Reumatol Clin. 2009;**5(1)**:40-43

Reumatología Clínica

www.reumatologiaclinica.org

Continuing Medical Education

Sacroiliac Joints: Osteoarthritis or Arthritis[a]

Ana Isabel García Díez, * Xavier Tomás Batllé, Jaume Pomés Talló, and Montserrat del Amo Conill

Departamento de Radiología, Centro de Diagnóstico por la Imagen Clínic (CDIC), Hospital Clínic, Barcelona, Spain

ARTICLE INFO

Article history:
Received January 31, 2008
Accepted February 7, 2008

Keywords:
Osteoarthritis
Arthritis
Sacroiliac joint
Diagnostic imaging

ABSTRACT

One of the most challenging aspects of treating the sacroiliac joint (SIJ) pain is the complexity of diagnosis. Imaging methods have gained importance for the diagnosis of SIJ diseases. CT and MR exams had equal efficacy superior to radiography in staging structural changes in the SIJ due to osteoarthritis or sacroiliitis. The diagnosis of spondyloarthropaty can be delayed for several years using certain radiography studies. MR imaging reveal early cartilage changes and active inflammatory changes in the subchondral bone and surrounding ligaments in spondyloarthropaties, as well as subperiosteal and transcapsular yuxtaarticular infiltrations characteristic of septic sacroiliitis, which could not be found by either CT of radiography. T1-WI with fat suppression (FS) and STIR images improve the demonstration of erosions and inflammatory changes respectively, on MR studies. Additional T1-FS after IV contrast has proven valuable in demonstrating the extension of inflammatory changes and abscesses in septic sacroiliitis, and in spondyloartropaties may be useful although this is debatable. Scintigraphy gives high sensibility only in early inflammatory changes and low specificity for the diagnosis of sacroiliitis due to high bone turnover in the SIJ, although specific radioprobes are useful in confirming the septic etiology and evaluating additional foci. This complex joint of very limited mobility shows a lot of structural variations and some anatomical degenerative changes due to age, which are necessary to know to an adequate image interpretation and diagnosis of disease.

Sacroilíacas: artrosis o artritis

Palabras clave:
Degeneración
Artritis
Articulación sacroilíaca
Diagnóstico por la imagen

RESUMEN

Uno de los principales retos en el tratamiento del dolor de la articulación sacroilíaca (AS) es llegar a un adecuado diagnóstico. Las técnicas por imagen han ganado un gran protagonismo en este aspecto. La tomografía computarizada (TC) y la resonancia magnética (RM) presentan igual eficacia en la detección de cambios estructurales en artrosis y artritis, y ambas son muy superiores a la radiografía simple, la cual puede retrasar el diagnóstico. Además, la RM puede mostrar incipientes cambios en el cartílago y actividad inflamatoria aguda en el hueso subcondral y ligamentos en las espondiloartropatías y las infiltraciones subperiósticas y transcapsulares periarticulares características de la artritis séptica, que no pueden detectarse por TC ni en imágenes radiográficas. Las secuencias potenciadas en T1 con supresión de la grasa y STIR en los estudios de RM son más sensibles para demostrar erosiones y cambios inflamatorios, respectivamente. Las imágenes potenciadas en T1 con supresión de la grasa y tras la administración intravenosa de contraste en las artritis sépticas definirán la extensión de los cambios infecciosos y diferenciarán abscesos; en las espondiloartropatías pueden ser útiles, aunque su uso es controvertido. La gammagrafía ósea es sensible en artritis activas de inicio, pero poco específica debido a la actividad normal de esta articulación, aunque con radiofármacos específicos es útil para confirmar una artritis séptica y descartar otros focos infecciosos. Esta compleja articulación de movilidad limitada muestra un amplio espectro de variaciones y cambios degenerativos a lo largo de la vida, y es necesario conocerlas para facilitar la interpretación de las imágenes y realizar un adecuado diagnóstico de enfermedad.

