Evidence-Based Diagnosis and Treatment of the Painful Sacroiliac Joint

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ABSTRACT: Sacroiliac joint (SIJ) pain refers to the pain arising from the SIJ joint structures. SIJ dysfunction generally refers to aberrant position or movement of SIJ structures that may or may not result in pain. This paper aims to clarify the difference between these clinical concepts and present current available evidence regarding diagnosis and treatment of SIJ disorders. Tests for SIJ dysfunction generally have poor inter-examiner reliability. A reference standard for SIJ dysfunction is not readily available, so validity of the tests for this disorder is unknown. Tests that stress the SIJ in order to provoke familiar pain have acceptable inter-examiner reliability and have clinically useful validity against an acceptable reference standard. It is unknown if provocation tests can reliably identify extra-articular SIJ sources of pain. Three or more positive pain provocation SIJ tests have sensitivity and specificity of 91% and 78%, respectively. Specificity of three or more positive tests increases to 87% in patients whose symptoms cannot be made to move towards the spinal midline, i.e., centralize. In chronic back pain populations, patients who have three or more positive provocation SIJ tests and whose symptoms cannot be made to centralize have a probability of having SIJ pain of 77%, and in pregnant populations with back pain, a probability of 89%. This combination of test findings could be used in research to evaluate the efficacy of specific treatments for SIJ pain. Treatments most likely to be effective are specific lumbopelvic stabilization training and injections of corticosteroid into the intra-articular space.

KEYWORDS: Corticosteroid Injection, Diagnostic Accuracy, Intra-Articular Injection, Lumbopelvic Stabilization Training, Pregnancy-Related Pelvic Girdle Pain, Sacroiliac Joint Dysfunction, Sacroiliac Joint Pain

The relationship between the sacroiliac joint (SIJ) and low back pain has been a subject of debate with some researchers regarding SIJ pain as a major contributor to the low back pain problem[1] with others regarding it as unimportant or irrelevant[2]. It is now generally accepted that about 13% (95% CI: 9-26%) of patients with persistent low back pain have the origin of pain confirmed as the SIJ[3]. Movement and positional abnormalities of the SIJ and their treatments have appeared in the manual therapy, manual medicine, osteopathic, and chiropractic literatures from the 19th century onwards[4-7]. The prevalence of these disorders is reported as being about 20% in college students[8] and between 8 and 16% in asymptomatic individuals[9]. The relationship between perceived motion and positional abnormalities remains unclear[8,10], and it is claimed that every patient with low back pain has these abnormalities, e.g., *a perceivable anterior rotary subluxation of the ilium,* and that the great majority can be made rapidly pain-free by its manual correction[11]. The purpose of this commentary is to clarify the conceptual distinction between these perceived anatomical and biomechanical abnormalities, i.e., SIJ dysfunction, and pain arising from the SIJ, and its relation to the common complaint of low back and referred pain into the buttock, pelvis, and lower extremity. In addition, fruitful directions for future research are discussed in some detail.

There are two clinical perspectives to consider: the SIJ as a load-transferring mechanical junction between the pelvis and the spine that may cause either the SIJ or other structures to produce painful stimuli, and the SIJ as a source of pain. The first perspective proposes that the joint is malfunctioning in some manner and the word *dysfunction* is commonly used to encapsulate the complexity of aberrations believed to occur. Unfortunately, the terms *SIJ dysfunction* and *SIJ pain* are commonly used interchangeably as though they have the same meaning. In this paper, these two terms will be clearly differentiated.

Sacroiliac Joint Dysfunction

The evidence favoring the perspective that mechanical SIJ dysfunctions are related to the experience of back and referred pain is less than convincing, despite the volume of papers published on the subject[12,13]. The range of motion in the SIJ is small, less than 4° of rotation and up

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to 1.6 mm of translation[14,15]. Additionally, in patients presumed to have an SIJ source of pain, Sturesson[16] found no difference in range of motion between the symptomatic and asymptomatic sides.

Reliability of Palpation SIJ Tests Aimed at Identifying Dysfunction

A large number of clinical tests have been proposed to assess movement or asymmetry of the SIJ. These tests have been examined for intra- and inter-examiner reliability in studies of varying quality. In general, inter-examiner reliability of individual tests is poor[13,17-25], but some tests have shown adequate reliability[26,27]. There is also evidence that greater experience in using these tests results in poorer inter-examiner reliability compared to the reliability of novices[24,28].

A number of studies have addressed the problem of poor reliability of individual palpation SIJ tests by assessing groups or clusters of tests with some success[29-32]. While this may provide some encouragement to those accustomed to using these tests, it is hard to see how this can be of real value. Clustering individually unreliable tests may improve reliability but still lacks face validity.

