Value of Color Doppler Ultrasound Assessment of Sacroiliac Joints in Patients with Inflammatory Low Back Pain

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ABSTRACT. ***Objective.*** To evaluate the diagnostic value of color Doppler ultrasound (CDUS) for the detection of sacroiliitis, in patients with inflammatory back pain (IBP).

Methods. Consecutive patients with IBP and suspected axial spondyloarthritis (SpA), but without a definitive diagnosis, were included. Consecutive patients with defined SpA and axial involvement were included as a control group. All patients underwent clinical evaluation, magnetic resonance imaging (MRI), and CDUS of sacroiliac joints (SIJ) within the same week. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for the diagnosis of sacroiliitis by CDUS were calculated, using MRI as the gold standard.

Results. There were 198 SIJ evaluated in 99 patients (36 with previous SpA). There were 61 men (61.6%), with a mean age of 39.8 years (SD 11.3) and median disease duration of 24 months (IQR 12–84). At the patient level, CDUS had a sensitivity of 63% (95% CI 48.7–75.7%) and a specificity of 89% (95% CI 76–96%). The PPV was 87.2% (95% CI 72.6–95.7%) and the NPV was 66.7% (95% CI 53.3–78.3%). At joint level, CDUS had a sensitivity of 60% (95% CI 49–70%) and a specificity of 93% (95% CI 88–98%). The PPV was 83% (95% CI 78–95%) and the NPV was 43% (95% CI 33–56%). The sensitivity of CDUS for the diagnosis of axial SpA was 54% (95% CI 36.6–71.2%), specificity was 82% (95% CI 63.1–93.9%), PPV was 79% (95% CI 57.8–92.9%), and NPV was 59% (95% CI 42.1–74.4%).

Conclusion. CDUS showed adequate diagnostic properties for detection of sacroiliitis and is a useful tool in patients with IBP. (First Release December 15 2018; J Rheumatol 2019;46:694–700; doi:10.3899/jrheum.180550)

Key Indexing Terms:
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Spondyloarthritis (SpA) represents a set of pathologies that share certain clinical and genetic characteristics, the prototype of which is ankylosing spondylitis (AS). The prevalence of SpA ranges between 0.5 and 1.9%[1]. As with other chronic inflammatory conditions, early diagnosis is essential to prevent irreversible changes and functional disability. The inflammatory involvement of the sacroiliac joints (SIJ), called sacroiliitis, is one of the hallmarks of SpA. The clinical evaluation of SIJ is poorly reproducible and does not allow a safe differentiation between sacroiliitis and mechanical low back pain[2]. The presence of HLA-B27 and the increase of acute-phase reactants (erythrocyte sedimentation rate and C-reactive protein) could help the diagnosis of SpA; however, no laboratory tests are pathognomonic of the disease[3]. The radiograph of the SIJ has been traditionally used for the diagnosis, classification, and monitoring of SpA, radiographic sacroiliitis being a central part of the diagnostic

criteria for AS[4]. However, radiography shows the consequences of the inflammatory process at SIJ, and detectable radiographic changes usually appear late, which can delay the diagnosis of the disease 6 to 8 years from the onset of symptoms[5,6]. Plain radiography is useful as a baseline diagnostic study to determine the presence and evolution of structural changes at the level of the pelvis or spine. It also serves to rule out other musculoskeletal complications, such as the presence of posttraumatic fractures, tumors, and infections[7]. Radiographs of SIJ are not useful for early diagnosis, and because of the high intraobserver and interobserver variability, false-positive and false-negative results could be present[8]. Another useful imaging modality to visualize the SIJ is computed tomography (CT), which allows a more detailed description of the more complex osteoarticular anatomy; it has less interobserver variability and is simple to perform[9]. Bone scintigraphy was also used for diagnosing sacroiliitis, but this technique lacks specificity[8]. Recent classification criteria and recommendations issued by the Assessment of SpondyloArthritis international Society (ASAS) Outcome Measures in Rheumatology working group give considerable weight to modern imaging methods, most notably magnetic resonance imaging (MRI)[10,11]. MRI is the diagnostic method of choice for the early detection of inflammatory lesions at the sacroiliac and spinal levels in SpA. These inflammatory changes can be visualized before they are seen by radiography or CT. The presence of osteitis in the subchondral bone is the most sensitive and specific lesion for the diagnosis of sacroiliitis. Therefore, MRI is considered the most sensitive imaging modality for the early detection of axial SpA (axSpA)[12]. MRI yields 3 major benefits: to ensure the early diagnosis of axSpA in the absence of radiographic sacroiliitis; to provide therapeutic guidance at any time during the course of the disease; and to supply objective information on the degree of inflammation and response to treatment[10,11].

