

## The Sacroiliac Joint in Chronic Low Back Pain

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**Study Design.** This was a cross-sectional analytic study.

**Objectives.** In relation to pain from the sacroiliac joint, this study sought to establish 1) its prevalence, 2) the validity of pain provocation, 3) whether any arthrographic abnormalities predict a response to joint block, and 4) whether certain pain patterns discriminate patients with this diagnosis.

**Summary of Background Data.** The true prevalence of sacroiliac joint pain is unknown and despite a plethora of clinical tests, none of these tests has been validated against an established criterion standard. To our knowledge, arthrography of the sacroiliac joint had never been studied.

**Methods.** Forty-three consecutive patients with chronic low back pain maximal below L5-S1 were investigated with sacroiliac joint blocks under image intensifier using radiographic contrast followed by 2% lignocaine. Information was obtained on pain provocation, analgesia, and image pattern.

**Results.** Thirteen patients (30%) obtained gratifying relief of their pain. Nine of these also exhibited tears of their ventral capsule. Groin pain was the only pain referral pattern found to be associated with response to sacroiliac joint block.

**Conclusion.** The sacroiliac joint is a significant source of pain in patients with chronic low back pain and warrants further study. [Key words: arthrography, local anesthetic, low back pain, sacroiliac joint] *Spine* 1995;20:31-37

The notion that the sacroiliac joint may be a source of chronic mechanical low back pain has been a recurrent subject of controversy throughout this century.<sup>5</sup> In some quarters, it is regarded as a significant source of back pain,<sup>8,10,19</sup> yet in others the concept is treated with skepticism.<sup>16</sup>

Until now, the study of sacroiliac joint pain has been frustrated by the fact that there has not been a satisfactory criterion standard by which its prevalence can be

measured and against which various clinical examinations can be validated. Imaging studies such as plain radiography, computed tomography (CT) and magnetic resonance imaging (MRI) do not demonstrate pain, and no feature evident on these studies has been shown to correlate with pain from the sacroiliac joint.<sup>5</sup>

A variety of examination procedures have been purported to be useful in detecting painful sacroiliac joints,<sup>5</sup> but none has been validated against any independent criterion standard. The purported clinical tests for sacroiliac joint pain are themselves subject to a high interobserver error<sup>3,4,17,18</sup> and depend on the skill and experience of the examiner. At best, they have been compared with other clinical tests, the validity of which are unknown.

Diagnostic injections provide an attractive, objective means of diagnosing joint pain. Under fluoroscopic guidance, needles can be precisely placed in the joint to inject radiographic contrast medium and local anesthetic. In this way, pain may be provoked and relieved. When relief of pain is accompanied by a negative control block, there is compelling evidence that the injected structure is the source of pain. Furthermore, as a diagnostic test, local anesthetic blocks are independent of interobserver error. The judgment as to whether a patient has sacroiliac joint pain is determined by whether radiographically proven injections relieve his or her pain, not by whether an examiner performing a clinical maneuver believes the patient has pain. The only liability of diagnostic blocks is that patients may offer a placebo response. However, this can be controlled by performing control blocks.

Unfortunately, diagnostic blocks of the sacroiliac joint suitable as a criterion standard have not been available to date. The classic method has been to approach the joint from behind.<sup>5,11</sup> The sinuous shape of the sacroiliac joint prevents a needle from entering the joint from behind, and at best, posterior blocks simply anesthetize the interosseous sacroiliac ligament and not the joint itself. Inspection of the anatomy of the sacroiliac joint<sup>4</sup> reveals that at its most inferior portion, the sacroiliac joint is readily accessible. Near the posterior superior iliac spine, the joint is apparent as a parasagittal slit and is not obstructed by overhanging bone. At this site, a needle can be readily introduced into the joint

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This work was performed at Diagnostic Conservative Management, New Orleans, Louisiana.

Dr. Schwarzer was supported by a Scholarship from the New South Wales Department of Health and by the International Spinal Injection Society.

