect of PIP of the second and third fingers (tophi).

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**Fig. 18:** Articular space preserved and multiple periarticular, pararticular and at the distance erosions, with typical characteristics of gout. Periarticular soft tissue swelling parcially calcified.

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Fig. 19: Periarticular soft tissue increase of density with pararticular "pounched out" shape with sclerosing margins erosion typical of tophaceous arthropaty.

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**Fig. 20:** Advanced gout at the IP joint of the thumb. We can find "overhanging edges" at the distal phalanx.

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Fig. 21: Comparative X-Ray of both hands in patient with advanced tophaceous arthropaty. Firstly asymmetrical distribution, affecting mainly DIP and PIP joints. We can find as well tophi, characteristic erosions and "overhanging edges".

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**Fig. 22:** Hyaline cartilage calcification. Linear calcification parallel to the articular surface of the metacarpal head.

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**Fig. 23:** Triangular fibrocartilage calcification and calcifications at lunotriquetral joint.

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Fig. 24: Capsular calcifications. Cottony aspect calcifications at the radial aspect of MCP joint of the third finger (red circle).

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Fig. 25: Cotton-like calcifications (synovial) and more lineal (capsular-ligamentous) at the MCP joints.

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Fig. 26: Chondrocalcinosis at the triangular fibrocatilage and degenerative changes at triscaphe joint without similar rhizarthrosis. This degenerative changes distribution is suggestive of deposition disease or traumatic antecedent.

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Fig. 27: In this figure we can appreciate all characteristic signs of DPPC arthropaty. Chondrocalcinosis, unusual distribution of degenerative changes in wrist an hand with severe OA at MCP joints (second and third fingers) and periarticular calcifications as well.

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Fig. 28: CT images in sagital (left) and coronal (right) plane at the wrist. We can appreciate firstly calcium depositum in articular spaces (dorsal aspect of capito-lunate joint in the left image and scapho-lunate joint space in the right image) and ligamentous (lunotriquetral ligament in the right image). Radioscaphoid OA (right image), dorsal flexion of lunate and dorsal subluxation of capitate (left image). Large subchondral cysts in the radius and scaphoid.

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Fig. 29: Lineal calcifications closed to ulnar aspect of the ulnar apophysis and carpal (red circle).

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**Fig. 30:** Lineal calcifications adjacent to the palmar aspect of both pisiforms (flexor carpi ulnaris tendon).

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**Fig. 31:** Unusual distribution of degenerative changes (extensive radiocarpal and MCP affection). In the third MCP joint we can observe "dropping osteophytes" and large subchondral cysts in the metacarpal head.

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Fig. 32: Deforming nonerosive arthropaty with multiple luxations and subluxations which make difficult to study articular spaces.

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Fig. 33: Palmar luxation of the distal phalange and dorsal subluxation of medium phalange causing "swan-neck" deformity without erosive arthropaty associated.

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Fig. 34: Coarse calcifications at the soft fleshy part and palmar aspect of the thumb.

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Fig. 35: Reabsortive changes at soft tissue and tufts of distal phalanges of the hand with calcic deposit adjacent and pararticular at PIP joint.

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**Fig. 36:** Typical "lace-like" appearance of subperiosteal bone reabsorption at the radial borde of the cortical of the middle phalanx of the third finger. This site is point of reference not only for diagnosis but for monitoring the effect of treatment as well.

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Fig. 37: Patient with long standing chronic renal insufficiency. We can appreciate severe decrease of bone density, calcic deposits in soft tissues and severe and widespread vascular calcifications.

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**Fig. 38:** Enlarged image of Fig.37 at fourth finger in which we can observe better severe loss of bone density (cotical thinnes, and scant osseous trabeculation), calcifications at ulnar aspect and vascular calcifications affecting small vassels.

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Conventional radiography has been used to perform exams. More recent images have been acquired with digital system radiography (Axion Luminos DRF, Siemens Medical Systems).

We also present some images obtained with multidetector CT (Aquilion 64, Thosiba) and MR (1.5T) techniques.
Conclusion

A detailed analysis of manifestations, in many cases fairly characteristic, by means of different imaging techniques of diverse pathologies in the hand and wrist, gives the opportunity to the radiologist to carry out a high-probability diagnosis.

In spite of emergency of other imaging techniques with more sensitivity, conventional radiography (X-Ray) still represents an indispensable and very useful technique for diagnosis.
References


