Article for Special Interest

Sacroiliac joint arthropathy and low back pain

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Introduction

Sacroiliac (S-I) joint dysfunction is understood by clinicians as one of many causes of the general category of low back pain. S-I joint dysfunction may wholly be responsible for the low back pain syndrome and/or may be contributory to low back pain in concern with other pathology of the lumbar spine. It is often an overlooked and underappreciated diagnosis. Sacroiliac (SI) joint pain is a challenging condition affecting 15% to 25% of patients with axial low back pain, for which there is no standard long-term treatment. Recent studies have demonstrated that historical and physical examination findings and radiological imaging are insufficient to diagnose SI joint pain. The most commonly used method to diagnose the SI joint as a pain generator is with small-volume local anesthetic blocks, although the validity of this practice remains unproven.

Brief Anatomy

The S-I joint can be thought of as the bottom joints of the spine relating to the hip bones, The sacrum (bottom of the spine) relates on each side to the ilia (hip bones) to form the sacroiliac joints. The sacroiliac (SI) joint is the largest axial joint in the body, with an average surface area of 17.5 cm^2.[1] There is wide variability in the adult SI joint, encompassing size, shape, and surface contour. Large disparities may even exist within the same individual. The SI joint is most often characterized as a large, auricular-shaped, diarthrodial synovial joint. In reality, only the anterior third of the interface between the sacrum and ilium is a true synovial joint; the rest of the junction is comprised of an intricate set of ligamentous connections. Because of an absent or rudimentary posterior capsule, the SI ligamentous structure is more extensive dorsally, functioning as a connecting band between the sacrum and ilia[2]. The main function of this ligamentous system is to limit motion in all planes of movement. In women the ligaments are weaker, allowing the mobility necessary for parturition.

Nerve supply

The innervation of the SI joint remains a subject of much debate. The lateral branches of the L4-S3 dorsal rami are cited by some experts as composing the major innervation to the posterior SI joint[1]. Other investigators claim that L3 and S4 contribute to the posterior nerve supply[3]. The innervation of the anterior joint is similarly ambiguous. Early 20th century German literature asserts the anterior SI joint is supplied by the obturator nerve, superior gluteal nerve and the lumbosacral trunk[4]. More recent literature suggests the anterior joint is innervated by L2-S2[1], L4-S2[5], and the L5-S2 ventral rami[6]. Some authors have even suggested that the anterior SI joint is devoid of nervous tissue[7]. In a study testing the ability of L5 dorsal ramus and S1-4 lateral branch blocks to protect the SI joint from an experimental stimulus, 6 of 10 subjects retained the ability to perceive ligamentous probing [8].

Biomechanics and function

There have been numerous attempts to discern the biomechanics of the SI joint. These motion studies can be summarized as follows: the SI joint rotates about all 3 axis, although the movements are very small and difficult to measure[9]. Miller et al.[10] studied the load-displacement behavior of single and paired SI joints in 8 elderly cadavers. The authors found that with 1 leg immobile, movements in all planes ranged from between 2 to 7.8 times more than that measured with both legs fixed. In a series of cadaveric studies, Vleeming et al.[11] found that

the total range of motion during flexion and extension at the SI joint rarely exceeded 2 degrees, with 4 degrees being the upper limit during sagittal rotation.

Prevalence

Studies are further compromised by the fact that most have used either physical examination findings and/or radiological imaging techniques to make the diagnosis of SI joint pain. Prevalence of SI joint arthropathy has not been well studied. The largest of these is a retrospective study by Bernard and Kirkaldy-Willis[12], who found a 22.5% prevalence rate in 1293 adult patients presenting with LBP. Diagnoses in this series were based predominantly on physical examination.

Schwarzer et al. [13] and Maigne et al. [14] conducted a prevalence study in 54 patients with unilateral LBP using a series of blocks done with different LA based on International Spinal Injection Society guidelines. Nineteen patients had a positive response (75% pain relief) to the lidocaine screening block. Among these patients, 10 (18.5%) responded with >2 h pain relief after the confirmatory block with bupivacaine and were considered to have true SI joint pain (95% CI, 9%–29%). Based on these studies, the prevalence of SI joint pain in carefully screened LBP patients appears to be in the 15%–25% range.

