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Idiopathic Pelvic Girdle Pain as it Relates to the Sacroiliac Joint

Challenges in Diagnosing Sacroiliac Joint Pain: A Narrative Review

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Abstract

Accurate diagnosis of sacroiliac joint (SIJ) pain is challenging. Diagnosis can be aided by pain referral patterns, historical features, physical examination maneuvers, and imaging. However, all of these diagnostic tools have limitations. The most reliable clinical tools may be a combination of three or more positive physical exam maneuvers, although the evidence is inconsistent even for this strategy. Intra-articular diagnostic SIJ injections are often used as the reference standard for "true" sacroiliac pain. However, such injections do not consider extra-articular sources of pain that may also exist as part of the sacroiliac joint complex. Research has established the posterior sacral ligaments as a possible source of pain, and the innervation of these ligaments has been anatomically defined. It is possible that by expanding our focus from the articular portion of the sacroiliac complex structure to both the joint and extra-capsular ligaments, advancements in clinical diagnosis and treatment will be possible.

Introduction

In 1994, the International Association for the Study of Pain (IASP) defined three criteria for diagnosing sacroiliac pain: localized pain in the sacroiliac region, pain that is produced by tension with several maneuvers, and pain that decreases with local infiltration of anesthetics to the articulation.[1] In the 25 year since that time, little progress has been made in improving our ability to accurately make a diagnosis in a patient reporting pain in the sacroiliac or posterior pelvic girdle region. This is despite increasing attention directed to the overall global burden of disease attributable to low back pain.[2] Progress has possibly been hindered by the dated assumption that in 90% of patients with the symptom of low back pain, the diagnosis of "nonspecific low back pain" is adequate.[3] Conventional means of diagnosis such as anesthetic injections suggest more accurate diagnoses are certainly possible.[4] Regardless, scrutiny is warranted as to why clarifying the diagnosis of sacroiliac pain remains so difficult.

This review will summarize the available evidence or lack thereof pertaining to relevant history including pain referral patterns, physical examination, and imaging modalities that can be used to diagnosis sacroiliac joint (SIJ) pain. Many of the studies that will be discussed hinge on the reference standard of an image-guided intra-articular anesthetic injection in order to confirm the diagnosis of SIJ pain. Accordingly, for such studies the term SIJ pain will be used as opposed to posterior pelvic girdle pain. Lastly, we will explore potential barriers as to why advancements in the diagnosis of sacroiliac pain have been limited.

Pain Referral Patterns

Slipman et al described pain referral patterns in patients with positive diagnostic intra-articular SIJ injections. Buttock pain was the most frequent symptom, present in 94% of patients, lower lumbar pain in 72% and groin pain in 14%. However, 50% of patients also described associated lower extremity pain, including foot pain in 14%. The authors concluded that pain referral patterns from the SIJ are not limited to the gluteal and lumbar region.[5]

The presence of lumbar pain in patients with confirmed SIJ pain contrasts with findings of Dreyfuss et al,

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who compared pain referral patterns, historical features, and physical exam findings in patients with positive or negative diagnostic intra-articular SIJ injections.[6] In that study, pain above L5 was uncommon in participants with a positive diagnostic SIJ injection. However, this finding may be influenced by the selection criteria for a diagnostic injection, which included the requirement for pain to be primarily below L5. Similar to the study by Slipman et al, pain referral extended beyond the gluteal and lumbar region in many patients. In another similar study, the only pain referral pattern reported to be specific to a positive diagnostic SIJ injection was the presence of groin pain.[6] Although specific, this finding may be present in only 14% of patients.[5] Groin pain has also been reported to correlate highly with intra-articular hip pathology, which interestingly can also present as gluteal pain.[7,8] Otherwise, the presence of buttock pain, thigh pain, calf pain, and foot pain were all found to be nonspecific.[6] Needless to say, pain referral patterns are not specific in discriminating between the diagnosis of SIJ pain and other sources of pain in the lumbosacral area.

