Conventional Radiology in Rheumatoid Arthritis

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KEYWORDS

• Rheumatoid arthritis • Peripheral arthropathies • Conventional radiology • Inflammation

KEY POINTS

- Rheumatoid arthritis (RA) is a polyarticular disease with bilateral and symmetric distribution.
- Small joints of the feet, wrists, and hands are frequently involved, especially metacarpal phalangeal joint (MCP), metatarsal phalangeal joint (MTP), and proximal interphalangeal joint.
- Periarticular osteoporosis and soft tissue swelling are the earliest radiographic signs. Erosions in specific sites are key for the radiologic diagnostis of RA.
- In the clinical practice, conventional radiography is still the method of choice for the evaluation of progression RA disease.
- Advanced RA disease causes subluxation, deformities, ulnar deviation of the MCP, lateral deviation of the MTP, and carpal collapse.

INTRODUCTION

With the change of treatment paradigm and the introduction of early aggressive therapies including biologicals and chemotherapy, the face of rheumatoid arthritis (RA) has changed fundamentally within the last decade. The focus of imaging has shifted from visualizing joint and bone destruction to early diagnosis before joints and bones are severely affected. Imaging of soft tissue features and bone marrow changes using ultrasound (US) and magnetic resonance (MR) has result in a new field of clinical research, aimed at determining the not yet defined place of imaging techniques in early diagnosis. Therefore, has also change the place of conventional radiographs. In addition to the conventional role of radiography in visualizing late sequelae that can be used in (surgical) treatment planning, radiographs have remained important in differential diagnosis in patients presenting with possible RA, visualizing complications of RA, and also, albeit less so, in monitoring (absence) of progressive disease during treatment. The reasons are that radiographs are very useful in differentiating RA from other clinical entities, and that radiographs have high specificity, provide a quick overview of all symptomatic joints, and are low-cost procedures. Unfortunately, the interpretation of conventional radiology can be considered a vanishing art. This article mainly focuses on conventional radiology of the wrist and hand in RA, but briefly reviews other joints, such as the feet, hip, knees, or cervical spine.[1–3]

PATHOLOPHYSIOLOGY

Imaging reflects pathophysiology of RA. The advantage of MR over conventional radiography is that it allows detection of the entire spectrum

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of changes in all tissues that occur in RA. Synovium and probably bone marrow are the target tissues of RA. Therefore, synovial joints, synovial tendon sheaths, and bone marrow are the primary structures involved. Secondary cartilage, cortical bone, and ligaments can be involved. Cartilage covers bone surface except in a bare area at the insertion of the capsule. The contact between the synovium and the bone not protected by cartilage or cortex makes this area the more susceptible area for developing small bone erosions.

The synovium has 2 layers separated by fat: the outer layer is fibrous and is continued with the periosteum; the inner layer has A cells from bone marrow and B cells from mesenchymal origin that have capacity for phagocytosis. There is no cell layer between the synoviocytes and the joint cavity, making the interchange of synovial fluid easier. Synovial hyperplasia and hyperemia lead to production of various cytokines, such as tumor necrosis factors and interleukin. Together with infiltration of the synovial tissue by macrophages, fibroblasts, and lymphocytes, this starts the process of destruction of tissue, including bone, by increasing the production of enzymes, mainly metalloproteinases, that increase inflammation and bone destruction, thus starting and maintaining a vicious circle.[4]

DIAGNOSIS OF RHEUMATOID ARTHRITIS

RA is a chronic systemic inflammatory disease characterized by synovial hyperplasia, autoantibody production (rheumatoid factor [RF] and anticitrullinated protein antibody [ACCP]), secondary cartilage and bone destruction, and systemic disease. There are no accurate criteria to diagnosis early RA. Early diagnosis is based on a combination of clinical, serologic, and imaging tests (**Table 1**). Unfortunately, the diagnosis cannot be based only on serologic tests. RF is only positive in 50% of the patients during the first 6 months; when the disease is more advanced, it becomes positive in 85% of the patients. RF is unspecific and can be positive in other diseases, such as reactive arthritis, other autoimmune diseases, infections, or malignancies, as well as in healthy subjects. Newer antibodies, especially ACCP, have higher specificity for RA and also are related to a poorer prognosis. However, 20% of the patients remain seronegative, and early diagnosis is also based on clinical examination and imaging techniques. Moreover, RF and ACCP are not used to monitor the disease because once positive they remain so. Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) measure inflammation activity and are used to monitor the patient's disease.[2,3,5]

Table 1
2010 the American College of Rheumatology/ European League Against Rheumatism classification criteria for rheumatoid arthritis

Joint distribution	
1 large joint	0
2–10 large joints	1
1–3 small joints (with or without involvement of large joints)	2
4–10 small joints (with or without involvement of large joints)	3
>10 joints (at least 1 small joint)	5
Serology	
Negative RF and negative ACPA	0
Low-positive RF or low-positive ACPA	2
High-positive RF or high-positive ACPA	3
Symptom duration	
<6 wk	0
>6 wk	1
Acute phase reactants	
Normal CRP and normal ESR	0
Abnormal CPR or abnormal ESR	1

ACR/EULAR classification criteria are valid for a patients having at least 1 joint with definitive clinical synovitis not explained by another disease. Score of 6 or more is needed for a classification of definite diagnosis of RA.

Joint distribution refers to any swollen or tender joint excluding DIP of hand and feet, first MTP, and first CMC.

Small joints are MCP, PIP, MTP 2 to 5, thumb IP, and wrist.

Large joints are shoulder, elbow, hip, knees, and ankles.

Abbreviations: ACPA, anticitrullinated protein antibodies; CMC, carpometacarpal joint.

In 2010, the American College of Rheumatology (ACR) and the European League Against Rheumatism (EULAR) published updated criteria to classify the RA. However, classification is not the same as diagnosis. Classification serves to define more homogeneous populations especially for research purposes, whereas diagnosis aims at being correct at the level of the individual patient. Because of the difficulty in making an early diagnosis, this classification system is used also in the diagnostic process. Before this system can be used, the patient has to fulfill one entry criterion, that is, the presence of at least one small joint with clinical synovitis, with the exception of the first metacarpal-phalangeal joint, the first carpo-metacarpal, and all distal interphalangeal joints (DIPs). Thereafter, the 2010 ACR/EULAR criteria can be used. All types of imaging studies can be used to confirm