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Review Article

Diagnosis and interventional pain management options for sacroiliac joint pain

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Abstract

The sacroiliac (SI) joint is among the most common sources of chronic low back pain, accounting for 15%–30% of patients presenting chronic low back pain. The complex anatomic structures, nerve innervation, and functional biomechanisms of the SI region make it challenging to diagnose and treat the SI joint as a pain source. In addition to physical therapy and medication for treating SI joint pain, multiple interventional measures including steroid injection, radiofrequency ablation, prolotherapy, and SI joint fusion have been proposed with various efficacies. This article describes the etiology, risk factors, and diagnostic methods as well as the different treatment modalities, focusing on interventional pain management options for patients suffering from SI joint pain.

Keywords: *Diagnostic block, Low back pain, Radiofrequency, Sacroiliac joint injection, Sacroiliac joint pain*

Introduction

The sacroiliac (SI) joint is one of the most common sources of chronic back pain, accounting for 15%–30% of patients presenting chronic low back pain [1,2]. Moreover, the prevalence of SI joint pain resulting from failed back surgery has been estimated to be 29% [3]. The SI joint is also the most likely source of low back pain in patients having undergone either lumbar or lumbosacral fusion surgeries [4,5]. Although SI joint dysfunction has resulted in a large proportion of chronic lower back pain, it has been underrated owing to the complexity of its etiology and the challenges in diagnostic evaluation. This article reviewed the etiology, diagnosis, and current treatments that focused on interventional modalities to treat SI joint pain.

Anatomy and nerve innervation of the sacroiliac joint

The SI joint is the largest true synovial joint in the body. Although there is significant variability between individuals regarding the shape and size [1], the surface area of the SI joint is about 17.5 cm^2, and the volume is 0.6–2.5 mL [6]. However, the synovial cleft is narrow and decreases with age, 1–2 mm in younger adults and 0–1 mm in adults older than 70-year-old [7]. Given the transfer of weight, impact absorption, stability and strength, the SI joint has a rough surface braced with strong ligaments and a network of muscles interlocking the pelvis and spine [8]. Moreover, existing literature has established that, the innervation of the SI joint is highly variable even at different sides in the same person [9,10]. Fortin *et al.* pointed out that the innervation of the posterior joint and ligaments mainly comes from the S1–S3 dorsal rami with a contribution from L5 [10]. Furthermore, a variety of controlled studies reported the marked and prolonged effectiveness of the L5 dorsal ramus and the lateral branch of the S1–S3 neurotomy for chronic SI joint pain [11,12]. However, the ventral SI joint is less clinically relevant [8].

Etiology of sacroiliac joint pain

The etiological causes of SI joint pain are divided into traumatic and atraumatic. Traumatic causes include fall, motor vehicle collision, lifting and pregnancy, whereas atraumatic causes include previous lumbar fusion, cumulative injury, arthritis, scoliosis, inflammatory arthropathy, and infection. The pathological causes of SI joint pain consist of intra-articular and extra-articular causes. Intra-articular causes include arthritis (osteoarthritis or rheumatoid arthritis), spondyloarthropathy, trauma, infection, and cystic disease, whereas extra-articular causes are composed of trauma/fractures, ligamentous injury, myofascial pain, enthesopathy, pregnancy, and cystic disease.

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Risk factors of sacroiliac joint pain

The risk factors for SI joint pain are obesity, leg length discrepancy, gait abnormalities, persistent strain or low-grade trauma (e.g., jogging), scoliosis, pregnancy, and spinal surgery (especially fusion to the sacrum) [1]. 10%–27% of patients with persistent mechanical lower back pain below L5 have pain secondary to the SI joint pathology. The prevalence of SI joint pain has been reported to increase to 32%–37% in lumbosacral fusion patients [1,4].

Diagnosis of sacroiliac joint pain

History, physical examination, and imaging study

The initial pain usually starts below the dermatomal level of L5 (above L5 indicating lumbar spine origin) referring to the entire lower extremity while taking the history of the patient into account. On physical examination, provocation tests, for example, Patrick's test, Gaenslen's Test, SI joint shear test, and Yeoman's test are helpful. In particular, various studies have reported that three or more than three provocation tests might provide a more sensitive and specific identification of the stress from the SI joint [1]. Imaging studies including radiography, computed tomography, single-photon emission computed tomography, bone scans, and other nuclear imaging techniques are able to give clues as to the presence of SI joint disorder, however, they are often inconclusive [13]. Clinically, imaging studies would be applied only to survey for a "red-flag" situation to exclude fracture, infection, and malignancy. However, the diagnostic block provides a better and more reliable option for the diagnosis [14].