The decision of whether to diagnose early axSpA by performing an MRI on a patient with chronic low back pain, psoriasis, uveitis, or inflammatory bowel disease is currently up to the clinical judgment of the attending physician, especially when the patient's condition meets the criteria of inflammatory back pain (IBP). On the other hand, MRI availability is limited in patients with metal implants, pacemakers, or claustrophobia, and it is a time-consuming and often expensive technique.

The utility of ultrasound (US) in the evaluation of sacroiliitis have not been extensively studied to date. US has been shown to be useful in guided SIJ injection[13]. The diagnostic value of sacroiliac US has been studied in patients with AS, showing sensitivity of 82% and specificity of 92% for diagnosis of active sacroiliitis, becoming a useful and practical tool in comparison with MRI[9].

There are scarce data on the utility of US in the evaluation of patients with inflammatory back pain (IBP)[14]. The aim of our present study was to determine the diagnostic value of color Doppler ultrasound (CDUS) for the detection of SI active inflammatory lesions present in MRI in patients suspected of having axSpA. The secondary objective was to determine the value of CDUS in diagnosing axSpA, taking as reference the MRI in the ASAS classification criteria.

MATERIALS AND METHODS

The study was conducted according to the Declaration of Helsinki and local regulations. Ethical approval for the study was obtained from the Hospital Local Ethics Committee (approval number 2107), and informed consent was obtained from all patients.

Included were consecutive patients older than 18 years, with IBP, without a definitive diagnosis of SpA (suspected axSpA), who were referred from orthopedic or general practitioners' clinics for an MRI of the SIJ. Consecutive patients with defined SpA (fulfilling ASAS criteria) and axial involvement were included as a control group.

Inflammatory back pain was defined as more than 3 months of continuous duration of pain with insidious onset that improves with exercise and does not improve with rest, and pain at night (with improvement upon getting up)[15]. Exclusion criteria were body mass index ≥ 30, history of pelvic surgery and trauma, and/or local corticosteroids injections within the past 6 weeks.

All patients underwent within the same week a complete clinical examination and both axial MRI and CDUS of SIJ

Clinical examination. Demographic and clinical data of the patients were collected. An assessment of the activity of the disease was carried out through the Bath Ankylosing Spondylitis Disease Activity Index[16], functional activity by the Bath Ankylosing Spondylitis Functional Index[17], and the degree of disability by the Health Assessment Questionnaire–Argentine version[18]. The Metrology Index was measured by the Bath Ankylosing Spondylitis Metrology Index (BASMI)[19].

Ultrasound evaluation. All US examinations were performed by 2 rheumatologists (JER and SR) experienced in the technique (each 8 years of US experience; since 2012 directors of twice-yearly university course on US applied to rheumatic diseases; members of the Pan American League of Associations for Rheumatology US Study Group) and blinded to clinical and MRI data. They used a MyLab 70 machine (Esaote) provided with a multifrequency convex array transducer (1–8 MHz) and a multifrequency linear transducer (4–13 MHz). The choice of the linear transducer versus the convex, the frequency of greyscale and color Doppler, Doppler pulse repetition frequency (PRF), and Doppler gain was decided mainly according to the patient's phenotype and the ability to better visualize the SIJ in each patient at the time of the study. Regardless, PRF (0.5–1 MHz), wall filters (2–3), and Doppler gain (40–80%) were always adjusted to avoid generating artifacts and to avoid the presence of Doppler signal at or below the bone cortex.