Accepted for publication: July 7, 1994.

Device status category: 1.

cavity from behind<sup>2,12-14</sup> and used to flood the entire joint with local anesthetic.

Infiltration of the joint with local anesthetic should anesthetize all nociceptors within the joint and thereby relieve any pain stemming from it. The target specificity of such blocks can be controlled by obtaining an arthrogram of the joint and by fluoroscopically monitoring the dispersal of the injectate.

In the present study, we employed diagnostic intra-articular blocks of the sacroiliac joint to estimate the prevalence of sacroiliac joint pain in a population with chronic low back pain that had defied diagnosis by conventional means. The study was not comprehensive or exhaustive, but basically addressed a null hypothesis. If sacroiliac joint pain does not exist, there would be no patients whose pain responds to diagnostic blocks. On the other hand, if there were patients whose pain could be relieved, the null hypothesis would be refuted, whereupon a concerted study would be justified to establish more reliably what the actual prevalence of sacroiliac joint pain might be. Opportunistically, a parallel study was conducted to determine whether there were clinical signs that might be indicative of sacroiliac joint pain.

As with any study of this nature, ethical considerations apply. Ideally, placebo controls should be used for diagnostic blocks. However, such control subjects require double radiation exposure and therefore need ethics clearance. We believed that, in the first instance, when the prevalence of sacroiliac joint pain was unknown and there even was doubt that the condition occurred at all, we could not justify submitting a sample of patients to double procedures. However, this would not compromise the intent of the study. If blocks of the sacroiliac joint failed to relieve the pain of a substantial proportion of patients, the validity of sacroiliac joint pain could be denied. If, on the other hand, patients could be found who responded, the study would provide data to justify a more rigorous pursuit of the condition and the need for double procedures and controlled blocks.

## ■ Patients and Methods

The source population consisted of 100 consecutive patients referred between April 1992 and October 1992 for investigation of low back pain at a radiology practice in New Orleans specializing in spinal pain. The patients were drawn from the metropolitan area of New Orleans but also included several interurban and interstate referrals. All had been referred by neurosurgeons, orthopedic surgeons, or physiatrists because noninvasive investigations had been nondiagnostic and, in the opinion of the referring physician, the patients' pain was severe enough to warrant invasive investigations. Patients under 18 years old or more than 80 years old and those who had previously undergone lumbar spinal surgery or who exhibited neurologic signs were excluded.

All patients had been referred for a variety of specific investigations. These included zygapophysial joint blocks and discography. The sacroiliac joints were studied opportunisti-

cally. To avoid performing sacroiliac blocks on all patients, and to maximize the positive yield from blocks, an arbitrary clinical criterion was adopted to screen patients. To be eligible for sacroiliac joint blocks, patients had to have pain centered below L5-S1 on the grounds that pain overlying the sacroiliac joint was more likely to stem from that joint than pain at more rostral levels.

Forty-three patients satisfied this criterion. There were 22 women and 21 men. Their median age was 32.8 years (interquartile range, 28.7–40.9 years) and median duration of pain was 14.0 months (interquartile range, 8.0–29.0 months).

The cause of back pain was work-related in 42% of the patients, and followed a motor vehicle accident in 37%. Pain of other causes accounted for the remaining 21% of patients. Workers' compensation or third party insurance coverage was present in 84%. Pain was unilateral in 68% and bilateral in 32%. The median age of patients and duration of pain did not differ from the source population. However, women made up a larger proportion of the study population than in the source population, with a female:male ratio of 1:1 instead of 3:7.

The distribution of pain was recorded for all patients, and all patients underwent a clinical examination that assessed whether the following movements aggravated their pain: forward flexion, extension, rotation of the trunk to the right and left, rotation to the left with right extension, and rotation to the right with left extension. Assessment also was done for whether straight leg raising in the supine position aggravated their back pain or leg pain.