[a] Note: Section accreditation provided by SEAFORMEC with 11.9 credits. Please consult the questions of each article at: http://www.reumatologiaclinica.org

* Corresponding author.
E-mail address: aigarcia@clinic.ub.es (A.I. García Díez).

1699-258X/$ - see front matter

Introduction

It is estimated that low back pain is originated in the sacroiliac joint in 15%-20% of cases. The particular configuration and anatomy of this joint determines the morphologic transformation it will suffer throughout the lifetime of the patient and that may produce degeneration in which extrinsic factors such as trauma or stress (scoliosis, asymmetry, past spinal surgery, pregnancy, parturition, etc) play a role, or intrinsic diseases of an inflammatory or infectious nature (spondyloarthropathies and, less frequently, septic arthritis) and, with a greater frequency, tumors.[1] One of the main challenges in the treatment of pain originating in the sacroiliac joint (SI) is reaching an adequate diagnosis. The clinical parameters and the physical examination are frequently unspecific and scarcely sensitive; the diagnostic imaging tests are a good auxiliary for the diagnosis of the etiology of pain. One of the most important keys to achieving maximum effectiveness with these tests and avoiding mistakes is having the knowledge on the advantages and limitations of each one of the imaging methods and familiarity with the anatomical variations and normal changes that this joint suffers throughout life.

Anatomic Review

The SI is one of the largest axial joints and is constituted in its superior and dorsal region by a syndesmosis, a fibrous joint in which the joint surfaces are bound by interosseous ligaments, and a cartilaginous zone, classically defined as synovial, extending through the 2 lower thirds of the ventral zone, which in reality has the structure of a symphysis with hyaline cartilage firmly bound to the adjacent bone by fibrous tissue. Only the distal third of the transition zone between the dorsal and ventral portions, and confined to the iliac bone, presents a structure of synovial characteristics. Hyaline cartilage in the anterior joint zone is thicker on the sacral side than on the iliac. This anatomical data could explain why changes start and are more profuse on the iliac side of the joint, while in rheumatoid arthritis they are poorly expressed in the SI joint and why inflammatory changes in spondyloarthropathies show similar characteristics to those occurring on a symphysis.[2,3] Joint stability is provided by the intrinsic ligaments (sacroiliac ligament in the ventral region and interosseous ligament in the dorsal region) and extrinsic, fibrous extensions from the adjacent muscles which contribute to capsular reinforcement.[2,4]

Physiological Changes and Variants

The joint surface varies between individuals and shows morphological changes on its surface starting at puberty.[4] In all joints, starting around 50 years of age, some sort of degeneration is seen, and these changes are more profuse in women than in men of the same age, progressing faster in multiparous women than in nulliparous ones. No relation has been found between the frequency of degenerative changes and the body mass index.[5] The most frequent changes are sclerosis, osteophites, and loss of joint space (considering a mean joint space distance, in normal subjects under 40 years of age, of 2.49 [0.66] mm, and 1.47 [0.21] mm in older individuals).[5,6] It has also been shown that age influences the observed anatomical variations. The most frequent is an accessory sacroiliac joint (17%-19%), an iliosacral complex (5.8%-9.5%), the bipartite iliac bone (4.1%-7.8%), a semicircular defect of the joint surfaces (3.7%-4.8%), a half-moon joint surface (3.5%), or ossification centers in the sacral rings (1%). Most are commonly observed in patients over 60, and some are more frequent in women (the first of the variants in women with over 3 children) and obese patients.[6,7] Knowing these variants is fundamental in order to avoid mistaken diagnoses.

Distinguishing Signs of Osteoarthritis and Arthritis

Both groups can present common structural changes in a sacroiliac joint when there has been previous inflammatory events, such as subchondral sclerosis, joint impingement (which will support the diagnosis of arthritis when the joint is narrower than 2 mm in patients under 40) and ankylosis. Osteophytes, pneumocysts, and intra-articular emptiness are common of osteoarthritis, although an arthritis without active inflammation can present intra-articular emptiness and would be a sign of inactivity. Erosions are typical of the chronic morphological changes of arthritis. All of these changes can be seen in the simple x-ray (Rx), computed tomography (CT), and magnetic resonance (MR), although with similar sensitivity between the latter 2 and significantly higher in both cases with respect to Rx (Figure 1).