Standardized scanning method[20,21] was used to investigate increased local perfusion with CDUS. Patients were placed prone in a relaxed, tension-free position. Subsequently, the transducer was placed in a transverse plane to the long axis of the spine, at the level of the spinous process of the fifth lumbar vertebra, which was taken as the initial anatomic landmark for the scans. Then, the transducer was moved caudally from the hyperechoic outline of the spinous process of the fifth lumbar vertebra until the first sacral foramen was recognized (hypoechoic cleft). From this point outward, the sacral crest (hyperechogenic prominence) is evidenced first, and then a new hypoechoic cleft corresponding to the SIJ. At that level, the iliac bone appears above the level of the sacrum. Continuing down, the second sacral foramen is recognized (hypoechoic cleft) and laterally another hypoechoic cleft corresponding again to the SIJ, which now at this level meets the iliac bone below the level of the sacrum. The procedure was also repeated on the contralateral side.

When color Doppler signal was found in or around the SIJ, spectral Doppler was used and the resistive index (RI) was measured. CDUS sacroiliitis was defined as the presence of 3 or more flow signals at SIJ with an RI ≤ 0.605 (Figure 1)[21]. Although there are different cutoff values

published in the literature to define a perfusion value at the SIJ level, represented by the color Doppler signal and the RI, we chose the cutoff values referenced by Ghosh, *et al*[21] to avoid false- positive results, giving greater specificity for the sacroiliitis diagnosis.

Reading of MRI. All MRI were read and interpreted by a single rheumatologist expert in reading images of patients with axSpA. The following sequences were used on the MRI assessment: T1-weighted sequence and T2-weighted sequence sensitive for free water [such as short-tau inversion