Patients underwent CT and MRI of the lumbar spine from L2 to S1. In addition to diagnostic blocks of their putatively symptomatic sacroiliac joint, all patients underwent zygapophysial joint blocks and 21 also underwent discography. Zygapophysial joint blocks were performed at L5-S1 and L4-L5 before any studies of their sacroiliac joint. When it was performed, discography always was the last procedure.

Zygapophysial joint blocks were adopted as a control procedure to obviate ethical restrictions concerning the use of sham procedures on the sacroiliac joint. The protocol required that patients undergo double blocks of the joint, using lignocaine on one occasion and bupivacaine on the other, details of which have been outlined elsewhere.<sup>20,21</sup> They constituted internal controls in that if patients were to offer placebo responses to diagnostic blocks they would be more likely to do so to one of the zygapophysial joint blocks rather than later when the sacroiliac joint was studied. Under these conditions, a positive response to sacroiliac joint blocks after negative blocks of the zygapophysial joints is more likely to constitute a true-positive response than a positive response to an isolated, uncontrolled sacroiliac joint block.

Sacroiliac joint injections usually were performed unilaterally, on the most painful side. Bilateral injections were performed if the pain was equivalent on both sides. Sacroiliac joint injections were performed using a technique devised by Aprill.<sup>2</sup> The procedures were performed with the patient lying on a fluoroscopy table in a prone position. The skin entry point was 1–3 cm below the inferior margin of the sacroiliac joint. At this point, the skin was infiltrated with 1% lignocaine. Under intermittent fluoroscopic control, a 22 gauge or 25 gauge needle was introduced and directed cephalad to strike the ilium 1 cm above the inferior margin of the target joint. The tip of the needle then was manipulated until it entered the joint space (Figure 1). Entry into the joint space

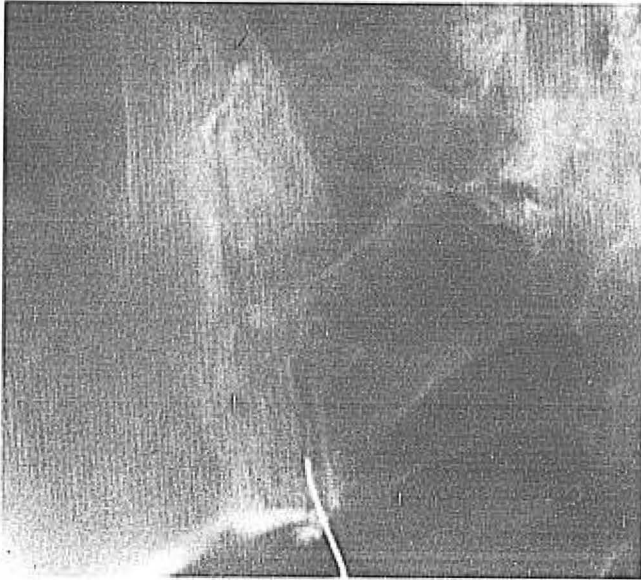


Figure 1. Prone view of an arthrogram of the left sacroiliac joint demonstrating correct needle position and spread of contrast within the joint. Radiographic contrast fills a small inferior subcapsular recess.

often was indicated by the needle assuming a distinct bend as it conformed to the joint contour. One milliliter of contrast medium then was injected. This initially filled a small inferior, subcapsular recess and then extended to the superior aspect of the joint (Figure 1). Then spot films were taken with views in the prone, lateral, and oblique positions to record the dispersal of contrast medium.

The prone view assesses the size and integrity of the inferior articular recess (Figure 1) and the lateral view reveals any disruption of the ventral capsule (Figure 2). The ipsilateral oblique view reveals the intra-articular contrast as a discrete line between the sacrum and the ilium (Figure 3). The contralateral oblique view (right anterior oblique position for left sacroiliac joint injection) demonstrates the *en face* view of the joint, showing its auricular configuration (Figure 4).