Patient History

Dreyfuss et al also found no association between the historical features –presence or absence of pain with standing, walking, sitting, lying down, coughing, bowel movements, or job activities – and a positive diagnostic SIJ injection.[9] Similarly, Schwarzer et al found no association between a positive diagnostic SIJ injection and the presence or absence of pain with sitting, standing, walking, or flexion and extension.[6] Despite common dogma that specific historical features indicate the presence of SIJ pain, evidence comparing these historical features to a reference standard such as a diagnostic SIJ injection are extremely limited. A 2010 systematic review concluded that there are no pain referral patterns or patient history items that can be relied upon to accurately diagnose SIJ pain.[10]

Physical Exam

There are conflicting studies regarding the validity of the physical exam in diagnosing SIJ pain. Maigne et al performed the first study using diagnostic SIJ injections as the reference standard to evaluate this physical exam for the diagnosis of SIJ pain. Ten of 54 participants had immediate pain relief on both occasions following consecutive anesthetic injections, commonly referred to as positive dual blocks, and were diagnosed with SIJ pain. In this study, there was no statistically significant association between any physical exam maneuver (distraction test, compression test, sacral thrust test, Gaenslen's test, or Patrick's test) and response to the diagnostic injections.[11] Dreyfuss et al evaluated 12 different features (including physical exam maneuvers) using a single diagnostic injection as a reference standard in 45 patients with a positive response and in 40 patients with a negative response.[9] No single exam maneuver, including Gillet's test, thigh thrust, Patrick's test, Gaenslen's test, sacral thrust, sacral tenderness with palpation, and joint play was found to have a statistically significant association with the response to the diagnostic injection, with the highest likelihood ratio being only 1.3. Increasing the number of tests that yielded positive results did not improve the diagnostic power, sensitivity, specificity, or likelihood ratios. More specifically, combinations of exam maneuvers, such as three or more positive results, still failed to show diagnostic utility. These results offer little evidence to support the use of physical examination for accurate diagnosis of SIJ pain.

These findings contrast two studies of similar design. Laslett et al evaluated 6 physical exam maneuvers (distraction, thigh thrust, Gaenslen's (right and left), compression, and sacral thrust) in 48 patients with predominantly gluteal pain. Dual diagnostic intra-articular anesthetic SIJ injections with lidocaine and bupivacaine were used as the reference standard to diagnose SIJ pain. Sixteen patients were diagnosed with SIJ pain and 32 had negative diagnostic blocks.[12] The thigh thrust test was the most sensitive test (0.88 95% [confidence interval] CI 0.64, 0.97), with a positive likelihood ratio of 2.8 (95%CI 1.66-4.98). The distraction was the most specific physical exam maneuver (0.81 95% CI 0.65, 0.91), with a positive likelihood ration of 3.2 (95% CI 1.42-7.31). The strongest combination of exam maneuvers was that the presence of three or more positive exam maneuvers, which resulted in a positive likelihood ratio of 4.29 (95% CI 2.34-8.58). Alternatively, the absence of any positive exam maneuvers resulted in a negative likelihood ratio of 0.00 (95% CI 0.0-0.5). In a separate study also using dual positive diagnostic injections as the reference standard, these findings were replicated. The presence of at least three out of five positive physical exam maneuvers was found to have a positive likelihood ratio of 4.02 and zero out of five positive physical exam maneuvers had a negative likelihood ratio of 0.00.[13]

A reasonable conclusion may be that in the absence of any positive physical exam maneuver, the diagnosis of SIJ pain is unlikely. With an increasing number of positive physical exam maneuvers, the diagnosis of SIJ pain is more likely. However, given the disparity in findings among the Dreyfuss, Laslett, and van der Wurff studies, no definitive conclusion can be reached regarding physical examination findings that are pathognomonic for SIJ pain.

Diagnostic Imaging

In cases of trauma or inflammatory sacroiliitis, abnormalities such as bone incongruities, bone erosions, joint space alterations, subchondral sclerosis, and ankylosis can be seen on imaging such as computed tomography (CT) scans or even plain films.[14,15] Similarly, in cases of

pelvic trauma, imaging can be diagnostic. However, radiographic findings are rarely helpful in the diagnosis of SIJ pain not related to an underlying rheumatologic condition or trauma. There are no studies that demonstrate an association between x-ray abnormalities of the SIJ and the presence or absence of SIJ pain using a reference standard such as a diagnostic injection. Elgafy et al found that the presence of SIJ abnormalities on CT in patients with positive diagnostic SIJ injections to be 57.5%, compared to 31% in age-matched controls without pelvic or low back pain.[15] This equates to an overall low sensitivity (57.5%) and low specificity (69%), suggesting that bone-imaging modalities such as x-ray or CT scan have low utility in diagnosing SIJ pain.