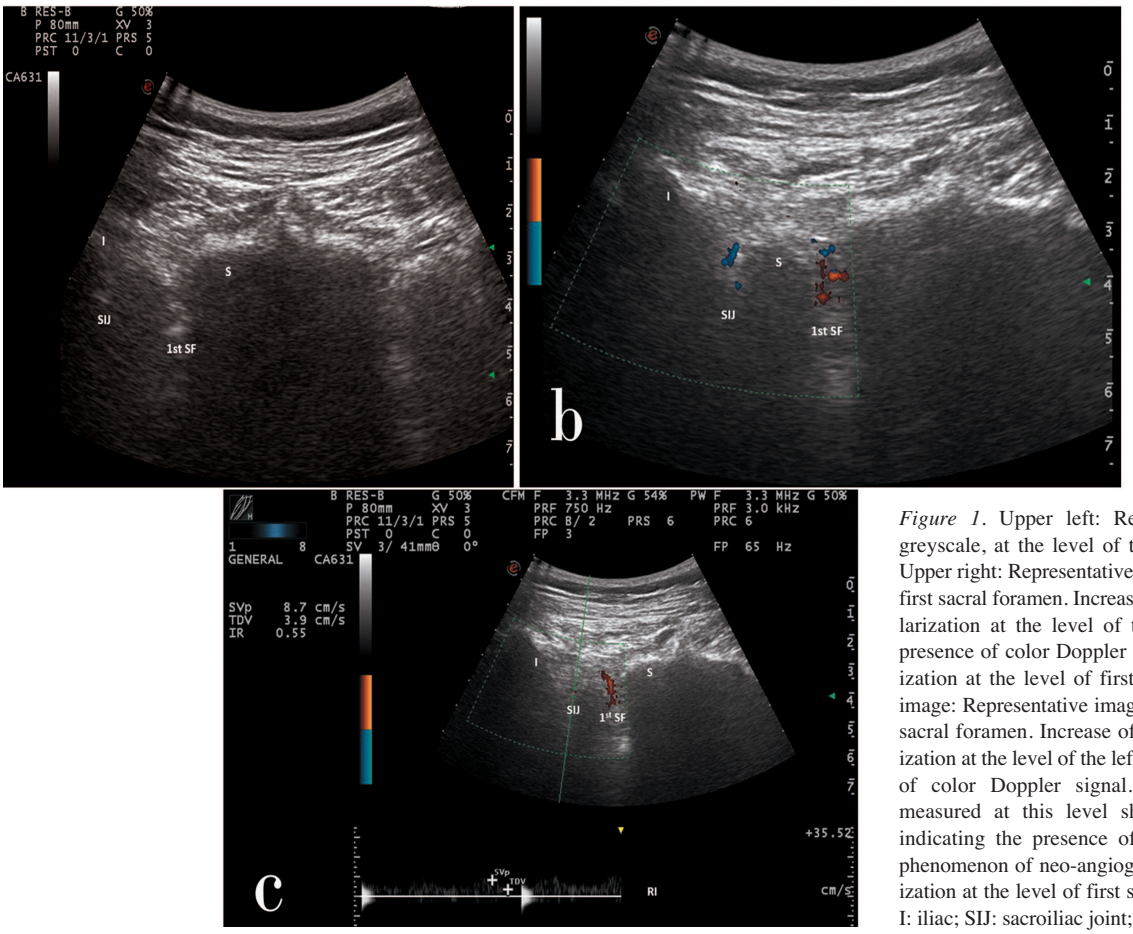

Figure 1. Upper left: Representative image on greyscale, at the level of the first sacral foramen. Upper right: Representative image at the level of the first sacral foramen. Increase of the abnormal vascularization at the level of the left SIJ, due to the presence of color Doppler signal. Visible vascularization at the level of first sacral foramen. Lower image: Representative image at the level of the first sacral foramen. Increase of the abnormal vascularization at the level of the left SIJ, due to the presence of color Doppler signal. The resistance index measured at this level shows a value of 0.55, indicating the presence of sacroiliitis due to the phenomenon of neo-angiogenesis. Visible vascularization at the level of first sacral foramen. S: sacral; I: iliac; SIJ: sacroiliac joint; SF: first sacral foramen.

