The Value of Radionuclide Imaging in the Diagnosis of Sacroiliac Syndrome

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Study Design A prospective study was done to assess the diagnostic value of radionuclide imaging (bone scan) in the evaluation of sacroiliac joint syndrome.

Objectives To determine the sensitivity and specificity of radionuclide imaging in establishing a diagnosis of sacroiliac joint syndrome in patients with low back pain.

Summary of Background Data There is no pathognomonic symptom or sign to establish the diagnosis of sacroiliac joint syndrome. It has been accepted that confirmation of sacroiliac joint syndrome requires relief of pain, a positive response to a sacroiliac joint block. Bone scanning has been proposed as a useful imaging technique to evaluate for sacroiliac joint syndrome. The authors explored the use of nuclear imaging as a cost-effective and noninvasive technique in the diagnostic algorithm of sacroiliac joint syndrome.

Methods Patients presenting to the author's Spine Center with complaints of low back pain including the region of the sacral sulcus were screened for inclusion into this study. Positive response to three provocative sacroiliac joint maneuvers was requisite, two of which had to be Patrick's test and pain with palpation over the sacral sulcus. Patients who met these criteria were entered into a physical therapy program comprised of lumbar spine stabilization techniques and excluded any interventions considered specific for sacroiliac joint syndrome. Those whose symptoms failed to improve with this program underwent bone scan and fluoroscopically guided sacroiliac joint block. Response to sacroiliac joint block was assessed with pre- and post-block visual analog scale scores completed by the patient. A reduction of the VAS rating by at least 80% was considered a positive response to sacroiliac joint block.

Results Fifty consecutive patients met the author's criteria and underwent bone scan and sacroiliac joint block. Thirty-one patients who had positive responses to sacroiliac joint block comprised the positive sacroiliac joint block group. Nineteen patients had less than 80% pain reduction with sacroiliac joint block and were labeled the negative sacroiliac joint block group. Four patients had positive bone scans, all of whom were in the positive sacroiliac joint group.

Conclusions The results demonstrated very low sensitivity and high specificity of nuclear imaging in the evaluation of sacroiliac joint syndrome. The authors do not recommend bone scan in the diagnostic algorithm for sacroiliac joint syndrome.

It is believed that sacroiliac joint syndrome (SIJS) manifests in many ways. Among these are low back or buttock,[1,4,6,9-11,17,20,23,26,27,32,33] groin,[20,25] abdominal,[11,20,25] thigh,[4,6,8,17,20,22,26,28,33] and calf pain.[4,22,26,28,33] Although a major focus of the symptoms must involve the region of the sacral sulcus,[5,14] this does not represent a pathognomonic feature[29] because other lower spine afflictions may refer pain to this region. Physical examination provides valuable but not conclusive information concerning the presence of SIJS.[12,27,29,30] Consequently, it is widely accepted that confirmation of SIJS requires a positive sacroiliac joint block (SIJB).[12,14,16,20,23-25,29,30] Diagnostic blocks, however, are invasive and uncomfortable for patients. A simpler screening procedure would be preferable. Radionuclide scanning is such a procedure. It has been used in the investigation of other disorders of the sacroiliac joint and could, in principle, be of value in the diagnosis of SIJS.[7,15,19,21,31]

The present study was done to evaluate the diagnostic value of radionuclide scanning using intra-articular diagnostic blocks as the gold standard for sacroiliac joint pain.

Our desire for precision while limiting the number of invasive procedures used during the pursuit of definitive diagnosis of low back pain led to a prospective analysis of the value of radionuclide imaging (bone scan) in diagnosing SIJS.

□ Methods

Subjects participating in this study were patients referred to our Spine Center with complaints of low back pain with or without leg pain. Subjects with a history of spondyloarthropathy, urethritis, peripheral arthritis, psoriasis, inflammatory bowel disease, or pain associated with early morning stiffness that resolves with exercise, positive root tension signs, or neuromuscular deficit were excluded. Inclusion criteria required a history of pain emanating from the region of the sacral sulcus. Physical examination had to demonstrate a positive response to a minimum of three widely accepted maneuvers typically used to diagnose SIJS. Two of the three positive responses had to include two specific stress maneuvers: Patrick's test and pain with pressure application to the sacroiliac ligaments at the sacral sulcus while in the prone position. Other maneuvers performed, which are believed to be indicative of SIJS, were shear, standing extension, Gaenslen, and Yeoman. Consecutive subjects who met these criteria were entered into a physical therapy regimen consisting of back education; lumbar spine stabilization techniques; enhancing upper extremity, lower extremity, and truncal conditioning; and improving soft tissue pliability. Interventions considered specific for SIJS, such as joint mobilization or manipulation, were not offered. Those who failed to improve with this regimen and still met inclusion criteria and the to-be-mentioned exclusion criteria had a bone scan completed.