Diagnostic Accuracy of Palpation SIJ Tests Aimed at Identifying Dysfunction

Diagnostic accuracy is determined by comparing the results of a test with the results of a reference standard deemed to be superior in making the diagnosis. Sensitivity and specificity are the key statistical measures used to estimate diagnostic accuracy and to calculate the likelihood ratios of a positive or negative test. Sensitivity is the proportion of patients with the disease in question who have positive tests. Specificity is the proportion of patients without the disease in question who have negative tests. In musculoskeletal medicine, individual tests generally have either high sensitivity or high specificity, but not both.

A test with high sensitivity and low specificity cannot be used to make a diagnosis because of the high proportion of cases with positive tests but negative to the reference standard; i.e., there is a high false positive rate. A test with high specificity and low sensitivity is useful in making the diagnosis, but a large proportion of cases positive to the reference standard will have negative tests; i.e., there is a high false negative rate[33,34]. Consequently, if making the diagnosis of SIJ dysfunction is the objective, tests for dysfunction need to have high specificity with respect to an acceptable reference standard.

The problem is that there is no widely accepted reference standard for SIJ dysfunction. Any reference standard must measure or identify the same phenomenon as the tests. The only credible developed reference standard for SIJ mobility so far utilized and studied is radiostereometric x-ray analysis during flexion/extension with metal markers imbedded into the sacrum and ilia[14,15,35]. Using a different reference standard, Dreyfuss et al[10] examined the diagnostic accuracy of commonly used palpation tests for position or mobility in relation to the results of diagnostic anesthetic injection into the SIJ. These researchers found that the sensitivity and specificity of the Gillet, standing flexion, and motion demand spring tests were poor. This was an expected finding given that the reference standard related to SIJ pain, not dysfunction. In an earlier study, the same authors found a prevalence of positive Gillet, standing flexion, and sitting flexion tests of 16%, 13%, and 8%, respectively, in asymptomatic individuals[9].

Cibulka et al[32] reported a sensitivity of 82% and specificity of 88% for three of four palpation-based tests (standing flexion, PSIS position in sitting, supine long sitting, and prone knee flexion). These results are unconvincing for three reasons: the study used an inappropriate reference standard, i.e., the presence or absence of low back pain; there was inadequate blinding in that the report does not use the word *blinding* nor describe a blinding procedure worthy of the name; and the study lacked face validity due to the use of a cluster of individually unreliable tests. Overall, palpation tests for SIJ movement, position, and symmetry are compromised for a variety of reasons, not the least of which are the normal variations in form and the common finding of natural fusion[36-38].

Sacroiliac Joint Pain

Stimulation of SIJ in asymptomatic volunteers produces pain[39]. Buttock and lower extremity pain can be ablated by the introduction of local anesthetic into the joint space under image intensifier guidance[40], and pain referral maps in symptomatic patients are available[39,41]. These facts provide a strong case for the SIJ as a potential and possibly sole source of pain in specific patients with buttock and lower extremity pain[30,42,43].

SIJ pain cannot be diagnosed using nerve blocks because of its diffuse innervation[44]. A reference standard for diagnosing SIJ pain was recommended in 1994 by the International Association Society for the Study of Pain (IASP)[45]. IASP's three diagnostic criteria were:

1. Pain is present in the region of the SIJ.
2. Stressing the SIJ by clinical tests that are selective for the joint reproduces the patient's pain.
3. Selectively infiltrating the putatively symptomatic joint completely relieves the patient of the pain.

Based on recent research, the IASP criteria have been superseded for a variety of reasons. Diagnostic injections must be performed under image intensifier control because *blind* injections rarely succeed in placing injectate within the SIJ cavity[46,47]. The optimal technique of injection was established in 1992[48] and is described in the current edition of the practice guidelines issued by the International Spine Intervention Society[42]. Because false positive responses to single diagnostic blocks into synovial joints are common[49], comparative or placebo-controlled blocks are now considered essential before a diagnosis of SIJ mediated pain is confirmed[42].

Clinical Pain Provocation Sacroiliac Joint Tests

Non-invasive clinical testing for SIJ pain rests on pain provocation tests that stress the SIJ structures and provoke the usual

or familiar pain of which the patient complains. The key tests (distraction, compression, thigh thrust, Gaenslen's, and sacral thrust) have been described in detail in previous publications[19,50-52] and are reproduced in Figures 1–5. The Drop test (Figure 6) described by Robinson et al is reliable[19] but has not yet been assessed for validity in a diagnostic accuracy study.

Reliability of Pain Provocation SIJ Tests

Early studies reported mixed results on the inter-examiner reliability of pain provocation tests[17,25,53,54], but subsequently these tests have been shown to possess acceptable levels of reliability provided that they are highly standardized[12,13,19,50].