On the other hand, when acute inflammatory signs are present in a spondyloarthropathy or infectious arthritis, the only test with enough sensitivity and specificity to detect inflammation is MR. Other tests, such as bone gammagram, are less exact, having an adequate sensitivity in the initial phase but low specificity, due to the physiologic uptake that occurs in joints, although if it is done with galium-67 or marked leukocytes, it is very useful in infectious arthritis and even allows the discrimination of other infectious foci.[8-10]

An infectious arthritis can have some common signs with inflammatory arthritis in MR, such as erosions and the shift in signal with intra-articular and subchondral bone uptake; however, it will present other very unspecific signs, allowing to differentiate it, such as the extension of these inflammatory signs and the uptake of contrast material by adjacent soft tissue (anterior and/or posterior subperiostic infiltration, and transcapsular infiltration to periarticular muscles) with the probability of developing abscesses and bone sequestration if there is a high degree of joint destruction.[11] Another of the characteristics of septic arthritis is the unilateral nature of the affection, although this is neither an excluding nor pathognomonic sign (Figure 2).

Figure 1. Oblique coronal image in T2 with fat saturation, in which chronic structural changes of sacroilitis (erosions and a reduction on joint space) can be observed, as well as signal change in the subchondral bone due to inflammatory activity. In the computed tomography of this patient, the same bilateral structural changes were seen, but the x-ray only showed chronic structural changes in the left sacroiliac joint.

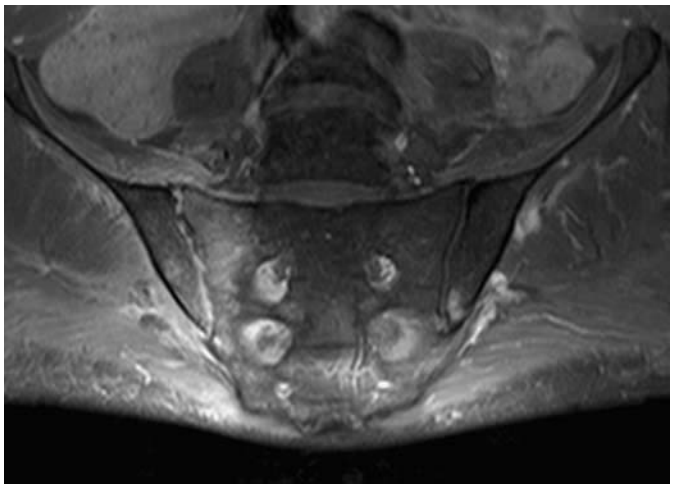

Figure 2. Patient with endocarditis and a probable septic sacroilitis. Oblique coronal image in T1 potentiated sequence with fat saturation after the intravenous administration of gadolinium. Intra-articular and right sacroiliac subchondral uptake is seen, as well as small subchondral foci in the left sacroiliac joint. The alteration in the signal of periarticular soft-tissue stands out, with the differentiation of a small collection (abscess) in the right gluteus muscle. The great affection of periarticular soft-tissue indicates infectious disease.

Proposal of Imaging Techniques to Be Performed

The x-ray is the cheapest and most accessible method, but it is incapable of identifying early structural changes and it is not specific for the evaluation of inflammatory activity signs. CT is a sensitive technique useful for the detection of morphologic changes in initial arthritis, but it is not so specific when one wishes to rule out inflammatory activity and, in addition, radiates the patient, something one must keep in mind when indicating it in young patients. MR is the most complete method, with a sensitivity similar to that of CT and with a good specificity to evaluate inflammation or infection. However, care must be taken with claustrophobic patients, patients with pacemakers of prosthetic implants.

