CLINICAL REVIEW

Evaluation and Treatment of Sacroiliac Joint Dysfunction in the Primary Care Setting

Pre-test Quiz

1. The innervation of the sacroiliac joint is primarily from the lateral branch of the sacral nerve.
2. Sacroiliitis and SI joint dysfunction are synonymous
3. SI joint pathology is readily diagnosed with imaging such as CT or MRI.

ABSTRACT

Mechanical dysfunction of the sacroiliac joint (SIJ) is an often overlooked, but a common cause of low back pain in the North American adult population. The diagnosis is primarily clinical and requires the exclusion of other potential etiologies of low back pain (LBP). A number of non-surgical treatment options are available for patients with this pathological entity. In cases of persistent, severe SIJ pain refractory to non-operative measures, SIJ fusion may be considered as a surgical intervention.

KEYWORDS: sacroiliitis, sacroiliac dysfunction, sacroiliac joint (SIJ), low back pain (LBP), gluteal pain, SI joint fusion, percutaneous SI joint fixation

Introduction

Although the etiologies are diverse and heterogeneous, low back pain (LBP) remains a leading source of morbidity in North America and a major financial burden on the healthcare system.[1] A common cause of LBP is the sacroiliac joint (SIJ), increasingly recognized as a major source of LBP and disability.[2] SIJ pain can be severely debilitating, leading to substantial functional impairment and diminished quality of life. Studies show that patients with SIJ dysfunction have a quality of life equivalent to those with advanced hip and knee arthritis and worse than those with chronic obstructive pulmonary disease or mild heart failure.[2]

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The notion that the SIJ is a common pain generator is not new but the joint's relevance as a target of both conservative and surgical treatments has waxed and waned over the last several decades. Nevertheless, a growing body of literature has resulted in improved knowledge of the anatomy, physiology, mechanics and pathology of this previously nebulous part of the musculoskeletal system. Improved understanding of SIJ anatomy and biomechanics has allowed for the development of evidence-based treatment pathways and effective treatment modalities for this condition.

In this review article we aim to provide clear guidance for appropriate identification, clinical and radiographic evaluation of mechanical SIJ dysfunction and provide a framework for treatment of this pathological entity in the primary care setting.

Epidemiology

SIJ dysfunction is a known contributor to LBP, accounting for approximately 15-30% of LBP cases in the outpatient setting.[3-7] Several primary risk factors for mechanical SIJ dysfunction have been identified: 1) multigravida females with a prior history of vaginal birth (likely due in part to the increased levels of estrogen or relaxin during the third trimester of pregnancy resulting in increased ligamentous laxity and trauma to the pelvic floor and SIJ ligaments during childbirth.[8-9]), 2) a prior history of high-energy pelvic trauma or iliac crest bone grafting, because of the extent of the associated soft tissue injury which can result in pathological motion at this joint.[10]), 3) a prior history of lumbosacral fusion, particularly multilevel lumbar fusion is a known risk factor for development of secondary mechanical SIJ dysfunction; the causal mechanism is analogous to that of adjacent segment disease, as several previously mobile segments in the lumbar spine and lumbosacral junction are immobilized, stress transferred to the SIJ substantially increases and results in subsequent degeneration. SIJ pain as a secondary source of discomfort following lumbar fusion is exceedingly common, with studies indicating between 34-43% of patients develop SIJ-related pain postoperatively.[11-14] Apart from these risk factors, many cases are idiopathic (see Table 1).

Table 1: Risk Factors for Sacroiliac Joint Dysfunction[8,9]

Idiopathic
Multigravida w/prior history of vaginal birth
High-energy pelvic trauma
Prior history of iliac crest bone grafting
Prior history of lumbosacral fusion (multilevel)

SIJ Anatomy and Biomechanics

The sacroiliac joint, the largest axial joint in the human body, is a complex syndesmosis, symphysis and synovial joint connecting the sacrum to the ilium. The joint plays a critical role in transferring spinal loads to the lower extremities, allowing limited but important motion, typically 1.1-2.2 degrees in flexion-extension, 0.5-8.0 degrees in lateral bending and 0.8-4.0 degrees in axial rotation, with minimal translation.[15-19] While movement in these planes supports daily activity, slight variations in movement patterns can significantly impair function.[20]