Validity of Pain Provocation SIJ Tests

A recent study confirmed that three or more pain provocation SIJ tests have modest predictive power in relation to controlled comparative SIJ blocks. Sensitivity and specificity were 91% and 78%, respectively[52]. In a second paper, the data were analyzed in more detail against a single block reference standard to report on the diagnostic accuracy of composites of pain provocation SIJ tests. It was found that the optimum number of positive tests is three or more positive tests[51]. Since that time, other researchers have replicated these findings against a double block standard[20] in a different and larger sample, using different examiners and a different physician performing the diagnostic injection. The results of the two studies are strikingly similar[55] despite the use of a slightly different mix of SIJ tests in each study. A comparison of results appears in Table 1.

SIJ pain and discogenic pain, as revealed by double SIJ blocks and provocation discography, rarely co-exist[56,57]. Anecdotal experience has indicated that provocation SIJ tests were commonly positive in those with nerve root pain secondary to a herniated lumbar disc and in those whose symptoms could be made to centralize during a McKenzie-type physical examination[58]. The centralization phenomenon is a common clinical observation when low back patients are examined using the standardized test movements and sustained postures first described by McKenzie[59]. The centralization phenomenon has been repeatedly described and evaluated for reliability and validity[60-74]. Subsequently, it has been found to be highly specific to discogenic pain and is not observed in patients with confirmed SIJ pain or facet joint pain[52,57,75-78]. On this basis, it seems reasonable to assume that SIJ tests, positive in the presence of the centralization phenomenon, are falsely positive.

Restricting the interpretation of the SIJ tests to non-centralization cases improves the specificity of three or more positive pain provocation SIJ tests from 78% to 87% with the sensitivity remaining at 91%[52]. Patients satisfying these criteria have a high probability that SIJ pain will be confirmed by diagnostic injection of local anesthetic. This *clinical reasoning process* may be considered a clinical prediction rule for the identification of a subset of patients most likely to have pain of SIJ origin. For convenience, we may refer to this as the SIJCPR.

Likelihood ratios are summary statistics derived from sensitivity and specificity values. The likelihood ratio for a positive test is an estimate of the probability of the condition/disease. Random guessing will produce a positive likelihood ratio of 1.0. Values higher than 1.0 represent probability better than random chance. The higher the value, the better the test. For example, a test with a positive likelihood ratio of 10 indicates that a positive test result is 10 times more likely in patients with the disease in question than in those known to be free of that disease. The likelihood ratio of a negative test describes the test's ability to rule out the disorder for which the test is applied. As the value of a negative likelihood ratio approaches zero, the test's power to rule out the disease in question approaches perfection. Conversely, as the value of the negative likelihood ratio increases towards 1.0, the test's ability to rule out the disorder approaches random chance[79]. When both the prevalence of the disorder and the results of a test are known, likelihood ratios permit calculation of the change in odds and probability of a disorder being present or absent[80]. Prior to any examination, the probability of a given disorder being present is its prevalence. For example, if the prevalence of SIJ pain is 13%[81], its pre-examination probability is 0.13. The diagnostic value of a test is reflected by how much the probability of the disorder increases when the test is positive and by how much it falls when it is negative. The diagnostic value of a given test can be depicted using Fagan's nomogram (http://araw.mede.uic.edu/cgi-bin/testcalc.pl) in which the pretest probability, prevalence, positive and negative likelihood ratios, and post-test probabilities are presented graphically. Figure 7 presents Fagan's nomogram using data from Laslett et al[52] in which three or more positive SIJ tests are considered positive for SIJ pain without consideration of the centralization phenomenon. The likelihood ratio for a positive test (three or more SIJ tests provoke the patient's familiar pain) is 4.16 so the probability of SIJ pain more than doubles from 26% to 59%. The likelihood ratio of a negative test is 0.12 yielding a post-test probability of 4%.

If the SIJCPR of three or more positive provocation SIJ tests and the absence of centralization are applied, the diagnostic performance is improved because the false positive rate is decreased with proportionate improvement in specificity from 78% to 87%. Fagan's nomogram created using the SIJCPR is presented in Figure 8. The sample size is 34 as a result of removal of the 9 centralization cases from the calculation and the prevalence is higher at 32%. The positive likelihood ratio is 7.0, yielding a post-test probability of 77%. The negative likelihood ratio is 0.10, yielding a post-test probability of about 5%.

The practical value of this data is as follows. If about 30% of patients with low back pain have pain of SIJ origin, and an individual patient has three or more positive provocation SIJ tests, there is a 59% chance that this patient will have SIJ pain. If a McKenzie assessment of repeated movements fails to reveal the centralization phenomenon, there is a 77% chance that the pain is of SIJ origin.