After the injection of contrast medium, the joint was infiltrated with 1 ml of 2% lignocaine.

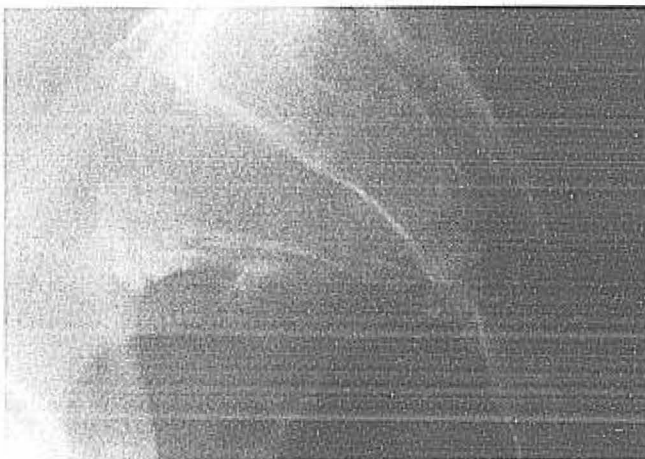


Figure 2. Lateral view of an arthrogram of the right sacroiliac joint demonstrating a ventral capsular tear.



Figure 3. Arthrogram of the left sacroiliac joint with the patient in a left anterior oblique position demonstrating a ventral capsular tear.

The pain response of the patient was recorded by an independent observer. The character and distribution of pain during the injection of contrast medium were noted and graded as "unfamiliar pain," "no pain," "similar pain," or "exact pain" reproduction. Patients were examined 10 minutes after the injection of local anesthetic to determine whether pain was abolished. A response was classed as definite if there was a 75% or greater reduction of pain over the sacroiliac joint and buttock. For unilateral injections, this degree of pain relief had

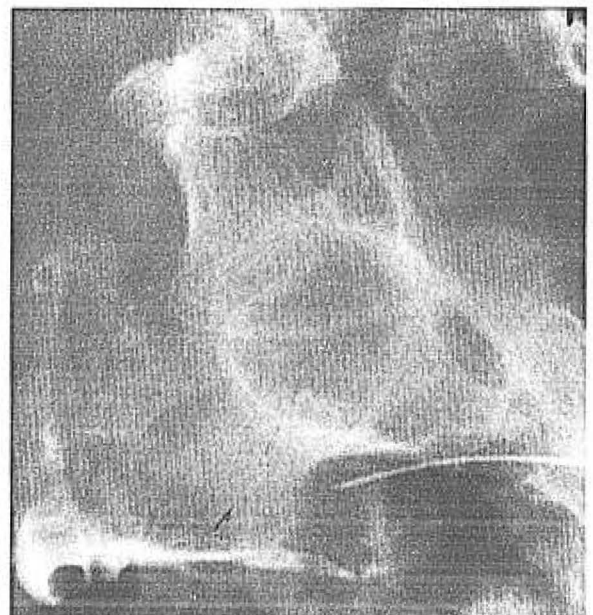


Figure 4. Arthrogram of the left sacroiliac joint with the patient in a right anterior oblique position. There is a ventral capsular tear and radiographic contrast surrounds the iliac vessels.





Figure 5. Axial view of a CT scan after the injection of the right sacroiliac joint demonstrating spread of radiographic contrast anteriorly along the lumbosacral plexus.

to be obtained on the side of the injection only, whereas in patients with bilateral injections, this degree of pain reduction had to be obtained bilaterally.

When leakage of radiographic contrast was found on plain radiography, CT was performed to further define the site of leakage (Figures 5, 6). All films were reviewed by the independent observer and the radiologist and a radiologic diagnosis then was made. Patients who underwent bilateral sacroiliac joint injections were required to demonstrate radiographic evidence of a tear on one or both sides to have a tear recorded.

