Radiologists role in erosive osteoarthritis: facing the villain sibling

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Learning objectives

To present the radiological patterns of erosive osteoarthritis (EOA) in each imaging technique.

To describe our protocol adjustment according to the different monitoring scales.

Background

Erosive osteoarthritis was first described in 1966, with an incidence of 2.5% approximately in the general population and up to 15% in symptomatic arthritic patients. Like non-erosive osteoarthritis, a predilection for hands, mainly for the distal interphalangeal joints followed by proximal interphalangeal joints, with strong symmetrical involvement. Metacarpophalangeal joints are rarely affected. Epidemiological statistics predominate in middle-aged caucasian women. [4]

Clinically, it is characterized by a premature and abrupt onset with local inflammation causing disabling pain and marked functional limitation followed by an aggressive course. Even so, exclusively by clinical criteria distinguishing erosive from classic osteoarthritis may no result achievable. [7]

Great controversy around its definition has raised: Many scientific reports state that erosive osteoarthritis may not be a distinct entity but a more severe form of non-erosive osteoarthritis while others state that is a completely different disease. The presence of serology analysis and clinical evolution indicative of other entities are practically exclude erosive osteoarthritis. [3]

The presence of serology analysis and clinical evolution indicative of other entities are practically exclude erosive osteoarthritis. [5]

Its etiology remains unknown, with a complex cluster of predisposing factors: genetic and immunologic variants in conjunction with local inflammatory factors. No predisposing risk factors have been detected.

Findings and procedure details
X-RAY

X-ray continues to be the initial study in the suspicion of erosive osteoarthritis presenting with the classical osteoarthritic triad: joint space narrowing, osteophytes and sclerosis Fig. 1 on page 4.

Initially, concurrent to the inflammatory outbreak, swell and increase of the adjacent soft tissues is detected Fig. 2 on page 5. In a short period of time or even simultaneously, articular impingement, predominantly asymmetric, is noticed Fig. 2 on page 5. As the disease progresses, remodeling osteolytic injuries may develop: subchondral cysts and irregular subchondral plates become more evident Fig. 3 on page 5. Central erosions together with marginal osteophytes, conforming a "gull wing" or "saw-tooth" appearance, are considered to be almost pathognomonic of the disease Fig. 4 on page 6. Eventually, when inflammation decreases, articular destruction reveals misalignment changes and ankyloses Fig. 5 on page 7.

Likewise, lesions in different stages may coexist. Many scales are used to evaluate the progression of the morphologic changes (VERBRUGGEN, KALLMAN, KELLGREN-LAWRENCE and ALTMAN). Its main challenge is accurateness in discriminating the subtle variations. [1]

Ultrasound

Ultrasound is more sensible for delineating synovial enlargement, effusion and increased vascularity Fig. 6 on page 7 representing synovitis. This findings are expression of the underlying inflammatory changes and direct indicators of erosive osteoarthritis. Its main advantage is the precocity in detecting incipient inflammatory modifications and subclinical conditions. [10]

MRI

MRI plays an important role in emphasizing its outstanding inflammatory component and the articular damage evaluating the whole joint tissues involved: cartilage, bone, soft tissue as well as bone marrow. For this reason, in the future, it may become of great therapeutic interest as it may enable to asses monitoring after treatment implementation Fig. 7 on page 8 [13].

Since the first MRI score publication (OHOA-MRI, 2011), some concepts have been redefined and quantification methods have emerged. The main adjustments with regard to prior classifications were: flexor tendons and collateral ligaments damage was excluded in this classification due to lower incidence and reability and proximal and distal parts of the joint were evaluated in conjunction. [9] Furthermore, if a realiable reflection
of the clinical course could be achieved by imaging studies, they could play a leading role in monitoring techniques.[13]

The current scores (HOAMRIS, 2014) include assessment of synovitis Fig. 8 on page 9, erosive damage Fig. 9 on page 10, cysts Fig. 10 on page 11, osteophytes Fig. 11 on page 11, joint space narrowing Fig. 12 on page 12, misalignment and bone marrow lesions Fig. 13 on page 13 with strict definitions of each item and grading on a 0-3 scale (normal, mid, moderate and severe). The latest MRI classifications seem to reach precise diagnose criteria and high inter-reader correlation. [9]

In our institution the protocol includes coronal and axial images in T1 weighted images, T2 weighted sequences with fat suppression techniques and T1 weighted images before and after the administration of intravenous contrast agents. Metacarpophalangeal and proximal and distal interphalangeal articulations are studied. Our coil surface allows to include metacarpophalangeal joints; we still can't provide data to prove if this joints could also be involved in some patients with erosive osteoarthritis despite this entity is a priori known for its fairly preservation of metacarpophalangeal spaces.