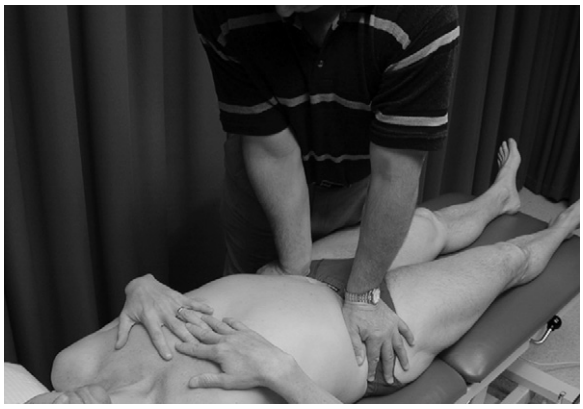


FIGURE 1. The distraction test (testing right and left SIJ simultaneously).

Note: Vertically oriented pressure is applied to the anterior superior iliac spinous processes directed posteriorly, distracting the sacroiliac joint.

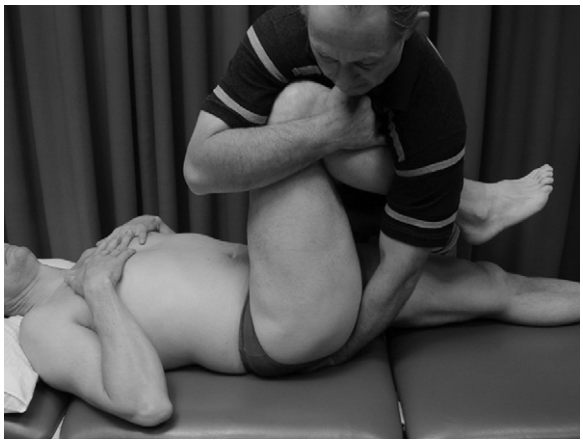
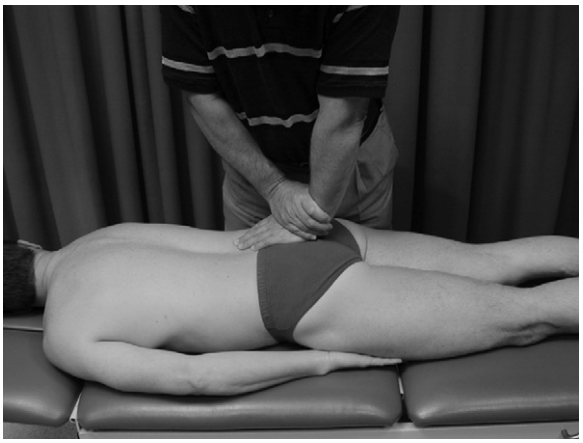


FIGURE 2. The thigh thrust test (testing the right SIJ).

Note: The sacrum is fixated against the table with the left hand, and a vertically oriented force is applied through the line of the femur directed posteriorly, producing a posterior shearing force at the SIJ.



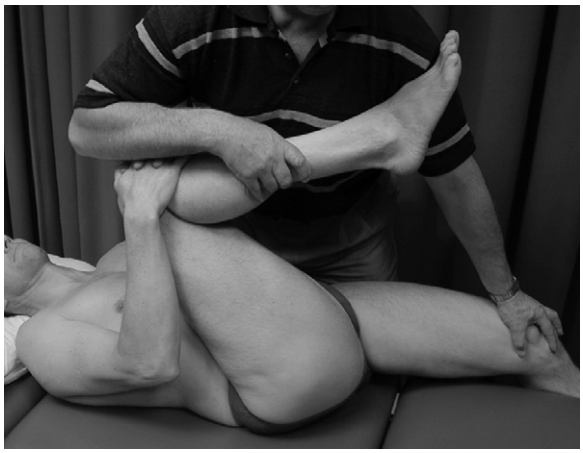


FIGURE 3. Gaenslen's test (testing the right SIJ in posterior rotation and the left SIJ in anterior rotation).

Note: The pelvis is stressed with a torsion force by a superior/posterior force applied to the right knee and a posteriorly directed force applied to the left knee.