There is limited literature on the association between MRI findings and SIJ pain. Findings of bone marrow edema, joint erosions, and fat infiltration are associated with the presence of ankylosing spondyloarthropathy. However, these abnormalities are seen equally in patients with nonspecific low back pain and asymptomatic patients.[16] In a sample of healthy asymptomatic military recruits, SIJ abnormalities visualized on magnetic resonance iaging (MRI) were present in 40.9% of participants, suggesting low specificity of such findings.[17] MRI findings have not been studied in the context of SIJ pain confirmed by intra-articular diagnostic SIJ injection.

Two studies have evaluated the diagnostic characteristics of radionuclide bone scans for confirmation of SIJ pain in reference to the reference standard of a positive diagnostic intra-articular SIJ injection. Both studies found low sensitivity (46.1% and 21%) and high specificity (89.5% and 100%) of radionuclide scans for the diagnosis of SIJ pain.[18,19] Given the low sensitivity, in addition to the radiation exposure associated with radionuclide bone scan, routine use of nuclear imaging to diagnose SIJ pain is not recommended.

Diagnostic Intra-Articular Injections

Diagnostic intra-articular SIJ injections are reviewed extensively elsewhere in this supplement. In patients deemed to have the clinical diagnosis of SIJ pain, a single diagnostic injection is positive between 29% and 63% of the time and when using a dual block paradigm, this decreases to 10%–33%.[10] This suggests a relatively high false positive rate of a single diagnostic injection, estimated to be 20% by Kennedy et al.[10] The study by Maigne et al in which 35 patients had a negative initial block and 19 patients had a positive initial block, only 10 of the 19 had a positive confirmatory block.[11] This would suggest that if 44 were deemed to not have SIJ pain, the false positive rate would be 9/44, or 20%. Using this example, it becomes apparent that using dual block paradigm as a reference does not allow for calculating the false negative rate of the injection, which remains poorly quantified, as it is unknown how many have "true" SIJ pain that had negative blocks. A triple block paradigm, including two anesthetic injections and one with placebo would be needed to more accurately define the false negative and false positive rates of intra-articular SIJ anesthetic injections.

There are technical limitations to the procedure as well including a compromised capsule due to ventral capsular defect that potentially anesthetizes the lumbosacral plexus in as many as 42% of people,[6] dorsal leakage of the joint capsule that potentially anesthetizes posterior structures occurring as frequently as 32%,[20] communication of the joint with the S1 foramen,[20] and difficulty accessing the joint in as many as 10% of patients.[11]

Although diagnostic injections are considered the reference standard, they are certainly not a "gold" standard for the diagnoses of SIJ pain or sacroiliac pain in general. In addition to the limitations above, using such an injection as the reference standard for sacroiliac pain in general also assumes that all sacroiliac pain is in fact intra-articular SIJ pain.

Posterior Sacroiliac Ligament Pain as a Potential Source of Pain

The SIJ complex constitutes a load-relieving mechanism in the otherwise rigid structure of the bony pelvis.[21] The SIJ allows a maximum rotation of 2°-2.5°[22] and translation of 0.7 mm,[23] despite a large surface area of approximately 1000 mm^2.[24] The stability of the joint, imperative to its function, is in large part due to the posterior sacral ligaments. These include the sacrotuberous ligament, sacrospinous ligament, anterior sacroiliac ligament, posterior sacroiliac ligament, and the interosseous sacroiliac ligament. By 55 years of age, these ligaments tend to ossify, further limiting movement at the SIJ complex.[25] Despite significant contributions of these ligaments to the SIJ complex and its biomechanics, the literature has largely focused on the intra-articular portion of the joint. This narrow view is inconsistent with the paradigm applied to other large, weight-bearing joints such as the shoulder, hip, and knee; in all cases, pathology relevant to both intra-articular and extra-articular structures is well described.

The fact that the intra-articular portion of the joint can be readily accessed and injected, combined with the fact that surgically the joint can be fused, may in part be why so much focus has stayed on the intra-articular component of the joint complex. Conceptually, it seems that pathology related to the posterior sacroiliac ligaments may also be a potential source of pain.