In the decision of one over the other, parameters such as the time since onset of sacroilitis, the suspicion of infectious or inflammatory activity, or the age of the patient must be accounted for (Table).

Quality of Our Imaging Tests

One of the fundamental points in reaching an adequate diagnosis is obtaining the studies with an optimal quality; if not, our sensitivity and specificity will be reduced.

In x-rays it is fundamental to obtain an image in which the emitting x ray tube is directed caudocranially, in order to de-project the sacroilliac joints. The obtention of images lying dow in pronation or in a oblique posteroanterior right and left position, allow us to obtain a tangential projection of the joint, avoiding the image of unfolding and improving sensitivity in detecting structural lesions.

In an examination with CT, coronal and oblique axial sections must be performed, following the axis of the sacrum, with technical characteristics of bone acquisition and/or reconstruction.

In a MR examination, the same imaging planes as in CT will be obtained, and one must include a potentiated T1 sequence and, especially, a T2 with fat saturation or a STIR sequence, being both very sensitive to inflammation, although the latter is preferable due to its increased sensitivity.[2,12] The inclusion of a T1 potentiated sequence with fat saturation offers a good contrast between cartilage and subchondral bone, and is very sensitive to detect erosions.[9] The obtention of T1 potentiated images with fat saturation after the administration of an intravenous bolus of gadolinium allows for the differentiation of edema with inflammatory or infectious changes, which show uptake. It has been observed that, with the use of gadolinium, more lesions are detected, although in some studies, the administration of contrast the final diagnosis of the patients is not modified.[8,12] Additionally, it must be considered that in degenerative lesions of the cartilage and subchondral bone, there can be an increase in contrast and, apart from its cost and the fact that it is not exempt of adverse effects, make its use debated in the evaluation of activity in inflammatory arthropathies. In general, MR is the most useful method for detecting inflammatory changes in a precocious way.

Table
Appropriate Imaging Techniques According to the Type of Arthritis

Arthritis	Phase	Imaging Technique	Observations
Inflammatory	Initial, with pain	MR + Rx	Rx if not taken previously
	Initial, without pain	MR or CT	MR in young patients
	Progressed, without pain	Rx	
	Progressed, with pain	MR + Rx	Rx if not taken previously
Infectious		MR	Soft-tissue evaluation
		GG, ^{67}Ga, or leukocytes	Rule out other foci
	FNA-CT	Etiologic diagnosis	

Abbreviations: CT, computed tomography; FNA, fine needle aspiration; GG, gammagram; MR, magnetic resonance; Rx, simple x-ray..

Other Applications

An extended clinical application is the use of CT as a guiding tool for diagnostic aspiration in septic arthritis to determine the agent causing the infection or to perform therapeutic infiltrations. One study, in which therapeutic infiltrations under echographic control were performed, showed some interesting results.[13]

Dynamic MR is a technique that is performed by administering an intravenous bolus of gadolinium in order to obtain serial images during the injection, managing to generate a timed contrast uptake intensity curve. It has been observed that there is a correlation between the degree of uptake and inflammatory cellularity in sacroiliac joints, making it an interesting tool to supervise pharmacologic treatment in inflammatory arthropathies[14]; however, this method is difficult to apply in the daily practice and reproducing the findings can be difficult to achieve.

Doppler echography with and without intravenous contrast is proposed as an interesting method in the evaluation of inflammatory activity and especially in the supervision of response to treatment, although it is limited by anatomical factors: only the most posterior part of the joint can be studied and visualization of vascular structures in the joint line is not easy.[15-17]

Conclusions

It is important to know the anatomical characteristics of the SI joint in order to understand the physiologic and pathologic changes that can occur, as well as the variants, to avoid false diagnoses in the imaging tests. An adequate indication for the imaging test is fundamental in order to establish a diagnosis, and in this decision one must take into account the possibility of septic or inflammatory arthritis and, in the latter case, if its the first episode or has progressed, or if there is a suspicion of activity.