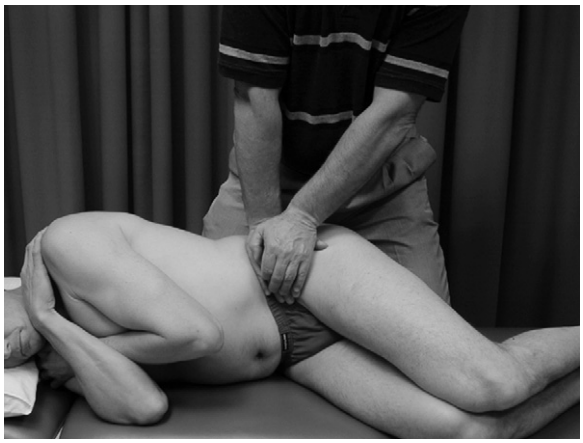


FIGURE 4. The compression test (testing right and left SIJ).

Note: A vertically directed force is applied to the iliac crest directed towards the floor, i.e., transversely across the pelvis, compressing the SIJs.

FIGURE 5. The sacral thrust test (testing right and left SIJ simultaneously).

Note: A vertically directed force is applied to the midline of the sacrum at the apex of the curve of the sacrum, directed anteriorly, producing a posterior shearing force at the SIJs with the sacrum nutated.

FIGURE 6. The drop test (testing the left SIJ).

Note: The patient raises the heel from the floor taking near full bodyweight, then drops the heel to the floor with a bump, retaining the knee in extension at all times, producing a cranially directed shear force at the left SIJ. Reprinted with permission[19]

TABLE 1. Comparison between Laslett M et al[51] and van der Wurff et al[20] studies of the validity of multiples of positive pain provocation SIJ tests.

Diagnostic accuracy statistic	Number of positive provocation SIJ tests									
	1 or more		2 or more		3 or more		4 or more		5 or more	
	ML	PvW	ML	PvW	ML	PvW	ML	PvW	ML	PvW
Sensitivity %	100	100	93	93	91	85	60	26	27	0
Specificity %	44	42	66	58	78	79	81	82	88	100
Positive LR	1.8	1.7	2.7	2.2	4.3	4.0	3.2	1.4	2.1	0
Negative LR	0.0	0.0	0.10	0.13	0.08	0.19	0.49	0.91	0.84	1.00

Notes:

1. LR = likelihood ratio, ML = Laslett M et al 2005, PvW = van der Wurff et al 2006
2. The shaded cells represent the optimal number of positive SIJ provocation tests producing the highest positive likelihood ratio, i.e., 3 or more.
3. The tests included in this study are distraction, compression, thigh thrust, Gaenslen's test, sacral thrust, and Patrick's FABER test.

Treatment

Treatment based on a presumed SIJ source of pain still begs the question of "why does it hurt?" An explanation may be that the SIJ is a source of pain for one of two reasons:

1. There is some support for the notion of an inflammatory condition within the joint either causing or associated with the pain[82,83].
2. The joint is unstable through ligamentous laxity or tearing of the joint capsule[39,84-86].

Inflammatory processes such as those found in ankylosing spondylitis[87,88] are known to affect the SIJ. In addition, instability secondary to trauma or childbirth may well be responsible for repeated minor traumas producing, perpetuating, and increasing inflammatory activity in the joint. These hypotheses regarding the causes of SIJ pain are still speculative and can only be validated or rejected by well-conducted research. However, there is already a most illuminating body of research on the subject of back pain, SIJ tests, and sacroiliac joint manipulation. A recent study prospectively attempted to find a clinical prediction rule for a positive outcome following application of a widely used SIJ manipulation[89,90]. In the original study, it is clear that the authors were searching for a clinical SIJ syndrome. In addition to many other variables included in their regression analyses, some 21 SIJ tests were evaluated, including tests for symmetry, pain provocation tests, and motion tests. None of the SIJ tests used were found to be predictive of the outcome of the manipulation. The authors reported,

> "Manipulation is thought to be indicated in the presence of hypomobility.
>
> Interestingly, although the technique used in this study is described as affecting the SI region, it was lumbar hypomobility that entered the prediction model. This finding reinforces the idea that the manipulation technique is not specific to the SI region but impacts the lumbar spine as well[90]."

One of five possible interpretations of the above results is possible:

1. None of the SIJ tests evaluated has any value in identifying the SIJ lesion believed to be treatable by the manipulation.
2. Very few patients in the sample had SIJ pain or dysfunction.
3. The manipulation used does not affect the SIJ significantly.
4. A non-mechanical mechanism is responsible for the patients' SIJ pain.
5. A combination of the above is true.

On the basis that provocation SIJ tests have been shown to be both reliable and valid predictors of SIJ pain, item 1 is at least partially false. It is highly likely that one or more of items 2 to 4 above are true. How then do we manage patients having a high probability of SIJ pain?

Unfortunately, there are no randomized trials of different treatments for patients with pain confirmed as arising from the SIJs. However, the literature concerning pelvic girdle pain (PGP) associated with pregnancy offers some good-quality information in this regard.