Mechanism of injury

The mechanism of SI joint injury has previously been described as a combination of axial loading and abrupt rotation. On an anatomic level, pathologic changes affecting many different SI joint structures can lead to nociception. These include capsular or synovial disruption, capsular and ligamentous tension, hypomobility or hypermobility, extraneous compression or shearing forces, abnormal joint mechanics, microfractures or macrofractures, chondromalacia, soft tissue injury, and inflammation. Mechanistically, there are numerous reported etiologies for SI joint pain. To simplify matters, these causes can be divided into intraarticular and extra-articular sources. Arthritis and infection are two examples of intraarticular causes of SI joint pain. Extra-articular sources are the more common of the two and include enthesopathy, fractures, ligamentous injury, and myofascial pain. Clinical studies have demonstrated significant pain relief after both intraarticular and periarticular SI joint injections[15, 16,17].

Diagnosis

History and Physical Examination

Many involve distraction of the SI joints, with 2 of the most common ones being Patrick's test and Gaenslen's test. Despite the plethora of diagnostic tests, clinical studies have for the most part demonstrated that neither medical history nor physical examination findings are consistently capable of identifying dysfunctional SI joints as pain generators. In addition, Dreyfuss et al.[18] found 20% of asymptomatic adults had positive findings on 3 commonly performed SI joint provocation tests. Some of these studies have found moderate to high inter-examiner reliability[19], most have not[20].

Radiological Studies

Radiologic findings in patients with SI joint pain have been similarly disappointing. In studies by Maigne et al. [21] and Slipman et al. [22], the investigators found sensitivities of 46% and 13%, respectively, for the use of radionuclide bone scanning in the identification of SI joint pain. In a retrospective analysis by Elgafy et al.[23], CT imaging was found to be 57.5% sensitive and 69% specific in diagnosing SI joint pain.

Pain Referral Patterns

Fortin et al.[24] performed provocative SI joint injections using contrast and lidocaine. Sensory changes were localized to the ipsilateral medial buttock inferior to the posterior superior iliac spine in 6 of the 10 subjects. In a follow-up study, independent examiners selected 16 individuals among 54 with chronic LBP whose pain diagrams most closely resembled the pain referral patterns obtained in the first study[25]. These 16 patients proceeded to undergo provocative SI joint injections with contrast and LA. All 16 experienced concordant pain during the injection, with 14 obtaining pain relief after deposition of LA. Slipman et al.[26] conducted a retrospective study to determine the pain referral patterns in 50 patients with injection-confirmed SI joint pain. In contrast to the findings by Fortin et al.[25] the authors found the most common referral patterns for SI joint pain to be radiation into the buttock (94%).

Diagnostic Blocks

Extravasation of LA to surrounding pain-generating structures such as muscles, ligaments, and lumbosacral nerve roots can lead to false-positive blocks. Conversely, failure to obtain adequate LA spread to the anterior and cephalad portions of the SI joint can result in false-negative blocks. In a classic study by North et al.[27] examining the specificity and sensitivity of a battery of lumbosacral LA blocks in 33 patients with a chief complaint of sciatica, the authors found the specificity of all blocks to be exceedingly low. SI joint blocks were not performed in this study.

In a pilot study by Fortin et al.[25] mapping SI joint referral patterns in asymptomatic volunteers, extravasation of contrast (mean 1.6 mL injected) occurred in 9 of 10 subjects during SI joint injection, with half having at least moderate spread outside the joint. After the injection of LA, 40% of subjects noted lower extremity numbness, indicating inadvertent anesthetization of the lumbosacral nerve roots. In the Maigne et al. [14] study, 3 of the initial 67 patients were excluded because of "sciatic palsy" after the screening block and another 7 were excluded because penetration of the SI joint was impossible. Regardless of the imaging modality used to confirm intraarticular injection, SI joint injections should never be performed blindly. Rosenberg et al.[28] performed a double-blind study in 37 patients (39 joints) to determine the accuracy of clinically guided SI joint injections using CT imaging as the standard. The authors found that intraarticular injection was accomplished in only 22% of patients, whereas sacral foraminal spread occurred 44% of the time. In 3 patients, no contrast was seen on CT scanning, indicating probable vascular uptake. In 24% of injections, contrast extended into the epidural space. Maigne et al.[14] sought to determine the prevalence of SI joint pain using a series of blocks with 2 different LA. In the 54 patients who completed the study, 19 obtained 75% pain relief with the lidocaine screening block.

Treatment

The treatment of SI joint pain is widely acknowledged to be one of the most challenging problems confronting pain physicians. Evidence supporting this statement can be seen by the plethora of different therapies that have been advocated for this disorder. Generally, these treatments can be divided into 2 categories: those directed at correcting the underlining pathology and those aimed at alleviating symptoms. For both of these categories, the evidence supporting any one therapy is limited by the lack of controlled outcome studies.