Data were recorded on a database using Epi Info<sup>7</sup> on a personal computer. Statistical analysis was performed using



Figure 6. Coronal view of a CT scan after the injection of the left sacroiliac joint demonstrating spread of radiographic contrast above piriformis immediately lateral to the L5 ventral ramus.

Table 1. Comparison of Injection and Zygapophysial Joint Injection

SIJ Result	Zygapophysial Joint Result	
	Positive	Negative
Positive	1	12
Negative	3	23

A positive response to zygapophysial joint injection is defined as a greater than 50% relief to a confirmatory block using 0.5% bupivacaine. A positive sacroiliac joint (SIJ) block is a greater than 75% relief after a block using 2% lignocaine. Four of the patients eligible for confirmatory injections into their zygapophysial joints were unable to have this performed and therefore were omitted from this table.

Statistix (Analytical Software, St. Paul, MN) Version 4.0.<sup>1</sup> Two by two contingency tables were used to observe relationships between the results of two different tests. The chi squared test was used to compare categorical data, and Fisher's exact test was used when the expected number of subjects per cell was less than five.

Three putative diagnostic criteria for sacroiliac joint pain were assessed: 1) reproduction of accustomed pain by the injection of contrast medium, 2) relief of pain after the injection of local anesthetic, and 3) abnormalities on imaging.

## Results

All 43 patients who were eligible for this study successfully underwent intra-articular sacroiliac joint injections. Upon injection of contrast medium into the joint, 16 patients had no reproduction of their pain or production of unfamiliar pain, 10 patients had similar reproduction, and 17 had exact reproduction of their pain. Thirteen patients obtained definite and gratifying relief of their pain after the injection of local anesthetic, four of whom obtained complete relief. Only one pa-

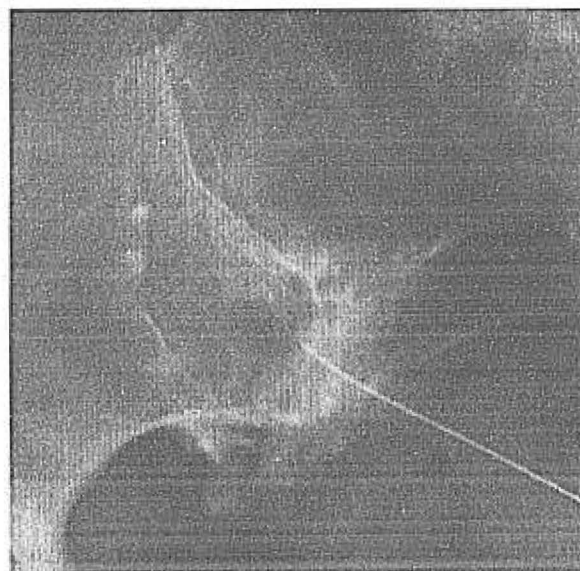


Figure 7. Left sacroiliac joint arthrogram taken with the patient in the right anterior oblique position demonstrating multiple diverticula.

**Table 2. Correlation of the Appearance of the Sacroiliac Joint on Arthrography and Post-arthrography CT With Response to Local Anesthetic Blocks of the Joint**

Imaging Abnormality	Response to Blocks		Totals
	Relief	No Relief	
Ventral tear	9	9	18
Diverticula	1	2	3
Diverticula with ventral tear	0	1	1
Diverticula with dorsal tear	0	1	1
Normal	3	17	20
Total	13	30	43

The presence of tears of the capsule is significantly associated with relief of pain ( $\chi^2 = 4.74$ ;  $P = 0.03$ ). Figures are numbers of patients.

tient who responded to blocks of the sacroiliac joint had responded to prior blocks of the lumbar zygapophysial joints (Table 1).

Twenty-three patients exhibited abnormalities on arthrography and post-arthrography CT of the joint. Tears of the ventral capsule were evident in 18 patients (Figures 1–6), diverticula of the capsule were evident in three patients (Figure 7), one patient exhibited diverticula and a ventral tear, and one patient exhibited diverticula and a tear of the dorsal capsule.