To consider a structure as a potentially new putative entity, a systematic approach is required. First, the entity must be accurately defined. A specific definition must be agreed upon. Conceptualization and validation of reliable diagnostic tests must be developed.[26] At that point, the pathophysiology of the structure can be quantitatively described in terms of incidence, prevalence, and natural

history. With this accomplished, advancements in treatment can follow. A paradigm shift may also allow for new interpretation of prior findings. Fortunately, some of this work has been accomplished already.

Dreyfuss et al have established face validity and construct validity of sacral lateral branch blocks as an accurate diagnosis of the posterior sacral ligaments.[27] The innervation of the SIJ complex was poorly understood until this study, though it remains somewhat controversial.[28,29] To test the hypothesis that if the SIJ is innervated exclusively from the posterior sacral lateral branches, diagnostic blocks of the sacral lateral branches would be a putative diagnostic test for SIJ pain, Dreyfuss et al used cadaveric specimens and live participants to demonstrate the course of the L5 dorsal ramus and S1-3 lateral branches, the structures they innervate, and functionally what occurs when these nerves are anesthetized.

First, the path of the L5 dorsal ramus and the sacral lateral branches to the SIJ were identified in cadavers, as well as associated bony-landmark targets as visualized by fluoroscopy. In order to account for anatomic variations, a multisite, multidepth technique was developed that successfully captured the target nerves in 91% (95% CI: 82%–100%). More recently, these targets have been altered to attain even higher capture rates.[30]

Second, in 20 normal volunteers, experimental noxious stimulation was applied using a spinal needle.[27] Under fluoroscopy, the interosseous ligament and dorsal sacroiliac ligaments were probed. This was followed by a high-pressure intra-articular injection to induce painful capsular distention. Both exposures experimentally induced pain in all 20 participants, demonstrating that both the ligaments and the intra-articular joint are potential pain generators.

Five to 7 days after the initial injections, the same participants underwent L5 dorsal ramus and multisite, multidepth S1-3 lateral branch injections. Ten participants received 0.75% bupivacaine (active) injections and 10 received saline (control) injections. The operator, the investigator, and the participants were blinded to the agent used. The participants rested supine for 30 minutes following the injections and were then exposed to interosseous and dorsal sacroiliac ligaments needling, as well as repeat capsular distention, and asked if they felt discomfort in the same sites as during the original needling session.

In the active group, 70% had insensate ligaments compared to 0%-10% of the control group. Alternatively, 26% percent of the active versus 10% of the control group did not feel repeat capsular distension. Six of seven participants (86%) retained the ability to sense SIJ capsular distension despite an insensate dorsal SIJ complex.

Based on these findings, the authors were able to conclude that multisite, multidepth sacral lateral branch blocks are physiologically effective at targeting and anesthetizing the sacral lateral branches at a rate of 70%, that they do not effectively block the intra-articular portion of the SIJ, but should be considered a potentially valuable tool to diagnose extra-articular SIJ pain.

Clinical Application

It is important to consider posterior sacral ligament pain as a potentially separate entity from intra-articular SIJ pain when evaluating and treating a patient presenting with posterior pelvic pain. More specifically, in patients with lower lumbar and gluteal pain, in whom sources of pain in the lumbar spine have been ruled out and have a clinical picture that seems consistent with SIJ complex pain, both the intra-articular and extra-articular components of the SIJ complex may be considered. In the setting of a negative intra-articular anesthetic SIJ injection, instead of ruling out the entire SIJ joint complex as a source of pain, the posterior ligaments can be considered separately via sacral lateral branch blocks. In theory, other potential extra-articular causes of SIJ complex pain may also exist. However, they should be subject to the same investigative rigor demonstrating face and construct validity as the Dreyfuss study used to investigate the posterior ligaments.[27]

Further, sacral lateral branch neurotomy is not an equivalent treatment to intra-articular steroid injection, as is evidenced by the inability of sacral lateral branch blocks to effectively prevent pain due to SIJ capsular distension.[27] Some providers consider performing sacral lateral branch neurotomy in patients who respond to intra-articular SIJ steroid injection but without a long-term effect; however, neurolysis cannot be assumed to provide relief without screening through sacral lateral branch blocks. Although both sacral lateral branch neurotomy and intra-articular SIJ injection of steroid may have potential benefits,[10,31] as covered elsewhere in this supplement, they should not be viewed as interchangeable or as to be equally therapeutic for the exact same pathology.