A bone scan was performed 3 hours after an intravenous injection of Tc-99m methylene diphosphonate. Bone scan images subsequently were acquired with a dual-headed gamma camera (Picker Prism 2000, Picker Prism International, Cleveland, OH) equipped with high resolution parallel collimators. The acquisition parameters included a 128 × 128 matrix with a pixel size of 2.33 mm, 22 minutes duration, with 60 stops of 3° each over an 180° arc.

Subsequent to completion of radionuclide imaging, a fluoroscopically guided SIJB was performed. Approximately 15 minutes before this latter procedure, a preinjection visual analog scale (VAS) rating and Mooney pain drawing was completed. The VAS was administered by a trained nurse or medical technician. SIJB was performed by one of the first two authors. Hendrix's technique was used with incorporation of slight modifications as patient positioning proceeded in a different manner.[18] These

modifications were necessary because of technical limitations; all blocks were performed in a myelographic suite and not with a C-arm imager. Immediately after infusion of 0.5 cc of Iohexol 300 mg/mL (Nycomed, Inc., New York, NY) into the most caudal aspect of the sacroiliac joint, establishing proper needle position (Figure 1), a combination of 1.0 cc of betamethasone sodium phosphate and acetate suspension, 6 mg/mL, and 2.0 cc of 1% lidocaine hydrochloride, 3.0 cc of 1% lidocaine hydrochloride, or 3.0 cc of 2% lidocaine hydrochloride was injected. Within 30 minutes of the SIJB, each subject completed a post-injection VAS with supervision by a trained nurse or medical technician. A reduction of 80% in the VAS rating was selected as the threshold for a positive block result. All data accumulation and statistical analysis was performed by the third author.

□ Results

Fifty consecutive subjects met the inclusion criteria and underwent nuclear scanning and SIJB. There were 17 men and 33 women who ranged in age from 18 to 77 years. Symptom duration at initial presentation ranged from 0.5 months to 84 months, with an average of 20.3 months. Thirty-five subjects had unilateral findings, whereas 15 had bilateral findings. Of this population, 31 obtained at least 80% symptom relief and were deemed to have a positive response to SIJB. This subpopulation was labeled the positive SIJB group (+SIJBG). The remaining 19 subjects had less than 80% reduction of their VAS scores. This group was identified as the negative SIJB group (-SIJBG). Four subjects had positive bone scans, all of whom were in the +SIJBG.

Within the +SIJBG, there were 27 subjects with negative scans (+SIJBG-S) and four with positive scans (+SIJBG+S). Patients in the +SIJBG-S ranged in age from 22 to 77 years; symptom duration, at the time of initial presentation, varied from 0.5 to 84 months; average symptom duration was 19.8 months. Their range of pre-block VAS scores was 3.9-8.5, with an average of 6.5. Post-block VAS scores extended from 0.0 to 0.9, with an average of 0.2 (Figure 2). The percentage reduction in VAS scores was 82-100%. The average decrement was 95.7%. Fifteen individuals perceived 100% abatement of their pre-block symptoms. Subjects in the +SIJBG+S ranged in age from 31 to 72 years, with symptom duration, at the time of initial presentation, of 0.5-23 months. Average symptom duration was 9.4 months. Their range of pre-block VAS scores was 6.9-9.6, with an average of 8.5. Post-block VAS scores extended from 0.0 to 0.6, with an average of 0.2. The percentage reduction in VAS scores was 94-100%. The average decrement was 98.5%. Three subjects perceived 100% abatement of their pre-block symptoms.

Subjects in the -SIJBG ranged in age from 18 to 66 years. Four were men, and 15 were women. Unilateral findings were obtained in 15, and four had bilateral symptoms. Duration of symptomatology averaged 23.3 months, with a range of 1-77 months. Their pre- and post-block VAS scores ranged from 2.2 to 10.0 and 1.5 to 9.5, respectively. The average pre-block VAS score was 6.7, and for the post-block rating, it was 5.0 (Figure 3). Percentage reduction in VAS scores ranged from 0.0 to 77.0, with an average of 28.4%. No patient claimed an increase in their VAS score after undergoing SIJB.

Using a two-by-two table, the sensitivity and specificity of nuclear imaging was determined to be 12.9% and 100%, respectively. McNemar's test, which quantitatively evaluates the systematic departure of discordance from symmetry, provided a *P* value of 0.001. The reproducibility of these results was determined by using the simple kappa coefficient. A value of 0.101 was obtained.