Intra-articular diagnostic block

Diagnostic SI joint blocks remain the only means of establishing a diagnosis of intra-articular SI joint pain [14]. The positive response of intra-articular diagnostic injections is a complete or near complete relief of pain. Concerning the qualitative evidence, the diagnostic accuracy is at Level II for dual diagnostic blocks with at least 70% pain relief as the criterion standard and Level III for single diagnostic blocks with at least 75% pain relief as the criterion standard [14,15]. The single blocks cannot detect false-positive cases. For the dual blocks, the first block is injected with lidocaine, and the second block is injected with bupivacaine [14]. Using the dual blocks for assessing the prevalence of SI joint pain, a variable prevalence of 10%–40.4% was noted with a false-positive rate of 12.5%–26% [14]. However, this method remained primarily for study design. Clinically, either a diagnostic block with local anesthetic or a therapeutic block with local anesthetic and a steroid is usually applied. The recommended volume of injectate ranges from 1 to 2 mL [14].

Fluoroscopy-guided block

The fluoroscopy-guided block is the gold standard for a diagnostic or therapeutic purpose in treating SI joint pain [16]. The fluoroscopy-guided block has been reported to have a higher accuracy rate of diagnosis than an ultrasound-guided injection [17]. A posterior approach to the SI joint has been widely accepted. A 22-gauge needle with a stylet is usually used in this approach. A quantity of 0.25 mL of contrast medium is usually adequate to confirm the proper needle position. The arthrograms needed for the procedure are anterior-posterior, lateral, ipsilateral oblique, and contra-lateral oblique views. Attention should be given when the flow goes outside of the joint, especially in cases of ventral capsular tears. Blocking pain from the SI joint is accomplished by injecting 1–2 mL of local anesthetic. If over 75% of the pain is reduced after a single diagnostic block, this test is considered positive. If around 50%–75% of the pain is reduced, the SI joint may be considered a major contributor to pain.

Extra-articular sources of pain

Pain originating from the SI joint and pain originating from other components of the SI complex almost always confuses clinicians. The intra-articular diagnostic blocks undervalue the prevalence of SI region pain from the peri-articular origins (such as ligaments and capsules) [18]. For diagnostic and therapeutic purposes, anesthetizing the innervations of the SI complex seems to resolve the bias better. Compared to an SI joint injection alone, the combined SI joint and S1-3 lateral branch injections have been reported to show significantly more improvement in the visual analog scale [19]. Moreover, Dreyfuss *et al.* [20] illustrated a multi-site, multi-depth technique to differentiate the origins of the pain. The results revealed that the sacral lateral branch block would be a robust way to select patients for radiofrequency (RF) neurotomy rather than the intra-articular block.

Non-interventional treatment

The prevalence of true leg discrepancy (5 mm or greater) in the general population has risen to 43.5% and significantly increases to 75% in patients with lower back pain [21]. Individualized lifting shoes may be useful in patients with true leg discrepancy. On the other hand, functional leg length discrepancy may be addressed through the aid of physical therapy. Transversus abdominis muscle exercise may cause some reduction of SI joint pain. Chiropractic manipulation, certain exercises, and Kinesio tape are helpful for SI joint pain disorder and pelvic stability [22]. With respect to medication, nonsteroidal anti-inflammatory drugs (NSAIDs) and muscle relaxants may be effective, while there is only weak evidence for the effectiveness of tricyclic antidepressants [23].

Interventional pain management options

Evidence of interventional pain management for sacroiliac joint pain

Multiple options for interventional treatment of chronic SI pain are available. The different assessments and critical appraisal systems for clinical evidence provide a framework for the decision-making process. In 2010, Vanelderen *et al.* [13] reported that an intra-articular therapeutic injection with corticosteroids and a local anesthetic has benefits which outweigh the risks, more so than other options with the highest evidence rating of 1B+. Later, another systemic review suggested that cooled RF neurotomy for the rami laterals seems to have better evidence of its effectiveness for both short-term and long-term pain controls. However, intra-articular steroid injection, peri-articular prolotherapy, pulsed RF, and conventional monopolar RF have limited or poor evidence of effectiveness in treating SI pain [24].