Last, research in which intra-articular anesthetic SIJ injections are used as the reference standard for "true" SIJ pain should be viewed through a different lens. Clinical predictors of SIJ complex pain found to not have an association with an intra-articular problem may still be associated with extra-articular pathology. Consider the SIJ physical exam literature as an example. A specific maneuver such as the thigh thrust test may not have a high positive predictive value for intra-articular joint pain but still have predictive value for posterior sacral ligament pain. Perhaps this discrepancy could be explained by a pathophysiological model, such as an exam maneuver that may preferentially stress the posterior ligaments. These questions remain largely unexplored. Similar arguments could be made for pain referral patterns, history, and image findings. Future investigation should include the use of multisite, multidepth sacral lateral branch blocks in order to determine what elements

of history, physical examination, and imaging studies are associated with posterior sacral ligament pain.

Conclusion

Accurate diagnosis of SIJ pain by means of pain referral patterns, historical features, physical exam maneuvers, and imaging remains challenging. The most reliable clinical tools may be a combination of three or more positive physical exam maneuvers, though the evidence is inconsistent. One of the primary challenges in the use of intra-articular diagnostic SIJ injections as the reference standard for "true" sacroiliac pain, is that extra-articular sources pain likely also exist. Within the last decade, research has established the posterior sacral ligaments as a possible source of pain, and the innervation of these ligaments has been anatomically defined. One potential path forward in the diagnosis and treatment of SIJ complex pain is to now define and quantify the incidence, prevalence and natural history of posterior sacral ligament (or extra-articular SIJ) pain. It is likely that expanding our focus from the articular portion of the sacroiliac complex structure to both the joint and extra-capsular ligaments, advancements in clinical diagnosis and treatment will be possible.