There was a weak but statistically significant association between ventral capsular tears of the joint and relief of pain upon anesthetizing the joint. A greater proportion—the majority—of patients who obtained relief exhibited this abnormality (Table 2). Diverticula were not associated with relief of pain. Only 15% of patients with normal arthrograms obtained relief of pain (Table 2).

There was a significant association between provocation of pain by injection of contrast medium and relief of pain after anesthetization of the joint (Table 3). However, this essentially was a negative correlation. Failure to reproduce pain and reproduction of similar but not exact pain were predictive of failure to relieve pain with blocks. Exact reproduction of pain occurred proportionally more frequently in patients who obtained relief, but not at a statistically significant level.

Using response to blocks alone as the diagnostic criterion, 13 out of 43 patients (30%; 95% confidence

**Table 3. Correlation of the Response to Provocation of the Sacroiliac Joint With Response to Anesthetization of That Joint**

Reproduction of Pain Upon Provocation	Response to Blocks		Totals
	Relief	No Relief	
None or dissimilar	2	14	16
Similar	2	8	10
Exact	9	8	17
Total	13	30	43

$P = 0.036$ ; Fisher exact test. Figures are numbers of patients.

**Table 4. Comparison of the Referral Patterns Between Patients With and Without Sacroiliac Joint Pain**

	Analgesic Positive (1) ( <i>P</i> Value)	Analgesia and Ventral Tear (2) ( <i>P</i> Value)
Groin pain	0.0001	0.004
Buttock pain	0.19	0.37
Thigh pain	0.45	0.67
Calf pain	0.72	0.67
Foot pain	0.69	0.67

*P* values are derived from Fisher exact test.

Criteria for sacroiliac joint pain are 1) a 75% reduction in pain after the intra-articular administration of 2% lignocaine, and 2) criteria for an analgesic response as in 1), as well as arthrographic evidence of a ventral capsular tear. Only patients with unilateral pain were considered for this analysis, and side of referred pain had to coincide with the side of injection.

interval, 16%–44%) showed evidence of sacroiliac joint pain. On a worst case analysis, this constitutes 13% (95% CI, 6%–20%) of the original sample. Using relief of pain combined with ventral capsular tear as the criteria, the prevalence of sacroiliac joint pain in those patients investigated was 9/43 (21%; 95% CI, 9%–33%) or 9% (95% CI, 3%–15%) on a worst case analysis. Seven patients satisfied the three criteria of provocation, relief, and abnormal imaging, constituting a prevalence of 16% (95% CI, 5%–27%) in those investigated and 7% (95% CI, 2%–12%) on a worst case analysis.

When the pain patterns of patients with sacroiliac joint pain were compared with those of patients whose pain was not of sacroiliac joint origin, the only clinically distinguishing characteristic was the presence of groin pain ( $P < 0.004$ ). No other pain distributions were found to be more common in one group than the other. In particular, radiation of pain below the knee was as common in patients with sacroiliac joint pain as in those without (Table 4). None of the conventional examination procedures tested could discriminate patients with sacroiliac joint pain from those who had no such pain (Table 5).

**Table 5. Comparison of Selected Historical and Examination Features Between Patients With and Without Sacroiliac Joint Pain**

	Analgesic Positive (1) ( <i>P</i> Value)	Analgesia and Ventral Tear (2) ( <i>P</i> Value)
Pain worse on sitting	0.15	0.23
Pain worse on standing	0.15	0.67
Pain worse on walking	0.10	0.18
Pain relieved by sitting	0.90	0.58
Pain relieved by standing	0.12	0.96
Pain relieved by walking	0.92	0.59
Pain worse on flexion	0.42	0.61
Pain worse on extension	0.13	0.56

*P* values are derived from Fisher exact test.

Criteria for sacroiliac joint pain are 1) a 75% reduction in pain after the intra-articular administration of 2% lignocaine, and 2) criteria for an analgesic response as in 1), as well as arthrographic evidence of a ventral capsular tear.