□ Discussion

Previous studies have identified a low specificity of nuclear imaging for sacroiliitis,[7,15,19,21,31] but not with unanimity.[2] These studies sprung from Russell's 1975 study, which attempted to refine the diagnostic evaluation of patients with inflammation of the sacroiliac joint (sacroiliitis).

As did Russell, this study focused on the issue of precision diagnosis, not epidemiology or outcomes. The results amplify the conclusions drawn in preliminary studies, which suggested the usefulness of radionuclide imaging in the diagnosis of SIJS.[30]

In the present study, a positive bone scan could be interpreted as confirming the presence of SIJS; specificity was 100%. Unfortunately, the sensitivity was so low, 12.9%, that we are unable to recommend radionuclide imaging as a substitute for SIJB. This interpretation need not be altered, even if the issue of placebo response is considered a design flaw in this study. Assuming one third of the positive responses to SIJB were false-positive,[3,13] the sensitivity and specificity values become 14.3% and 96.6%, respectively. The *P* value remains 0.001 under this scenario.

A question that may be raised about this study entails the exclusion of joint manipulation or mobilization in the therapeutic algorithm. This specific omission was chosen on two theoretical grounds. First, if the sacroiliac joint could be mobilized, the possibility exists that such motion would effect sacroiliac joint cartilage or osseous elements, leading to a positive result on bone scan. Second, if sacroiliac joint manipulation is an appropriate intervention and we used these techniques, we would have selected out for nonresponders. Generalized statements about SIJS would have been precluded because of the inherent bias created by such selection.

Another potential criticism of this study is the use of a variety of medication combinations. Although the subjects received one of three different injectates, the immediate local anesthetic effects should have been similar. In each instance, at least 20 mg of lidocaine was delivered, which represents a sufficient dose to adequately anesthetize the joint.

Given the results reported in this study and the ensuing discussion, a critical issue necessarily arises; what is the underlying pathology leading to the development of SIJS? Is it inflammatory? If the answer is affirmative, a much higher sensitivity value similar to that seen in sacroiliitis should have been obtained.[8] Perhaps SIJS is typically a disorder of mild synovial irritation, which, in most instances, should not be detected with radionuclide imaging. As the disorder progressed, because of chronicity or intensity of the inflammatory response, adjacent cartilaginous or osseous structures become involved. Once that transpired, osteoblastic activity would accelerate. Such an alteration in bone metabolism would be detected with nuclear imaging. If this is an accurate explanation of the underlying pathophysiology of SIJS, the low sensitivity of bone scan would be expected. In conclusion, radionuclide imaging is an inappropriate diagnostic tool for the routine evaluation of SIJS. Definitive proof of this statement has been generated from the sensitivity and specificity percentages obtained in this study. A *P* value of 0.001 proves these were not random results, and a simple kappa coefficient of 0.101 demonstrates the reproducibility of our data.

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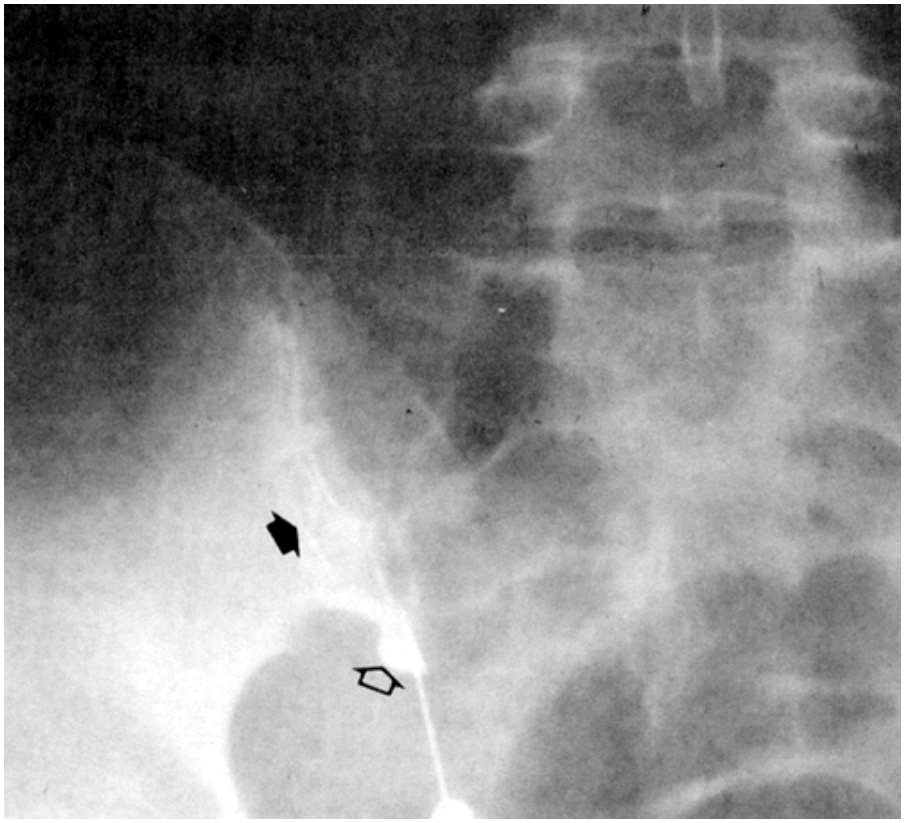