SIJ innervation is variable and involves multiple nerves, including the sacral plexus, superior gluteal nerve, dorsal rami of L4-S4, anterior rami of L2-S2 and the obturator nerve. Histologic studies have identified nociceptors and mechanoreceptors, predominantly within the anterior capsule and cartilage, that are mainly supplied by the dorsal rami of S1-S3. Activation of these nociceptors can cause SIJ pain; thus, they are targeted as a therapeutic focus in interventional pain procedures such as radiofrequency neurotomy and injection therapies aimed at denervating or modulating afferent input to the SIJ.[21-23]

Finite element studies suggest that normal SIJ loads can range from 79-140 Newtons during physiological activities.[20] The bone density of the sacrum plays a critical role in force distribution, being highest near the sacral body and lowest in the sacral ala. Variability in trabecular architecture and density influences load transmission and may be implicated in implant loosening and failure of SIJ fusion procedures.[24-26] Joint stability is mediated by both form and force closure mechanisms. Form closure relies on the inherent anatomical interlocking of the sacral and iliac surfaces, providing passive stability. Force closure, in contrast, is dynamic and depends on the compression forces generated by surrounding muscles, ligaments and fascial structures.[27]

Anatomically, the SIJ is unique; it is a synovial joint at the anterior third and a fibrous joint in the posterior two-thirds. The considerable stability is attributed in part to the robust anterior and posterior ligamentous complexes. Extensive ligamentous structures and muscles including the erector spinae, lumbar multifidus, gluteal muscles and muscles of the abdominal wall stabilize the remaining portion.[28] While these muscles do not directly produce movement across the SIJ, they aid in pelvic stabilization and load transmission. Decreased muscle thickness in the paraspinal musculature has been associated with SIJ-related pain.[29] When stabilizing mechanisms are compromised through trauma, degeneration, hypermobility or

other pathologic mechanisms, joint motion and pain may ensue. For example, SIJ dysfunction following lumbar fusion is one frequently cited mechanism of altered stability; the increased stress across the SIJ contributes to subsequent instability and pain.[20]

Pathophysiology

Mechanical SIJ dysfunction most commonly arises from repetitive trauma that disrupts normal load transfer across the pelvis, leading to pathological motion and degenerative arthropathy.

Pregnancy, pelvic trauma and prior lumbosacral fusion are all examples of this phenomenon. These mechanical insults initiate a cascade of inflammation, nociceptive activation and pain that may begin insidiously or acutely. Key pain generators include increased ligamentous or capsular tension, extraneous compression or shear forces, myofascial or kinetic chain imbalances, joint hypo- or hypermobility or other forces that disrupt normal load transfer across the pelvis.

Non-mechanical causes of SIJ pathology include inflammatory spondyloarthropathies, crystalline arthridites (such as gout), infection, metabolic bone disease and rarely, neoplasms. Infections are most often caused by *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Cryptococcus* and *Mycobacterium* tuberculosis, particularly in patients with immunosuppression, endocarditis, IV drug use or other predisposing conditions. Among neoplastic causes, metastatic disease is most common, with pelvic involvement occurring in nearly 40% of skeletal metastases, second only to the spine.[30]

Clinical Evaluation

SIJ dysfunction typically presents as buttock pain or LBP, with referral patterns often mimicking other spinal, pelvic or hip pathologies.[31] Differential diagnoses include piriformis syndrome, lumbar spinal stenosis, lumbar disc herniation, degenerative disc disease, hip osteoarthritis, gluteal tendinopathies, labral tears, hamstring origin avulsion injuries and sciatic, pelvic, or pudendal nerve entrapment via greater trochanteric, ischiofemoral or posterior femoroacetabular impingement or other aberrant anatomical stressors.[32] Differentiating mechanical SIJ dysfunction from sacroiliitis, an inflammatory condition, is essential for selecting an appropriate treatment plan.

Accurate diagnosis of SIJ pathology relies heavily on clinical evaluation. Patients typically report Fortin's sign, defined as pain consistently localized to an area within 1cm inferomedial to the posterior superior iliac spine (PSIS) that may radiate into the buttocks, groin, posterior thigh or even past the knee and into the foot.[33-34] This

reproducible pattern is a key diagnostic feature that strongly suggests SIJ dysfunction and serves as a clinical pearl in LBP evaluation. Pain above the PSIS may suggest alternative etiologies such as facet-mediated pain, superior cluneal nerve entrapment or quadratus lumborum myofascial dysfunction. Pain below the PSIS more commonly reflects piriformis syndrome or middle cluneal nerve entrapment.[32] Symptoms often worsen with prolonged standing, sitting or transitional movements. Some patients report relief with a tight-fitting belt, likely due to SIJ stabilization (see Table 2).