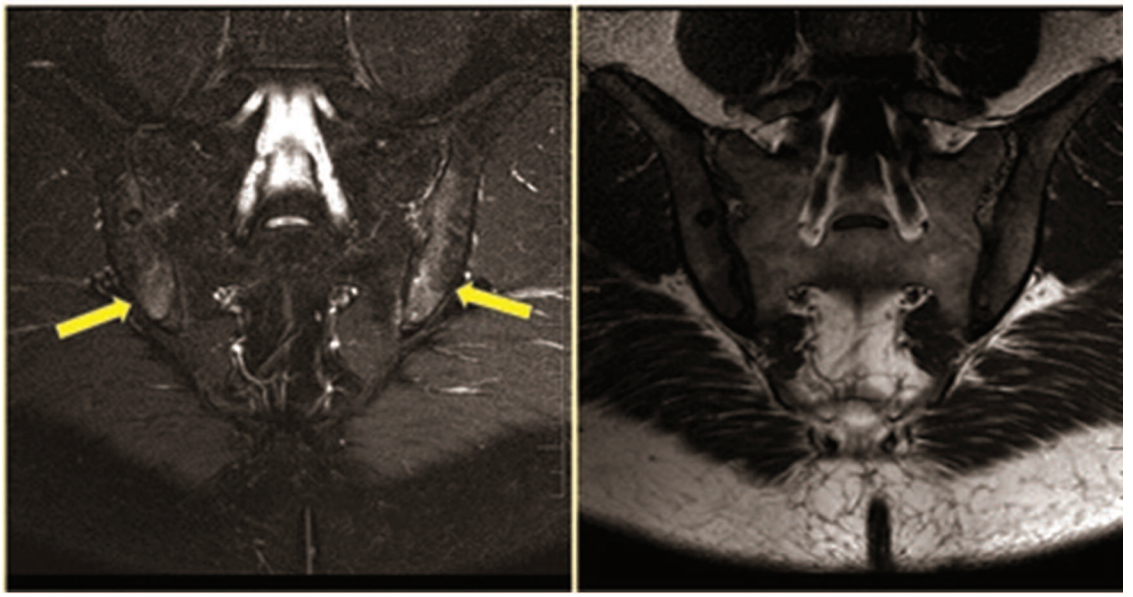

Figure 2. Magnetic resonance images in STIR sequences (left), showing bone edema (osteitis) at both SIJ (arrows); and in sequence T1 (right). SIJ: sacroiliac joints; STIR: short-tau inversion recovery.

recovery (STIR)]. MRI was performed with a whole-body scanner with a field strength of 1.5 Tesla. The whole sacral bone was covered from its anterior to its posterior border (10–12 slices).

MRI sacroiliitis was defined according to ASAS criteria of active sacroiliac inflammatory lesions: bone marrow edema (BME) on STIR, clearly present and located in a typical anatomical area (subchondral bone). If there were 1 signal (lesion) by MRI slice suggesting active inflammation, the lesion should be present on at least 2 consecutive slices. If there were more than 1 signal on a single slice, 1 slice was enough[15] (Figure 2).

The sole presence of other active inflammatory lesions, such as synovitis, enthesitis, or capsulitis, without concomitant BME/osteitis, was not sufficient for the definition of sacroiliitis on MRI[22].

Statistical analysis. Descriptive statistics were performed. Categorical variables were expressed as percentages with their corresponding 95% CI. Continuous variables were expressed as mean or median and their corresponding SD or interquartile range (IQR), respectively. According to the distribution of the variable, chi-square test and Fisher's exact test were used for the comparison of categorical data and Student t test or Mann-Whitney U test were used for continuous data.

All diagnostic test properties of US were analyzed both at patient level and at joint level.

Sensitivity, specificity, positive predictive values (PPV), negative predictive values (NPV), and the positive likelihood ratio (LR+) and the negative likelihood ratio (LR–) for the diagnosis of sacroiliitis by CDUS features were calculated, using MRI as the gold standard. A reproducibility assessment was performed for the CDUS. Both rheumatologists assessed 10 patients on the same day, with the aim of evaluating the interobserver reproducibility of the CDUS findings. The intraobserver and interobserver reliability of the assessments of sacroiliitis was calculated by percentage of exact agreement and κ analysis. Excellent reliability was considered when the κ value was > 0.8. All diagnostic test properties of US were analyzed both at patient level and at joint level.

Sample size calculation. The study required 109 SIJ, estimating an expected sensitivity of 85%, an expected specificity of 80%, and a prevalence of sacroiliitis in the population of 40%, with an accuracy of 10% and a confidence level of 95%.

RESULTS

A total of 198 SIJ were assessed from 99 patients with IBP, 63 with suspected axSpA, and 36 with previous diagnosis of SpA, all of them with axial involvement (16 AS, 10 psoriatic arthritis, and 10 nonradiographic axSpA).

Sixty-one patients (61.6%) were male, mean age was 39.8 years (SD 11.3), and median disease duration was 24 months (IQR 12–84). There was a predominance of male patients in the group with defined SpA (p = 0.001). The metrology, determined by BASMI, was significantly higher in patients with defined SpA (p = 0.004). Table 1 shows patient characteristics.

Diagnostic test properties of US using MRI as reference method. At patient level, MRI detected active sacroiliitis in 54 out of 99 patients (54.5%; 95% CI 44–65). CDUS revealed sacroiliitis in 34 out of these 54 (63%) SIJ with active sacroiliitis, while MRI detected sacroiliitis in 5 out of 45 (11%) SIJ without active sacroiliitis, giving a sensitivity for the diagnosis of sacroiliitis among all patients of 63% (95% CI 48.7–75.7%) and a specificity of 89% (95% CI 76–96%). The PPV was 87.2% (95% CI 72.6–95.7%) and the NPV was 66.7% (95% CI 53.3–78.3%). The LR+ was 5.7 (95% CI 2.4–13.3) and the LR– was 0.42 (95% CI 0.29–0.6; Table 2).