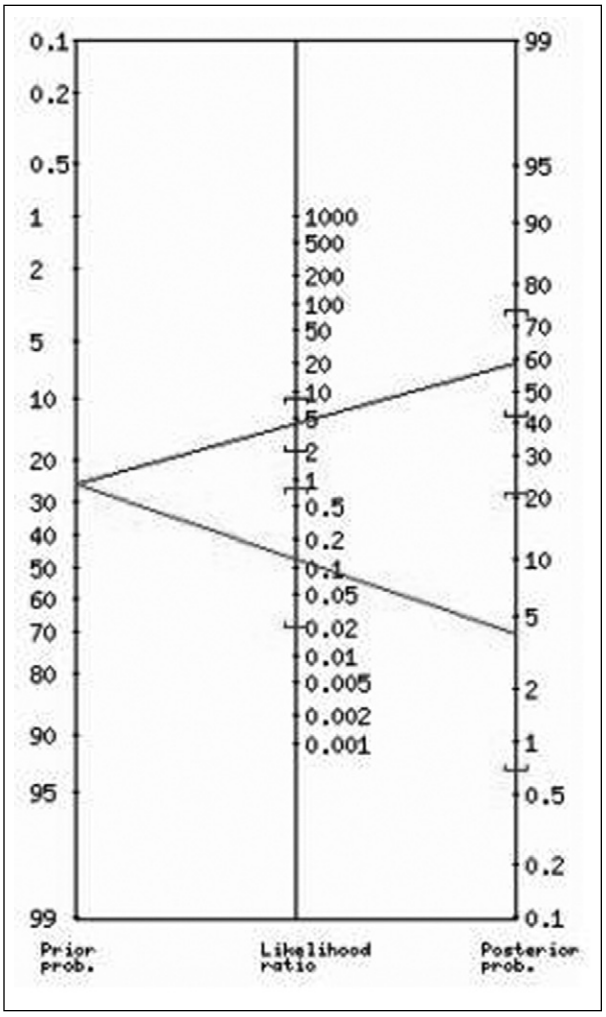


FIGURE 7. Fagan's nomogram from data derived from Laslett et al[52], N=43.

Notes: Prior probability (odds): 26% (0.3)

POSITIVE TEST: Positive likelihood ratio: 4.16, 95% confidence interval: [2.10,8.21] Posterior probability (odds): 59% (1.4) 95% confidence interval: [42%,74%]

NEGATIVE TEST: Negative likelihood ratio: 0.12, 95% confidence interval: [0.02,0.76] Posterior probability (odds): 4% (0.0) 95% confidence interval: [1%,21%]

Odds = Probability / (1-Probability) +LR = Sensitivity / (1-Specificity) -LR = (1 - Sensitivity) / Specificity Posterior Odds = Prior Odds x LR

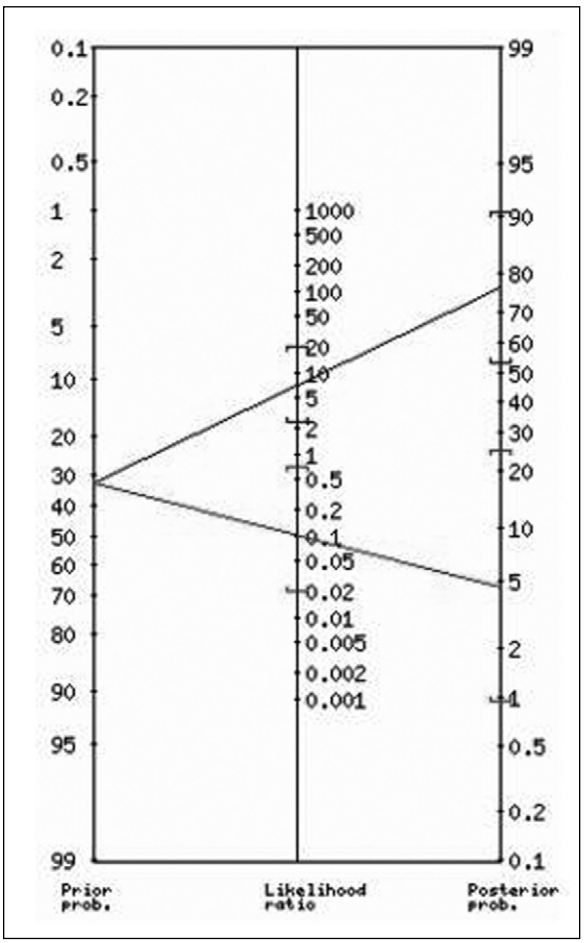


FIGURE 8. Fagan's nomogram from data derived from Laslett et al[52], N=34.