For pain over the PSIS or other physical presentations suggesting SIJ dysfunction, physical examination should include SIJ-specific provocation tests. Level 1 evidence supports a Clinical Diagnostic Rule for SIJ pain, using 3 or more positive results out of five standardized maneuvers, with dominant examination findings being pain in PSIS area. Provocation tests include the distraction (gapping) test, SI compression test, Patrick's (FABER) test, thigh thrust or posterior shear (POSH), sacral thrust and Gaenslen's (Pelvic torsion) test.[35-36] These diagnostic criteria are good or better than rules for other lumbar spine conditions, making SIJ diagnosis among the best evidence-based diagnostic rules in LBP classification.[35] Meeting the criteria of 3 or more positive exam find-

Table 2: Differential Diagnoses[32]

Piriformis syndrome
Sciatic nerve irritation/entrapment radiating pain
Ischiofemoral impingement and/or semimembranosus origin avulsion
Conjoined hamstring tendon origin avulsion and/or sacrotuberous ligament insertion avulsion
Pudendal nerve irritation/entrapment
Obturator internus tears or source of pundendal irritation
Adductor magnus origin tendinoisis/avulsion
Greater trochanteric pelvic/sciatic impingement and/or greater trochanteric bursitis
Gluteus maximus origin tendonitis
Sacroiliac joint pain/dysfunction
Gluteus maximus claudication
Posterior femoroacetabular impingement and/or posterior labral tear
Hip-Spine syndrome

ings has an 85% positive-predictive value of positive response to diagnostic injection.

Radiographic Evaluation

While imaging plays a role in ruling out alternative diagnoses, no imaging modality has demonstrated reliable diagnostic utility for mechanical SIJ dysfunction, though there is some utility of MRI in the setting of inflammatory sacroiliitis.[37] Studies have shown that imaging provides minimal benefit in the management of LBP in the absence of red flag symptoms preceding a trial of non-operative management.[38] If symptoms do not improve after 6-8 weeks of non-surgical treatment, lumbar radiographs are indicated. Patients presenting with red flag symptoms, however, warrant immediate imaging.

Plain radiographs

Upright anteroposterior (AP) and lateral lumbar spine radiographs are the initial imaging modality of choice for LBP due to their accessibility and economic value. PA and oblique views of the SIJs themselves can be done but rarely influence therapeutic decision-making.

Plain radiographs often reveal degenerative changes of the SIJ, but such findings are also prevalent among asymptomatic adults over the age of 50.[39] This high prevalence of SIJ degeneration in pain-free individuals complicates efforts to attribute LBP or pelvic pain to the SIJ in symptomatic patients. Evidence suggests that SIJ degeneration is a normal part of aging, with many patients exhibiting significant radiographic findings without reporting associated pain. This incongruity between imaging findings and clinical symptoms has contributed to the challenge of diagnosis and treatment of SIJ related pain.[40]

Computed Tomography (CT)

CT is highly effective in detecting structural changes of the SIJ and subchondral demineralization and erosions of the iliac surface early in an inflammatory disease course. In later stages, CT can reveal ankylosis of the SIJ. Compared to MRI, CT is often less expensive and allows for more rapid acquisition of images, but is limited in its' ability to detect bone marrow edema and very early cartilage abnormalities.[41] CT imaging, though useful in some settings for identifying sacroiliiitis or fractures, demonstrates limited sensitivity (57%) and specificity (69%) for mechanical dysfunction.[42]

Magnetic Resonance Imaging (MRI)

MRI remains the gold standard and most sensitive imaging modality for detecting inflammatory SI pathology manifesting as bone marrow edema, particularly in spondyloarthropathies, but has limited utility in purely mechanical cases.[43-44] MRI of the lumbar

spine allows for visualization of degenerative changes within the intervertebral discs and facet joints and identification of spinal stenosis involving the central canal and/or neuroforamina.[45-46]

Nuclear Medicine

Nuclear medicine imaging techniques, such as bone scintigraphy and gallium scans, may be helpful in specific clinical scenarios, such as detecting malignancies, infections, and certain bone disorders like Paget's disease and fibrous dysplasia. Bone scintigraphy with single photon emission computed tomography (SPECT/CT) is a more recent imaging modality that has been shown to improve anatomical localization of active lesions through radiotracer uptake in patients with non-specific musculoskeletal pain. These modalities, however, generally lack sufficient sensitivity for routine use in the context of SIJ dysfunction.[47]