Psychosocial Issues

Recent studies have provided incontrovertible evidence that psychopathology and other psychosocial factors can influence both the development of chronic pain conditions and the response to treatment. In a study by Polatin et al.[29] conducted in 200 chronic LBP patients, the authors found that 77% met lifetime criteria and 59% demonstrated current symptoms for at least one psychiatric diagnosis, with the most common being depression, substance abuse, and anxiety disorders. Notably, more than 50% of those with depression and more than 90% of patients with substance abuse or an anxiety disorder experienced symptoms before the onset of LBP. Most, but not all, studies have shown untreated psychopathology to negatively affect LBP treatment outcomes.

Conservative Management

Nonsurgical stabilization programs have been advocated for SI joint pain. These range from the application of pelvic belts that reduce the sagittal rotation of incompetent SI joints in pregnant women to exercise-induced pelvic stabilization programs. In a study by Mooney et al.[30], the authors found that 5 women with injection-confirmed SI joint pain had electromyographic-documented hyperactivity of the ipsilateral gluteus muscles and contralateral latissimus muscle compared with 15 asymptomatic control patients. After a 2-1/2 month exercise program, all 5 patients achieved a significant reduction in pain and a return of myoelectric activity to normal patterns.

Intraarticular Injections

Intraarticular injections with steroid and LA often serve the dual function of being therapeutic and aiding in diagnosis. To summarize these studies, most but not all investigators have found radiologically guided SI joint injections to provide good to excellent pain relief lasting from 6 months to 1 year. Along with a multitude of studies demonstrating prolonged pain relief after intraarticular SI joint steroid injections, double-blind studies have shown a beneficial effect for periarticular corticosteroid treatment as well [16].

Radiofrequency Denervation Procedures

Several investigators have performed radiofrequency (RF) denervation procedures in an attempt to provide prolonged pain relief to patients suffering SI joint pain. The techniques used have ranged from denervating the nerves supplying the SI joint[31] to creating lesions in the joint itself [32], with one study using a combination of the two[33]. The success rates of studies targeting the nerve supply are higher than those focusing on the joint itself, with approximately two thirds of patients reporting significant pain relief. The major drawback to percutaneous RF denervation procedures is that they should not be expected to alleviate pain emanating from the ventral SI joint. In the study by Schwarzer et al.[14], ventral capsular pathology was shown to account for 69% of all CT pathology in the 13 patients with a positive response to diagnostic SI joint blocks. Complicating matters further are that the nerves lesioned during RF procedures innervate other pain-generating structures besides the SI joint, and the SI joint is likely innervated by other nerves inaccessible for denervation.

Surgical and Other Invasive Interventions

In 1999, Srejic et al.[34] reported 12–16 months of significant pain relief in 4 patients with SI joint pain who received a series of 3 intraarticular injections with hyaluronic acid. Three of these patients had postsurgical SI joint pain and one suffered from severe osteoarthritis of the spine. The rationale for this treatment stems from studies demonstrating long-term pain relief with hyaluronic acid injections in degenerative joint disease of the knee. Ongley et al.[35] found that LBP patients who received 6 wks of proliferant therapy had lower pain scores and disability indices at their 6 months follow-up than "control" patients who received saline injections. Despite these findings, the lack of specific diagnoses, the numerous other treatment differences between groups, and the targeting of pain generators outside the SI joints limit the relevance of this study. Neuroaugmentation of the third sacral nerve root has also been reported to provide adequate pain relief in 2 patients with severe SI joint pain unresponsive to conventional therapy[36].

Conclusion

The SI joint is a real yet underappreciated pain generator in an estimated 15% to 25% of patients with axial LBP. Whereas historical and physical examination findings have been previously advocated as useful tools in identifying patients with SI joint pain, more recent studies have demonstrated they have limited diagnostic value. Presently, small-volume diagnostic blocks remain the most commonly used method for diagnosing this disorder. Owing to the complexity of the joint, the mechanisms of SI pain are numerous and ill-defined. When a pathological condition such as leg length discrepancy or altered gait mechanics is present, correcting the underlying defect is the safest and most reliable treatment option. Intraarticular and periarticular corticosteroid injections have been shown in most, but not all, studies to provide good to excellent pain relief lasting up to 10 month in patients with and without spondylarthropathy. One promising area in the treatment of SI joint pain is RF denervation, although the conclusions that can be drawn are limited by the heterogeneous methods used and the lack of controlled studies.

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