Intra-articular steroid injection

Corticosteroids offer anti-inflammatory mechanisms to reduce pain in various clinical conditions, such as in patients with tendinitis, tenosynovitis, arthritis, and other musculoskeletal problems. It has been reported that intra-articular steroid injections have intermediate-term benefits, in which more than half of the patients had positive responses to treatment in a 6-month follow-up [1]. With a blind injection method, only 22% of the patients received successful intra-articular injections on computed tomographic scanning, indicating that the injectates did not extend into the joint spaces [25]. Different cadaveric studies have revealed that the ultrasound guidance method presents a better rate of accuracy for intra-articular injection at a rate of 80%–88.2% [26,27]. Although the fluoroscopy and computed tomography-guided techniques could provide more precise needle placement during the procedure, ultrasound guidance is more readily available and feasible in clinical practice. The successful intra-articular injection rate using the ultrasound guidance technique has been reported to be 60% in the first 30 injections, and it gradually improved, reaching 93.5% in the last 30 injections [28]. Regarding the recent studies, the ultrasound-guided injection method not only has a similar treatment effect as the fluoroscopically guided injection method but also facilitates the avoidance of critical vessel injury [17,28].

Radiofrequency ablation

The mechanism of RF denervation to alleviate pain sensation consists in applying an electrical current generated by radio waves to heat nerve fibers and thus reduce pain signals [29]. In 2001, Ferrante *et al.* [30] reported the first bipolar RF technique employed in treating SI joint disorder by creating a strip lesion of the posterior SI joint with RF needles inserted at <1-cm intervals. As a result, 36% of the patients experienced 50% pain relief for 6 months. Afterward, conventional unipolar (or monopolar) RF targeting the lateral branches of the primary dorsal rami was adopted in several studies [11,12], which resulted in sustained relief for 6 months in over 60% of subjects [24]. Currently, in addition to conventional unipolar RF, several modified techniques targeting the lateral branches of the primary dorsal rami have been proposed by different manufacturers, including cooled RF ablation [31], Simplicity III RF ablation [32], bipolar RF ablation [33], and the latest quadrapolar RF ablation [34]. However, studies comparing the effects among those techniques are still lacking.

Prolotherapy

Relative to the etiology described above, SI joint pain can be generated from extra-articular elements including ligaments and capsules. Prolotherapy involves the injection of hyperosmolar dextrose or platelet-rich plasma (PRP) into the area where repairing and strengthening are thought to be needed. The application of prolotherapy for SI joint pain consists of making an injection in the periarticular and intra-articular areas to treat pain and sacral ligament laxity. Some studies reported the positive clinical outcomes of prolotherapy for SI joint pain and even a superior effect and longer duration for relief of SI joint pain compared to the injection of a steroid into the joint [35,36]. In recent studies, a significant reduction in the pain scores of SI joint pain was observed in patients receiving intra-articular PRP injections compared to those receiving steroid injections [37,38]. Additional data and trials are needed to validate the application of prolotherapy.

Percutaneous sacroiliac joint fusion

The rationale for SI joint fusion is to relieve pain created by the movement of a joint through the removal of movement by arthrodesis of the joint space [39]. Only few comparative studies of percutaneous SI joint fusion and denervation have been reported, and they had limited clinical evidence [40,41]. The safety and effectiveness of percutaneous fusion compared with denervation remained inconclusive. However, surgical fusion with a percutaneous SI screw placement might have a higher rate of complications than RF neurotomy [41].

Conclusion

The diagnosis and management of patients with SI joint pain remains challenging. There are no specific historic features, provocation tests or radiological findings to provide a definite diagnosis of SI join pain. A diagnostic SI joint block helps to establish a more accurate diagnosis of intra-articular SI joint pain. We therefore recommend a multimodal approach to treat patients with SI joint pain. Physical therapy and NSAIDs are the first-line choices. Intra-articular steroid injection, RF ablation, and prolotherapy can be considered as interventional pain management options for SI joint pain relief. In the event of a failure of those treatments, a percutaneous SI fusion may be considered.

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Conflicts of interest

There are no conflicts of interest.

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