Diagnostic Injections

Diagnostic intra-articular SIJ injections performed under fluoroscopy or CT guidance are considered the gold standard for confirming SIJ-mediated pain (see Figure 1). Contrast-enhanced imaging ensures accurate placement, addressing the high rates of inaccuracy with blind injections. Rosenberg et al. found that only 22% of blind SIJ injections were within the joint space.[48-50]

Non-surgical Treatment

Non-surgical treatment remains the primary management approach

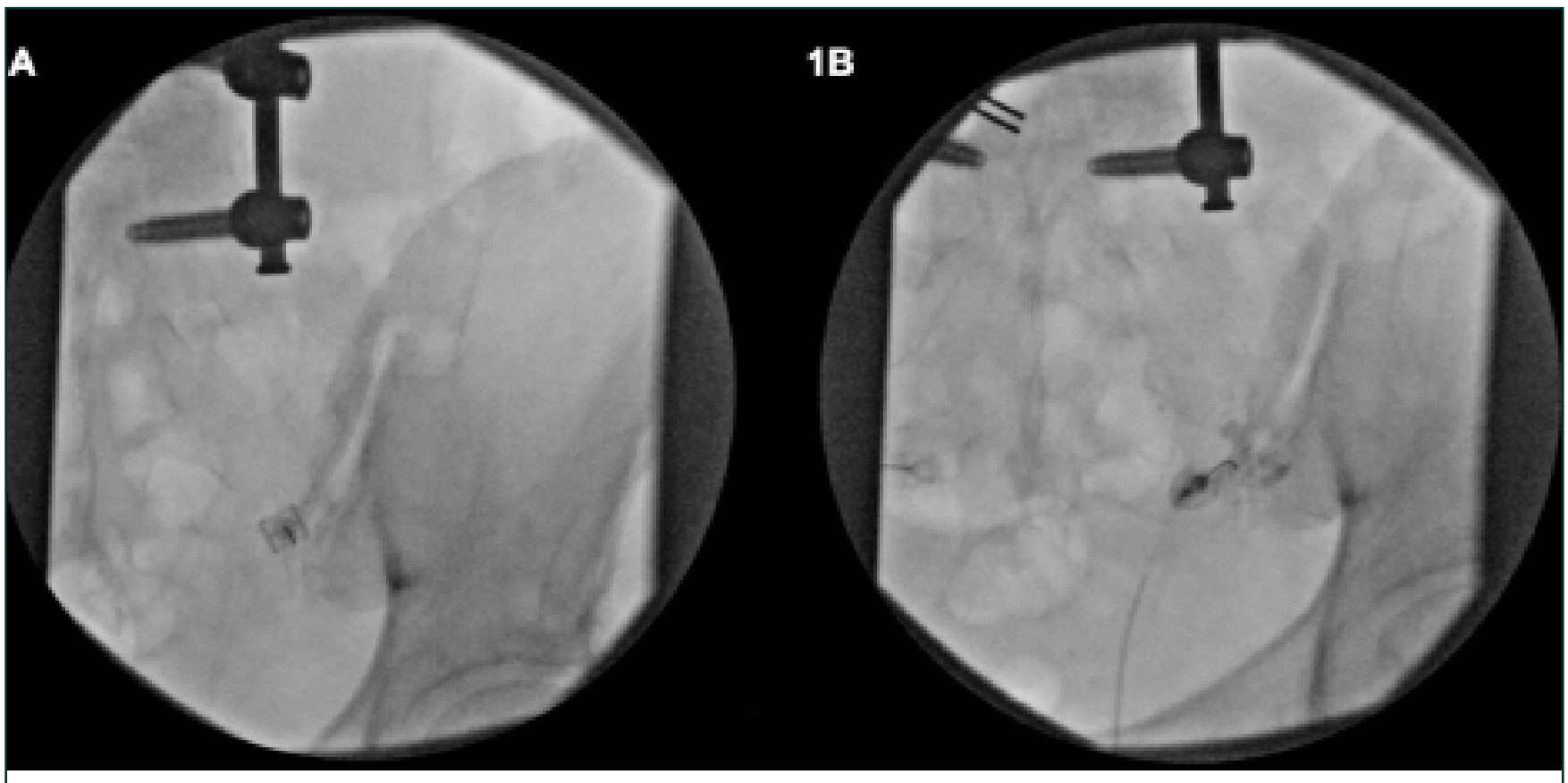

Figure 1: Demonstrates fluoroscopic intra-articular SIJ injection, done in the procedure suite by physiatrist. Image 1A is seen on the left and demonstrates placement of the spinal needle in the synovial portion of the SIJ. Image 1B demonstrates extravasation of radiopaque dye within the SIJ, confirming accurate placement of the needle.