**Images for this section:**
**Fig. 1:** Complete collapse of the joint space (dashed red line) and marginal osteophytes (red arrows) associating marked subchondral sclerosis (red arrowheads) in the second and third distal interphalangic articulations.

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**Fig. 2:** Important increase (dashed red line in the enlarged image) in perimeter of the soft tissue outlying the second distal phalange of the right hand equivalent of inflammatory initial osteoarthritic changes. In the same disposition, asymmetric articular joint space narrowing (small red double arrows) is identified with impingement in the media half.

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**Fig. 3:** Ovoid radiolucent lesions indicative of subchondral cysts (red arrows) in the distal third interphalangic articulation. Dashed red line emphasizes alignment disruption in the third and fourth distal interphalangic articulations, more evident in the latter.

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**Fig. 4:** Central erosions (red arrow) concurrently with marginal osteophytes (red arrowheads), emulating the distinctive "gull wing" (dashed red line) and the "saw-tooth" appearances (dashed red line).

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![Image of central erosions and osteophytes](image1.jpg)

**Fig. 5:** Complete ankyloses of the distal interphalangic articulation (red rectangle).

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**Fig. 6:** Distal interphalangeal joint ultrasound. In the first image, low echogenicity fluid in the synovial space denotes effusion (red dashed line). There is an increased Doppler activity indicating local inflammatory activity expressing underlying synovitis.

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Fig. 7: Axial T1-weighted images with fat suppression after the administration of contrast agents. Superior imaging corresponds to initial MRI exam: thickened and enhancing synovium of the second proximal interphalangic joint is seen (red circle) (accordant to a moderate grade). Inferior imaging corresponds to control exam a year after treatment implementation in the same patient: marked decrease in the enhancing pattern can be observed (red circle)(accordant to mild grade).

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**Fig. 8:** Axial T1-weighted with fat suppression images before and after the administration of gadolinium. There is an enlargement of the synovial that presents posterior enhancement (red arrows) that would correspond to moderate synovitis.

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**Fig. 9:** Coronal T1-weighted images presenting marked subchondral bone loss with sharply margined bone erosions and attritions in the proximal interphalangeal articulations (red arrows) and a typical "gull wing" morphology (dashed red line). This lesions would correspond to moderate erosive damage as 26-50% of the joint surface is affected.

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**Fig. 10:** Coronal and axial T2-weighted images with fat suppression techniques demonstrating a well-defined high signal intensity lesion corresponding to cyst in the head of the fifth metacarpal bone (red circles) of the right hand in a mild form (affecting <10% of bone volume).

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**Fig. 11:** X-ray and coronal T1-weighted MRI images of the left hand in the same patient affected with erosive osteoarthritis. Marked osteoarthritic changes can be observed with important predilection for distal interphalangeal joints. In the fourth and fifth interphalangeal joints, prominent osteophites are highlighted with red arrowheads.

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**Fig. 12:** Coronal T1-weighted images displaying severe space narrowing in the fifth proximal interphalangeal joint of the right hand in a severe form with integral cartilage loss and practically complete ankylosis of the articulation (red rectangle).

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![Image of Fig. 12](image1)

**Fig. 13:** Coronal T2-weighted images with fat suppression illustrating ill-defined high intensity signal in the third phalange (red circle) indicating edema. There is also an evident angulation and luxation of the joint indicative of severe malalignment (>20° angulation) (dashed red lines).

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Conclusion

Erosive osteoarthritis is defined, from a radiological point of view, by its predominantly inflammatory component. Due to its worst outcoming, a prompt diagnose and a treatment implementation is critical in the setting of erosive osteoarthritis.

Even though X-ray still persists to be the initial prove, MRI has gained ground in the last decades owing to its potential in detecting the inflammatory signs and bone marrow involvement.

MRI studies are developing in order to asses its relability in the diagnose and evolution of the disease. More studies are required to validate the existing scores as well as to monitor treatment response.

Personal information

References