At joint level, MRI detected active sacroiliitis in 87 out of 198 (43.9%; 95% CI 37–51) assessed SIJ. Active sacroiliitis by MRI was present in 53/128 (41.4%; 95% CI 33–50) SIJ from patients suspected of having SpA, and in 34/70 (48.6%; 95% CI 33–50) SIJ from patients with defined SpA.

The CDUS revealed sacroiliitis in 52 out of those 87 (59.8%) SIJ with active sacroiliitis by MRI, while it detected sacroiliitis in 8 out of 111 (7.2%) SIJ without active sacroiliitis by MRI, giving a sensitivity for the diagnosis of sacroiliitis among all patients of 60% (95% CI 49–70%) and a specificity of 93% (95% CI 88–98%). PPV was 83% (95% CI 78–95%) and NPV was 43% (95% CI 33–56%). The LR+ was 5.5 (95% CI 2.34–12.91) and the LR– was 0.66 (95% CI 0.54–0.77). Table 2 and Table 3 show detailed descriptions of test diagnostic properties for CDUS, using MRI as the reference method.

Diagnostic test properties of US in patients suspected of having SpA. Among 63 patients with suspected axSpA, 35 (56%; 95% CI 42–68.1) fulfilled ASAS classification criteria (imaging arm) for SpA after MRI assessment. The CDUS showed sacroiliitis in 19 out of these 35 patients and in 5 out of 28 patients not fulfilling ASAS criteria. The sensitivity of CDUS for diagnosis of axSpA (according to the ASAS imaging arm) was 54% (95% CI 36.6–71.2%) and specificity was 82% (95% CI 63.1–93.9%), with a PPV of 79% (95% CI 57.8–92.9%) and an NPV of 59% (95% CI 42.1–74.4%). The LR+ was 3.04 (95% CI 1.3–7.12) and the LR– was 0.56 (95% CI 0.37–0.83).

The interobserver agreement between the 2 ultrasonographers, considering dichotomically the presence or absence of sacroiliitis by CDUS, was good (85% agreement, κ: 0.6939, p = 0.0009).

DISCUSSION

Over the past 2 decades, musculoskeletal US has played an increasingly important role in optimizing diagnosis, assessment, and monitoring of patients with rheumatic and musculoskeletal diseases[23,24]. The advantages of US such as noninvasiveness, availability, relative low cost, repeatability, and high patient acceptance facilitate its progressive implementation in rheumatologic clinics all over the world. In the published European League Against Rheumatism (EULAR) recommendations for the use of imaging in the diagnosis and management of SpA in clinical practice, CDUS was recommended only to detect peripheral enthesitis, which may support the diagnosis of SpA, or to detect peripheral synovitis, tenosynovitis, and bursitis, and to monitor synovitis and enthesitis in peripheral SpA[23,25]. Despite recognizing that 2 studies showed CDUS as a sensitive and specific tool for diagnosing active sacroiliitis[26,27], EULAR stated that US is not recommended for diagnosis of sacroiliitis as part of axSpA, based on risk of patient selection bias and applicability concerns in those studies[25]. In general, it is considered difficult to image synovitis and effusion of the SIJ

Table 1. Demographic and clinical characteristics of patients.