Notes: Prior probability (odds): 32% (0.5)

POSITIVE TEST: Positive likelihood ratio: 6.97, 95% confidence interval: [2.39,20] Posterior probability (odds): 77% (3.3) 95% confidence interval: [53%,91%]

NEGATIVE TEST: Negative likelihood ratio: 0.10, 95% confidence interval: [0.02,0.68] Posterior probability (odds): 5% (0.0) 95% confidence interval: [1%,25%]

Odds = Probability / (1-Probability) +LR = Sensitivity / (1 - Specificity) -LR = (1 - Sensitivity) / Specificity Posterior Odds = Prior Odds x LR

Some 54% of women with pregnancy-related PGP satisfy the SIJCPR[91]. This study did not include a randomized controlled trial of interventions, but other studies on similar populations have been carried out. Stuge et al compared specific stabilization exercises with individualized physical therapy without stabilization exercises in post-partum women with PGP. They found that specific stabilization training resulted in 50% reduction in disability, 30 mm reduction in pain on a 100 mm VAS scale, and improvement in quality of life at one year compared to insignificant changes in the control group[92]. This treatment effect and the differences with respect to the control group were retained at a 2-year follow-up[93]. A similar trial conducted by Elden et al revealed that treatment with stabilizing exercises was superior to *standard treatment* and that acupuncture provided additional benefit[94]. There is evidence that exercises not specifically aimed at improving lumbopelvic stability are no more effective than other commonly used treatments[95,96].

There are other interventions not available to physical therapists that may have value in the treatment of persistent SIJ pain. Corticosteroid injections[88,97,98], phenol injections[99], and radiofrequency neurotomy[100-104] are minimally invasive and appear to be effective in a proportion of cases of SIJ pain, especially if there is imaging evidence of sacroiliitis. Prolotherapy has been recommended by some reports, but the quality of evidence is poor, and methods and subjects are heterogeneous[105]. The evidence in favor of these interventions is limited[106]. Surgical debridement[107] and fusion[108] are more invasive but appear to offer a moderate chance of pain reduction and functional improvement in patients with confirmed SIJ pain unresponsive to more conservative interventions.

Discussion

This paper is a narrative review of the available literature that attempts to synthesize from a large literature base. There are at least three major *schools of thought*:

1. Those who regard the SIJ as either irrelevant or rarely an issue in clinical practice. This group is dominated by clinicians with a surgical background who offer mainly surgical solutions to clinical issues.
2. Those who consider the clinical examination as either useless or of minimal utility and demand only the reference standard of diagnosis, i.e., controlled intra-articular anesthetic injections. This group generally consists of clinicians with a pain medicine background who commonly accept the SIJ as a significant source of back and referred pain, but who deem only injections and neurotomy as viable treatment methods.
3. Those who regard structural and biomechanical aspects of the SIJ and spine as the key determinants in the problem of back pain. These individuals generally have a physical therapy, chiropractic, osteopathic, or manual medicine background.

The manual therapy literature is awash with books, chapters, and papers on the treatment of the sacroiliac joint. Most of these treatment methods are based explicitly or implicitly on the presumption that some biomechanical malfunction or dysfunction causes either the SIJ or other tissues to provoke the pain of which the patient complains. This hypothesis is fragile indeed, since the means by which such dysfunctions are identified rest upon a flimsy evidential base, disputed by published data showing tests for SIJ dysfunction to be unreliable and invalid.

Provocation SIJ tests are more frequently positive in back pain patients than the accepted prevalence of SIJ pain[58]. This indicates that individual tests are often false-positive, supporting a long-held belief that SIJ-generated pain can only be entertained as a possible diagnosis when multiple tests are positive. With this background information and despite an abundance of evidence indicating that no clinical picture is able to characterize pain of SIJ origin[3,10,40,109], a study was initiated to investigate the diagnostic accuracy of pain-provocation SIJ tests. This study was completed in 1998 but publication of results was delayed until 2003. This delay is at least partially responsible for the perpetuation of beliefs that no clinical picture characterizes a patient with SIJ pain[42,110].

It has been pointed out that diagnostic injection into the SIJ can provide data on an intra-articular source of pain but not on pain arising from the extra-articular ligaments[3,51]. In addition, injectate may spread from a successful intra-articular injection to adjacent structures including the dorsal sacral foramina, the L5 spinal nerve and lumbosacral plexus[84]. It is clear that the reference standard for diagnosing SIJ pain is not perfect. This has been used to discredit the procedure as well as the clinical tests predictive of the diagnostic injection outcome[85]. This view, however, is not universally accepted[111]. A recent review of SIJ interventions concluded that there is limited evidence in support of diagnostic and therapeutic procedures for the SIJ[106]. Despite the shortcomings, controlled blocks under fluoroscopic guidance remain the best available reference standard for identifying intra-articular SIJ pain.