for SIJ dysfunction. Several conservative treatment modalities have been extrapolated from the LBP literature, given the overlap in symptomatology and biomechanical principles. Pharmacologic therapies including acetaminophen, non-steroidal anti-inflammatories (NSAIDs), muscle relaxants, opioids and topical analgesics may provide symptomatic relief. Bracing and physical therapy may provide reasonable adjuncts. Further treatment options for non-refractory pain include image-guided intra-articular corticosteroid injections and radiofrequency ablation (RFA) of lateral branch nerves.

Table 3: Conservative Treatment Options[8,63]

Medications
• Acetaminophen/Paracetamol
• NSAIDs
• Muscle relaxants
• Tramadol
• Oral steroids
• Atypical anticonvulsants
Topicals
• Lidocaine
• Diclofenac
• Capsaicin
Physical therapy (PT)
Bracing
• Pelvic belts
Weight loss
Image guided injections
• CT-guided corticosteroid injection
• Ultrasound guided corticosteroid injection
Radiofrequency ablation (RFA)
• Lateral branch nerves of S1, S2, S3

Pharmaceutical Treatment

The American Geriatric Society guidelines recommend acetaminophen as a first-line treatment for LBP due to its favorable safety profile, but a systematic review concluded acetaminophen was ineffective treating acute LBP; van der Gaag et al. found NSAIDs to be slightly effective in reducing the intensity of acute LBP.[51-52] Evidence regarding the effectiveness of these over-the-counter analgesics in managing chronic LBP remains conflicting; high-quality evidence from three studies with a total of 1,825 participants suggested that acetaminophen was no more effective than placebo.[53]

Literature on the utility of muscle relaxants is controversial. A systematic review of 30 trials found benzodiazepines, non-benzodiazepines and anti-spasticity muscle relaxants (in combination with benzodiazepines and non-benzodiazepines) were effective in the treatment of non-specific LBP. While a systematic review of 49 trials reported no clinically meaningful pain relief.[54-55] This uncertainty, coupled with the risk of adverse events calls for caution in the use of muscle relaxants for LBP management.

For patients with chronic LBP, opioids like tramadol produce

modest, short-term pain relief that may or may not be clinically meaningful.[56-58] Due to the potential for drug dependence and negative side effects, we recommend against the use of opioid medication for SIJ-related pain (see Table 3).

Topicals

Topical analgesics such as lidocaine, diclofenac and capsaicin have shown some promise in reducing non-specific LBP alone or in combination with systemic analgesics.[59-61] While evidence for their efficacy when applied to SIJ pain is limited, the low-risk side-effect profile makes them a reasonable alternative to systemic pharmacologic options.[62]

Bracing

The use of pelvic belts in combination with muscle strengthening may increase pelvic stability by reducing the sagittal rotation in the SIJs and alleviating tension in the SIJ ligaments.[63-64]

Weight Reduction

The specific data considering the relationship between obesity/elevated body mass index and mechanical SIJ pain is sparse; however, given that the SIJ is a load-bearing joint, an association between obesity and LBP seems plausible. Evidence suggests a link between obesity and LBP, likely due to increased mechanical stress on the spine and systemic inflammation. The same is likely true with the SIJ, but there is limited research confirming that weight loss significantly reduces LBP symptoms.[65] A systematic review of surgical and non-operative weight loss interventions found only low-quality evidence of improvements in pain, disability or quality of life.[66] While weight loss may offer some benefit for SIJ pain, current evidence supports moderate weight reduction to be used in conjunction with other non-operative treatment modalities.

Physical Therapy

Structured physical therapy programs that emphasize core strengthening, pelvic stabilization and manual therapy techniques may be beneficial for SIJ pain. During the acute phase, deficits in flexibility and strength should be identified and addressed to minimize the effects of reduced mobility, including muscle atrophy and ligament weakening.[8] Given that deconditioning of the paraspinal muscles has been implicated in the pathogenesis of mechanical SIJ pain, physical therapy directed at improved core strength and muscular control is a logical initial option for patients with presumptive mechanical SIJ dysfunction.