## ■ Discussion

This study represents the first concerted, formal exploration of sacroiliac joint pain using diagnostic blocks. A novel technique was employed to provide provocation, analgesic, and imaging data on the sacroiliac joint. In this way, an estimate of the prevalence of pain arising from the sacroiliac joint could be obtained. All patients had undergone other blocks that acted as controls and decreased the likelihood that their responses to sacroiliac blocks were false-positive. The results refute the null hypothesis that sacroiliac joint pain does not occur among patients with chronic low back pain.

The estimate of the prevalence of sacroiliac joint pain in these patients depends on the criteria adopted. Relief of pain after controlled diagnostic blocks should, in principle, be a sufficient criterion. Under these conditions, the prevalence of sacroiliac joint pain would appear to be at least 13% and perhaps as high as 30%. However, cynical observers might not trust a response to diagnostic blocks alone and would prefer to see pathologic evidence of why the joint should be painful. In this regard, the present study provides some data.

Tears of the ventral capsule of the joint are significantly associated with relief of pain, although they are not pathognomonic of sacroiliac joint pain. Nonetheless, they constitute a plausible basis for pain in that they indicate some form of traumatic disruption of the joint. They are not likely to be artifactual because in the present study, injections into the joint were not sufficiently forcible to disrupt a normal joint capsule.

Under these circumstances, the combination of relief of pain and ventral capsular tears indicates a prevalence of sacroiliac joint pain of 21% of patients investigated—9% on a worst case analysis. Neither of these figures is negligible.

Whether other lesions might be the basis of sacroiliac joint pain was not addressed in the present study. Such lesions might exist, but they would need to be pursued in future studies designed expressly for that purpose. The prime purpose of the present study was to determine whether sacroiliac joint pain does occur and therefore whether it was worthy of further consideration.

Reproduction of pain upon distending the joint with contrast medium is used by some investigators of lumbar zygapophysial joint pain as a diagnostic criterion for pain from those joints.<sup>6,15</sup> In the context of sacroiliac joint pain, however, this criterion is not valid. Failure to reproduce pain has some negative predictive value, but reproduction of exact pain occurs in patients who obtain relief upon blocking the joint and in those who do not. For this reason, pain provocation is not suitable as a diagnostic criterion. This leaves diagnostic blocks as the only available contender as a criterion standard for sacroiliac joint pain.

Regarding the hypothesis addressed in this study, it cannot be stated that sacroiliac joint pain does not exist.

Otherwise, under controlled conditions, no patients should have responded to diagnostic blocks. However, it is not a common condition. Nonetheless, the results of the present study justify further pursuit of this entity.

The prevalence estimates obtained from this study should constitute minimum values because the study was biased against finding the condition. Only patients with pain below L5–S1 were investigated. It may be that patients with other forms of pain also could have sacroiliac joint pain. This could be determined by a future study in which the diagnostic blocks are applied to patients with back pain irrespective of its distribution.

In the present study, no conventional clinical features were found to be predictive of sacroiliac joint pain, save that groin pain was strongly associated although not absolutely. Whether or not less conventional examination techniques such as those described in the manual medicine literature<sup>8–10,19</sup> are able to detect painful sacroiliac joints has yet to be determined, but the diagnostic blocks employed in the present study could be used as a criterion standard in studies to this end.

In some quarters, it is believed that sacroiliac pain is an unrecognized basis for disability in some patients with low back pain. The results of this study lend credence to this belief, but they do not support unbridled claims regarding the prevalence of sacroiliac joint pain. More importantly, the present study describes a technique that can serve as a criterion standard for epidemiologic and other clinical studies that should pursue more precisely the prevalence and clinical diagnosis of sacroiliac joint pain lest patients with this condition continue to go unrecognized.

## Acknowledgments

Special thanks go to Dr. Joseph Fortin, who provided several of the patients for this study.

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