Feature	All Patients, n = 99	Patients with SpA, n = 36	Patients with Low Back Pain (suspected SpA), n = 63	p
Male, n (%)	61 (61.6)	30 (83)	31 (49)	0.001
Age, yrs, mean (SD)	39.8 (11.3)	42.7 (13.9)	38.2 (9.3)	0.0622
Disease duration, mos, median (IQR)	24 (12–84)	24 (12–120)	30 (6–60)	0.622
HLA-B27, n/tested (%)	25/88 (28.4)	12/32 (37.5)	13/56 (23)	0.235
BASDAI, mean (SD)	4.5 (2.3)	4.3 (2.3)	4.7 (2.3)	0.4351
BASFI, mean (SD)	3.2 (2.5)	3.6 (2.7)	2.9 (2.3)	0.1999
BASMI, mean (SD)	2.32 (0.14), n = 95	2.95 (0.30), n = 34	1.96 (0.12), n = 61	0.004
ESR, median (IQR)	17 (8–34)	24 (8–38)	15.5 (8–30)	0.2723
CRP mg/l, median (IQR)	2.9 (1–10)	3.7 (0.8–11)	2.6 (1–9)	0.6616
HAQ-A, median (IQR)	0.62 (0.125–1)	0.62 (0.25–1.12)	0.55 (0.18–1)	0.3686

SpA: spondyloarthritis; IQR: interquartile range; ESR: erythrocyte sedimentation rate; CRP: C-reactive protein; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; BASFI: Bath Ankylosing Spondylitis Functional Index; BASMI: Bath Ankylosing Spondylitis Metrology Index; HAQ-A: Health Assessment Questionnaire–Argentine version.

Table 2. CDUS diagnostic properties for the diagnosis of sacroiliitis at patient level.

Properties	All Patients, n = 99 (198 SIJ)	Suspected SpA Patients, n = 63 (126 SIJ)	SpA Patients, n = 36 (72 SIJ)
Sensitivity, % (95% CI)	63 (49–76)	64 (45–80)	62 (38–82)
Specificity, % (95% CI)	89 (76–96)	93 (78– 99)	80 (52–96)
PPV, % (95% CI)	87 (73–96)	91 (72–99)	81 (54–96)
NPV, % (95% CI)	67 (53–78)	70 (53.5–83)	60 (36–81)
LR+ (95% CI)	5.7 (2.4–13.3)	9.55 (2.4–37)	3.1 (1.1–9)
LR– (95% CI)	0.42 (0.29–0.6)	0.39 (0.25–0.62)	0.48 (0.26–0.87)

CDUS: color Doppler ultrasound; SIJ: sacroiliac joints; SpA: spondyloarthritis; LR+: likelihood ratio positive; LR–: LR negative; PPV: positive predictive value; NPV: negative predictive value.

Table 3. CDUS diagnostic properties for the diagnosis of sacroiliitis at joint level.

Properties	All Patients, n = 99 (198 SIJ)
Sensitivity, % (95% CI)	60 (49–70)
Specificity, % (95% CI)	93 (88–98)
PPV, % (95% CI)	83 (78–95)
NPV, % (95% CI)	43 (33–56)
LR+, (95% CI)	5.5 (2.34–12.91)
LR–, (95% CI)	0.66 (0.54–0.77)

CDUS: color Doppler ultrasound; SIJ: sacroiliac joints; LR+: likelihood ratio positive; LR–: LR negative; PPV: positive predictive value; NPV: negative predictive value.

space, and the deeper, more anteriorly located part of the SIJ is not visible on US[7]. However, color Doppler signal could be seen around the SIJ, and with a low resistive index, might be indicative of sacroiliitis. Arslan, *et al* showed the utility of Duplex and color Doppler sonography for diagnosing active sacroiliitis through an increased vascularization around the posterior regions of SIJ and decreased RI values[28]. Also, patients with early osteoarthritis and healthy volunteers had increased vascularity around SIJ, but their RI values were significantly higher than those of patients with sacroiliitis. In addition, the increase of the RI value detected by these imaging techniques could serve as a treatment response to evaluate therapeutic efficacy[28]. Arslan, *et al* concluded that Duplex and color Doppler sonography can be useful to diagnose active sacroiliitis and for monitoring the disease after treatment. Jiang, *et al* studied the power Doppler (PD) signal and RI at the SIJ level in 55 patients with active AS, before and 3 months after treatment with infliximab[29]. They found significant changes in the 2 variables, with decreased PD signal and increase in RI[29]. Unlu, *et al* also demonstrated a significant change in the RI of joint vascularity in response to antitumor necrosis therapy in patients with AS. They investigated by Duplex and CDUS not only SIJ but also lumbar and thoracic vertebral paraspinal areas[30].

