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Magnetic resonance imaging in juvenile idiopathic arthritis: Peculiarities of imaging children☆

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Abstract The term juvenile idiopathic arthritis (JIA) encompasses a heterogeneous group of arthritides with no known cause that begin before the age of 16 years and persist for at least 6 weeks. In recent decades, imaging techniques have acquired a fundamental role in the diagnosis and follow-up of JIA, owing to the unification of the different criteria for classification, which has strengthened the research in this field, and to the development of disease-modifying antirheumatic drugs. In this article, we briefly explain what JIA is. Moreover, we describe the role and limitations of plain-film radiography, ultrasonography, and magnetic resonance imaging (MRI). Finally, we review the MRI protocol and findings, and we comment on the differential diagnosis.

PALABRAS CLAVE
Articulaciones;
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Pediatría;
Imagen por resonancia magnética

Artritis idiopática juvenil, peculiaridades de la imagen en la edad pediátrica con especial interés en la resonancia magnética

Resumen El término artritis idiopática juvenil (AIJ) engloba a un grupo heterogéneo de artritis de origen desconocido, que persisten durante al menos 6 semanas y se inicia antes de los 16 años. En las últimas décadas las técnicas de imagen han adquirido un papel fundamental en el diagnóstico y seguimiento de esta entidad, debido a la unificación de los criterios de clasificación existentes, que han potenciado la investigación en este campo, y por el desarrollo de fármacos antirreumáticos modificadores de la enfermedad. En este artículo se explicará brevemente en qué consiste la AIJ, se describirán el papel y las limitaciones de la radiografía, de la ecografía y de la resonancia magnética (RM), se revisará el protocolo y los hallazgos de imagen por RM, y se comentará el diagnóstico diferencial.

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Introduction

Juvenile idiopathic arthritis (JIA) is the most common cause of rheumatic disease in children.[1] It includes a heterogeneous group of arthritis presenting before 16 years old and lasting at least 6 weeks.[2] It mainly affects the sinovial membrane whose persistent inflammation is associated with the appearance of cartilage damage and bone erosions.[3] Its etiology is unknown but includes probably genetic and environmental factors.[4] In adult patients with rheumatoid arthritis it has been proved that disease-modifying antirheumatic drugs (DMARD) can stop the progression of the disease and induce the occasional repair of erosions.[5,6] The verification that clinical parameters with poor markers of the inflammatory activity and articular damage has boosted the importance of images in the diagnosis and follow-up of patients with JIA.[7–10] Also the possibility of finding and being able to fight acute inflammations has favored the use of ultrasound–especially magnetic resonance (MR) facing simple radiology.

The International League of Associations of Rheumatology (ILAR) developed a classification aimed at unifying nomenclature and diagnostic criteria and establish homogeneous groups of kids with chronic arthritis. Such classification recognizes seven (7) entities according to the peculiarities they show during the first 6 moths after diagnosis[2]:

1. Systemic arthritis is the of one or more joints affected with or after a 2-week fever measured at least in 3 consecutive days. It needs to be accompanied by one or more of the following findings: erythematous rash, general adenopathies, hepatomegalia or splenomegalia and serositis.
2. Oligoarthritis is the affectation of 1–4 joints 6 months after diagnosis. Persistent subtype does not affect over 4 joints during the course of the disease and the extended form affects more than 4 joints 6 months after diagnosis.
3. Poliarthritis with a negative factor affects 5 or more joints 6 months after diagnosis being the rheumatoid factor test negative.
4. Poliarthritis with a positive rheumatoid factor also affects 5 or more joints during the first 6 months being the rheumatoid factor test is positive in at least 2 determinations done with at least 3 months of difference during the first 6 months.
5. Psoriatic arthritis is characterized by arthritis and psoriasis, or arthritis and at least 2 of the following features: dactilitis, nail pitting, or onicolisis, or psoriasis in a first-degree relative.
6. The subtype enthesitis associated with arthritis is characterized by arthritis and enthesitis, or arthritis or enthesites associated with at least 2 of the following findings: sacroiliac joint inflammation and/or inflammatory pain at the lumbosacral area, antigen HLA-B27, beginning of arthritis in a kid over 6 years, acute anterior uveitis or history of ankylosing spondylitis, enthesitis associated with arthritis, sacroiliitis with bowel inflammatory disease, Reiter syndrome or anterior uveitis in a first-degree relative.
7. Undifferentiated arthritis associated with that arthritis of unknown origin for more than 6 weeks criteria not matching the criteria of any categories or on the contrary matching the diagnostic criteria of 2 or more different categories.

Goal of this article is to review the role of images in diagnosis and follow-up of JIA with special attention to unique aspects of child age.

Image techniques

During these last few years radiology has gained major role managing JIA. It allows us to diagnose and establish how serious the disease is, and it also helps for the early identification of complications, and to monitor the evolution and therapeutic treatment of patients. Disease-modifying antirheumatic drugs (DMARD) have soared on demand of image techniques sensitive to acute inflammatory changes that allow for the early diagnosis and monitoring of therapeutic response.[11] This is why radiologists should be familiar to the usefulness and limitations of the various techniques of available images.

Simple X-ray

Simple X-ray is a quick, available, cheap, easy to use technique. It helps you preclude other causes of articular pain and lets you know about the basal state of the joint.[12] It is also important to evaluate bone maturity and limb-length discrepancies. But it will not allow you to evaluate acute inflammatory changes or see the cartilage which at pediatric age is a very important component of the skeletal system.[13,14] Similarly it is less sensitive than other image modalities when assessing chronic structural changes,[15] uses ionizing radiation and inter-observer variability in its interpretation is really high.[16]

It can be normal at early stages of the disease.[14] The earliest radiological changes such as the increase of periarticular soft tissues, periarticular osteopenia, growth of epifisaria and periostitis show the hyper-revascularization and inflammatory response that usually accompany sinovial hypertrophy.[12,17] At this stage especially when diagnosis is still unknown you have to watch out not to take juxta-articular osteopenia for the radiolucent metaphyseal bands you can sometimes see in children with leukemia. In advanced stages of the disease, persistent sinovial proliferation can condition a certain disfunction of cartilage and subchondral bone expressed by a decrease of articular space, juxta-articular erosions and ankylosis.[18]

Also the chronic inflammation of the joint, atrophy for disuse and prolonged treatment with corticoids can condition diffuse osteopenia and the development of compression fractures especially vertebral and at the load epiphysis level of lower limbs.[12,13,19]

Ultrasound

Ultrasound is a cheap, accessible technique for the evaluation of joints in real time. It does not require sedation