Figure 1. Radiographic representation of correct needle placement for sacroiliac joint block. The contrast material injected into joint space demonstrates an arthrographic pattern (black arrow) and filling of the inferior synovial capsule (white arrow).

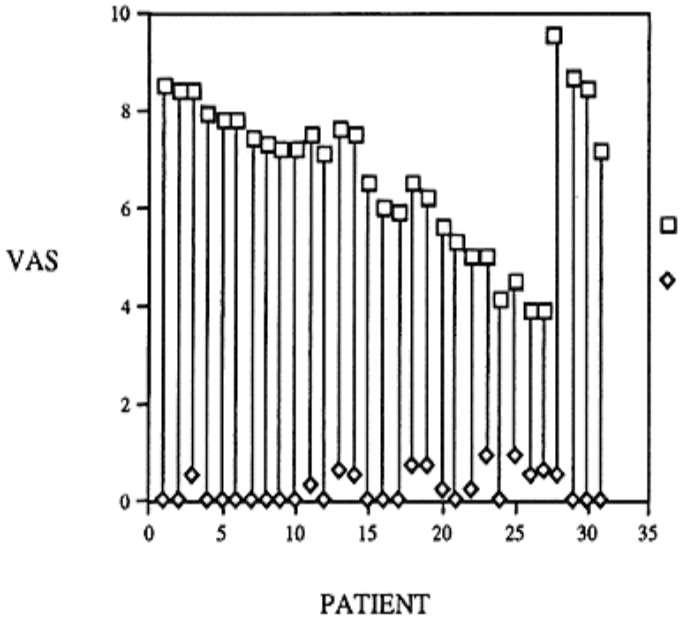

Figure 2. Pre- and post-sacroiliac
(SIJB) visual analog scores (VAS)
subjects in the positive response t
group. * Subjects 28-31 had positi
results on bone scans.

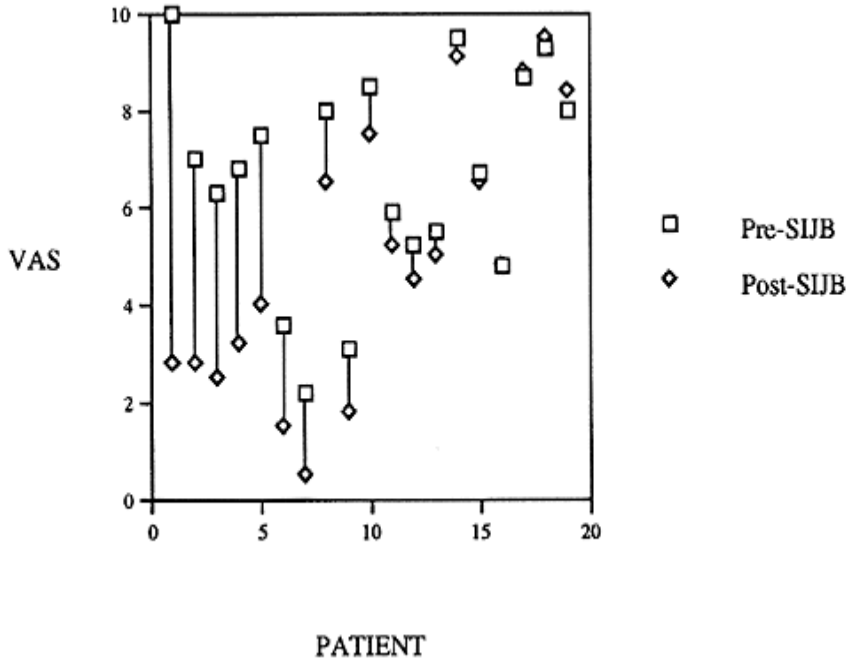

Figure 3. Pre- and post-sacroiliac joint block (SIJB) visual analog scale (VAS) scores for each subject in thenegative response to SIJB and negative bone scan group.

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