We defined the presence of active sacroiliitis by CDUS when 3 or more signals were present and RI was ≤ 0.605[21]. Ghosh, *et al* could demonstrate the usefulness of CDUS as a cost-effective technique not inferior to MRI for the diagnosis

of sacroiliitis in patients with early nonradiographic SpA[21]. They studied a limited number of patients and had some difficulties with obese patients. We included a larger number of patients and excluded those patients with BMI ≥ 30.

In our study, we included a large number of consecutive patients with IBP, selected only by the performance of a sacroiliac MRI within the same week, and also a group of patients with known SpA. We showed that CDUS had good sensitivity with very good specificity for the detection of inflamed SIJ, defined by MRI. Our study showed a higher sensitivity and similar specificity than those of Klauser, *et al*[27]. One difference among the populations was that the prevalence of sacroiliitis in their study was lower than in ours (34% vs 44%), perhaps due to a less stringent definition of IBP in their study[27]. Another difference was that Klauser, *et al* did not use resistive index, and their main objective was to evaluate contrast-enhanced CDUS and not unenhanced CDUS as in our study[27]. While they demonstrated that the use of contrast-enhanced sensitivity of US for detecting active sacroiliitis had an acceptable NPV, it is important to note that the use of contrast not only increases costs, but also increases the time a procedure takes, and it is not free of adverse events (although this work showed no increase in adverse events). Both studies showed a very high specificity and NPV, so CDUS could be used as an easier and cheaper screening tool in patients with inflammatory low back pain, while the more difficult and expensive MRI was reserved only for positive cases, to certify diagnosis. Mohammadi, *et al* showed a sensitivity and a specificity for active sacroiliitis detection with CDUS of 82% and 92%, respectively, using blood flow spectral Doppler waveform[9]. In active sacroiliitis the pulsatile monophasic flow predominated, unlike in the inactive disease, where there was no flow, or triphasic flow was present. They concluded that CDUS is a practical and useful tool in the diagnosis of sacroiliitis, using MRI as a gold standard[9]. Spadaro, *et al* compared the presence of US synovial effusion on SIJ with different physical examination maneuvers in 45 patients with SpA and 30 healthy controls, with and without IBP[31]. The presence of IBP was significantly associated with the presence of joint effusion at the level of the SIJ, assessed by US alone or associated with at least 1 SIJ evaluation test, with an LR of 2.67 and 4.04, respectively. They suggested that high-resolution US is useful for evaluating SIJ in patients with SpA, resulting in fast and inexpensive imaging, and supplementing physical examination to detect the origin of IBP. A recently published Spanish study[32] demonstrated the validity of the CDUS to assess SI compromise in patients with SpA. The accuracy of CDUS, compared to physical examination of SIJ as a reference method, at the patient level, showed a global sensitivity of 70.3%, a specificity of 85.7%, an LR+ of 4.9, and an LR– of 0.36. Taking as an optimal cutpoint an RI ≤ 0.75, the sensitivity was 76.2% and the specificity was 77.8%. The authors concluded that the CDUS of the SIJ appears to be a valid and feasible diagnostic method for detecting active inflammation in patients with SpA[32].

Our study has some limitations. First, MRI and CDUS were not performed on the same day; however, they were performed within the same week, so this temporal difference could not represent a huge bias. Second, because of the cross-sectional design of the study, we could not be sure that patients who did not fulfill criteria for SpA would not develop SpA in the future. However, the primary aim was the detection of sacroiliitis, and not the diagnosis of SpA. The correlation interobserver was good although there is ample evidence of adequate reproducibility of US findings, even among sonographers with wide experience in the use of US applied to rheumatology[33].

CDUS largely used for assessment of peripheral arthritis and enthesitis in SpA could also be a practical and useful tool for the diagnosis of active sacroiliitis in patients with IBP. Our results need to be confirmed in other larger cohorts.

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