References

1. Cohen SP. Sacroiliac joint pain: A comprehensive review of anatomy, diagnosis, and treatment. Anesth Analg. 2005;101:1440-53.

2. Pugakka KB, Melsen F, Jurik AG, Boel LW, Vestergy A, Egund N. MR imaging of the normal sacroiliac joint with correlation to histology. Skeletal Radiol. 2004;33:1528.
3. Muche B, Bollow M, François RJ, Sieper J, Hamm B, Braun J. Anatomic structures involved in early- and late-stage sacroiliitis in spondylarthritis. Arthritis Rheum. 2003;48:1374-84.
4. Walker JM. The sacroiliac joint: a critical review. Phys Ther. 1992;72:903-16.
5. Shibata Y, Shirai Y, Miyamoto M. The aging process in the sacroiliac joint: helical computed tomography análisis. J Orthop Sci. 2002;7:12-8.
6. Demir M, Mavi A, Gümüsburun E, Bayram M, Gürsoy S. Anatomical variations with joint space measurements on CT. Kobe J Med Sci. 2007;53:209-17.
7. Prassopoulos PK, Faflia CP, Voloudaki AE, Gourtsoyiannis NC. Sacroiliac joints: anatomical variants on CT. J Comput Assist Tomogr. 1999;23:323-7.
8. Yu W, Feng F, Dion E, Yang H, Jiang M, Genant HK. Comparison of radiography, computed tomography and magnetic resonance imaging in the detection of sacroiliitis accompanying ankylosing spondylitis. Skeletal Radiol. 1998;27:311-20.
9. Puhakka KB, Jurik AG, Egund N, Schiottz-Christensen B, Stengaard-Pedersen K, Van Overeem Hansen G, et al. Imaging of sacroiliitis in early seronegative spondyloarthropathy. Acta Radiologica. 2003;44:218-29.
10. Inanc N, Atagündüz P, Sen F, Biren T, Turoglu HT, Direskeneli H. The investigation of sacroiliitis with different imaging techniques in spondyloarthropaties. Rheumatol Int. 2005;25:591-4.
11. Stürzenbecher A, Braun J, Paris S, Biedermann T, Hamm B, Bollow M. MR imaging of septic sacroiliitis. Skeletal Radiol. 2000;29:439-46.
12. Bredella MA, Steinbach LS, Morgan S, Ward M, Davis JC. MRI of the sacroiliac joints in patients with moderate to severe ankylosing spondylitis. AJR Am J Roentgenol. 2006;187:1420-6.
13. Pekkafal MZ, Kralp MZ, Basekim CÇ, Silit E, Mutlu H, Öztürk E, et al. Sacroiliac joint injections performed with sonographic guidance. J Ultrasound Med. 2003;22:553-9.
14. Bollow M, Fisher T, Reißhauer H, Backhaus M, Sieper J, Hamm B, et al. Quantitative analyses of sacroiliac biopsies in spondyloarthropathies: T cells and macrophages predominate in early and active sacroiliitis-cellularity correlates with the degree of enhancement detected by magnetic resonance imaging. Ann Rheum Dis. 2000;59:135-40.
15. Arslan H, Sakarya ME, Adak B, Unai O, Syarlioglu M. Duplex and color Doppler sonographic findings in active sacroiliitis. AJR Am J Roentgenol. 1999;173:677-80.
16. Ünlü E, Pamuk ÖN, Çakir N. Color and duplex Doppler sonography to detect sacroiliitis and spinal inflammation in ankilosing spondylitis. Can this method reveal response to anti-tumor necrosis factor therapy? J Rheum. 2007;34:110-6.
17. Klauser A, Halpern EJ, Frauscher F, Gvozdic D, Duftner C, Springer P, et al. Inflammatory low back pain: high negative predictive value of contrast-enhanced color Doppler ultrasound in the detection of inflamed sacroiliac joints. Arthritis Rheum. 2005;53:440-4.