This author ceased mobilizing and manipulating the SIJ 20 years ago after becoming convinced of the poor outcome of the procedures. But as a manual therapist, it is hard to give up on a hard-won skill, and from time to time SIJ manipulation was attempted when he was convinced that the SIJ was a source of pain. Subsequent anecdotal experience led to the belief that when a patient satisfies the SIJCPR, manipulation is either unsuccessful or actually aggravates the pain. This experience was later strengthened during research when it became apparent that in cases with confirmed SIJ pain, the patient commonly reported no change or aggravation after manipulation. However, there is a single case report of a patient satisfying the SIJCPR who responded to exercises specifically targeted to an observed directional preference[112]. This case report suggests that

there may be a subgroup of patients likely to have SIJ-mediated pain that is treatable by specific movement/loading strategies; i.e., there exists a subgroup of patients with mechanical SIJ pain.

A goal of this paper is to steer future research into areas with the greatest potential. While back pain patients will have structural and biomechanical aberrations, focusing on these aspects is fraught with problems associated with the reliability and validity of test procedures. A focus on the presence of pain and disability is directly applicable to the patients presenting in our clinics, and the tests associated with this perspective have satisfactory reliability and validity. At the present time, there are no studies that have examined the efficacy, efficiency, and therapeutic value of treatments applied to a cohort of patients confirmed as having SIJ pain. Ideally, such a study would require such a cohort whose SIJ pain has been confirmed by comparative or placebo-controlled SIJ blocks under fluoroscopic guidance. Such a study would not address the question of pain arising from SIJ ligaments external to the SIJ cavity and inaccessible to injected local anesthetic, but it would be a start towards identifying treatments useful for intra-articular SIJ pain.

Researchers should be aware that intra-articular SIJ pain is not a homogeneous subgroup of the low back pain population. Some SIJ pain patients may be best treated by exercise, some by intra-articular corticosteroid or phenol injection, and some by other treatments such as manipulation or prolotherapy. A few may need surgical fusion.

In this author's opinion, the treatments with the most potential for reductions in pain and disability are exercises aimed at improvement in lumbopelvic stability and intra-articular steroid injections. While these treatments could be studied separately, it may be preferable that the treatment arm of the study follow a sequence with an initial period of stabilization training followed by steroid injection for those patients not achieving a satisfactory outcome from exercise. The control arm of the study should be subjected to a sequence of any two of a number of treatments excluding those used in the treatment arm.

One fruitful and achievable research protocol would use the SIJCPR to identify a subgroup of patients most likely to have SIJ pain. Based on available data, 70% to 80% of a normal heterogeneous back pain population who satisfied the SIJCPR would also satisfy the reference standard for diagnosis of SIJ pain, if they were to receive it. If the same SIJCPR were applied to a cohort of women with pregnancy-related PGP, this proportion would likely be much higher. Calculation of the posterior probability from data provided by Gutke et al[91] resulted in an 89% (95% CI 83–93%) probability that those satisfying the rule would have SIJ pain. While such a cohort will still contain some cases with pain arising from structures other than the internal contents of the SIJ, it seems highly likely that if there are effective treatment methods for SIJ pain, differences in outcomes between treatments will be identified. In the author's opinion, the treatments with most potential for reductions in pain and disability are exercises aimed at improvement in lumbopelvic stability and intra-articular steroid injections.

Summary and Clinical Implications

The pain-provocation SIJ tests are reliable if performed in a highly standardized manner, using sufficient force to stress the SIJ. These tests by themselves have some validity in relation to a satisfactory reference standard (controlled fluoroscopically guided intra-articular injection of local anesthetic), but they have even better validity when not interpreted in patients known to have some other source of pain, e.g., discogenic pain. Because a significant proportion of back patients with discogenic pain can be identified using the McKenzie system of evaluation to determine the presence of the centralization phenomenon, the following SIJCPR can be easily applied to the great majority of back pain patients:

1. Three or more provocation tests provoke the usual pain.
2. Centralization of pain is not achieved during a McKenzie evaluation of repeated movements/sustained positions.

Low back pain patients satisfying this SIJCPR have a probability of SIJ pain exceeding 70% and in those with pregnancy-related PGP, the probability is close to 90%. The SIJCPR is a convenient and easily applied selection criterion for future randomized controlled trials investigating potentially valuable treatments for SIJ pain. The treatments with the most potential for success in managing intra-articular SIJ pain are exercise regimes aimed at stabilizing the lumbopelvic mechanism and fluoroscopically guided intra-articular corticosteroid injection.

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