References

1. Merskey H, Bogduk N, International Association for the Study of Pain, eds. *Classification of Chronic Pain: Descriptions of Chronic Pain Syndromes and Definitions of Pain Terms*. 2nd ed. Seattle, WA: IASP Press; 1994:222.
2. Global Burden of Disease Study 2013 Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015;386(9995):743-800.
3. Koes BW, van Tulder MW, Thomas S. Diagnosis and treatment of low back pain. *BMJ*. 2006;332(7555):1430-1434.
4. DePalma MJ, Ketchum JM, Saullo T. What is the source of chronic low back pain and does age play a role? *Pain Med*. 2011;12(2):224-233.
5. Slipman CW, Jackson HB, Lipetz JS, Chan KT, Lenrow D, Vresilovic EJ. Sacroiliac joint pain referral zones. *Arch Phys Med Rehabil*. 2000;81(3):334-338.
6. Schwarzer AC, Aprill CN, Bogduk N. The sacroiliac joint in chronic low back pain. *Spine*. 1995;20(1):31-37.
7. Lesher JM, Dreyfuss P, Hager N, Kaplan M, Furman M. Hip joint pain referral patterns: a descriptive study. *Pain Med*. 2008;9(1):22-25.
8. Khan AM, McLoughlin E, Giannakas K, Hutchinson C, Andrew JG. Hip osteoarthritis: where is the pain? *Ann R Coll Surg Engl*. 2004;86(2):119-121.
9. Dreyfuss P, Michaelsen M, Pauza K, McLarty J, Bogduk N. The value of medical history and physical examination in diagnosing sacroiliac joint pain. *Spine*. 1996;21(22):2594-2602.
10. Kennedy DJ, Engel A, Kreiner DS, Nampiaparampil D, Duszynski B, MacVicar J. Fluoroscopically guided diagnostic and therapeutic intra-articular sacroiliac joint injections: a systematic review. *Pain Med*. 2015;16(8):1500-1518.
11. Maigne JY, Aivaliklis A, Pfefer F. Results of sacroiliac joint double block and value of sacroiliac pain provocation tests in 54 patients with low back pain. *Spine*. 1996;21(16):1889-1892.
12. Laslett M, Aprill CN, McDonald B, Young SB. Diagnosis of sacroiliac joint pain: validity of individual provocation tests and composites of tests. *Man Ther*. 2005;10(3):207-218.
13. van der Wurff P, Buijs EJ, Groen GJ. A multitest regimen of pain provocation tests as an aid to reduce unnecessary minimally invasive sacroiliac joint procedures. *Arch Phys Med Rehabil*. 2006;87(1):10-14.
14. Montandon C, Costa MAB, Carvalho TN, Montandon Júnior ME, K-I-SS T. Sacroiliíte: avaliação por imagem. *Radiol Bras*. 2007;40(1):53-60.
15. Elgafy H, Semaan HB, Ebraheim NA, Coombs RJ. Computed tomography findings in patients with sacroiliac pain. *Clin Orthop*. 2001;382:112-118.
16. Weber U, Lambert RGW, Østergaard M, Hodler J, Pedersen SJ, Maksymowych WP. The diagnostic utility of magnetic resonance imaging in spondylarthritis: an international multicenter evaluation of one hundred eighty-seven subjects. *Arthritis Rheum*. 2010;62(10):3048-3058.
17. Varkas G, de Hooge M, Renson T, et al. Effect of mechanical stress on magnetic resonance imaging of the sacroiliac joints: assessment of military recruits by magnetic resonance imaging study. *Rheumatology*. 2018;57(3):508-513.
18. Slipman CW, Sterenfeld EB, Chou LH, Herzog R, Vresilovic E. The value of radionuclide imaging in the diagnosis of sacroiliac joint syndrome. *Spine*. 1996;21(19):2251-2254.
19. Maigne JY, Boulahdour H, Chatellier G. Value of quantitative radionuclide bone scanning in the diagnosis of sacroiliac joint syndrome in 32 patients with low back pain. *Eur Spine J*. 1998;7(4):328-331.
20. Fortin JD, Washington WJ, Falco FJ. Three pathways between the sacroiliac joint and neural structures. *AJNR Am J Neuroradiol*. 1999 Sep;20(8):1429-1434.
21. McGrath M. Clinical considerations of sacroiliac joint anatomy: a review of function, motion and pain. *J Osteopath Med*. 2004;7(1):16-24.
22. Egund N, Olsson TH, Schmid H, Selvik G. Movements in the sacroiliac joints demonstrated with roentgen stereophotogrammetry. *Acta Radiol Diagn (Stockh)*. 1978;19(5):833-846.
23. Sturesson B, Uden A, Vleeming A. A radiostereometric analysis of movements of the sacroiliac joints during the standing hip flexion test. *Spine*. 2000;25(3):364-368.
24. Ebraheim NA, Madsen TD, Xu R, Mehalik J, Yeasting RA. Dynamic changes in the contact area of the sacroiliac joint. *Orthopedics*. 2003;26(7):711-714.
25. Rosatelli AL, Agur AM, Chhaya S. Anatomy of the interosseous region of the sacroiliac joint. *J Orthop Sports Phys Ther*. 2006 Apr;36(4):200-208.
26. Schneider BJ, Levin J, Kennedy DJ. A Paradigm Shift? *Pain Med*. 2018;19(1):204-205.
27. Dreyfuss P, Henning T, Malladi N, Goldstein B, Bogduk N. The ability of multi-site, multi-depth sacral lateral branch blocks to anesthetize the sacroiliac joint complex. *Pain Med*. 2009;10(4):679-688.
28. Grob KR, Neuhuber WL, Kissling RO. [Innervation of the sacroiliac joint of the human]. *Z Rheumatol*. 1995;54(2):117-122.
29. Ikeda R. [Innervation of the sacroiliac joint. Macroscopical and histological studies]. *Nihon Ika Daigaku Zasshi*. 1991;58(5):587-596.
30. Stout A, Dreyfuss P, Swain N, Roberts S, Loh E, Agur A. Proposed optimal fluoroscopic targets for cooled radiofrequency neurotomy of the sacral lateral branches to improve clinical outcomes: an anatomical study. *Pain Med*. 2018;19(10):1916-1923.
31. King W, Ahmed SU, Baisden J, et al. Diagnosis and treatment of posterior sacroiliac complex pain: a systematic review with comprehensive analysis of the published data. *Pain Med*. 2015;16(2):257-265.

Disclosure

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