Image Guided Injections

In the management of SIJ pain, image-guided corticosteroid injec-

tions may be considered when oral medications and physical therapy fail to provide adequate pain relief.[67] Image guidance may be achieved via several different modalities, such as fluoroscopy, ultrasound or CT. Image-guided corticosteroid injections serve both diagnostic and therapeutic purposes, although their effects may in some instances be temporary. Nevertheless, injections are often a

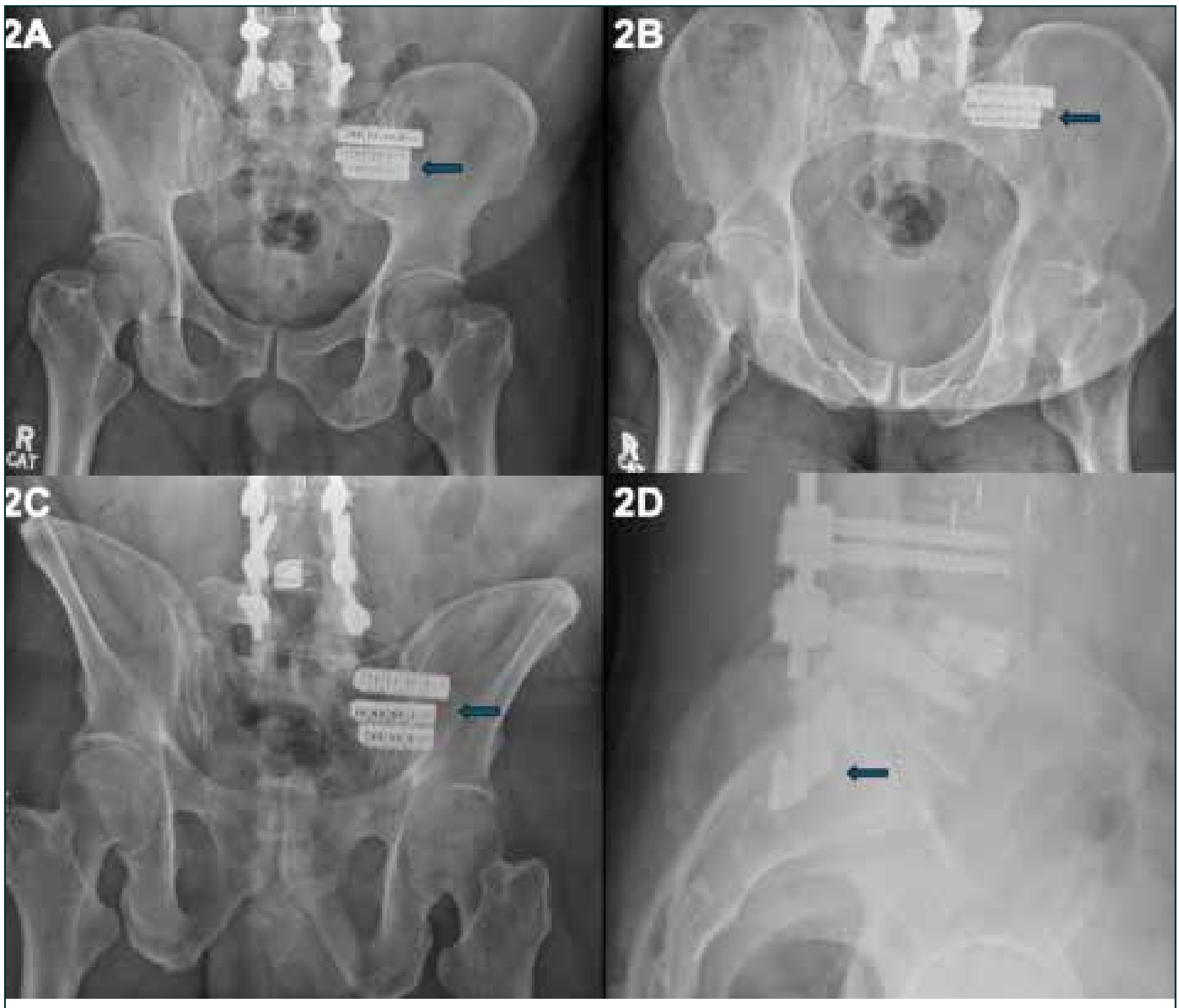

Figure 2: Postoperative films in a 64-year-old male that underwent percutaneous SIJF. The figure demonstrates AP (2A), pelvic inlet (2B), pelvic outlet and lateral views of the pelvis and sacrum. This patient, with a prior history of multilevel lumbosacral fusion presented with clinical complaints related to significant, debilitating left-sided buttock pain, as well as several positive provocative physical examination findings suggestive of SIJ dysfunction. He was investigated thoroughly, and other possible pain generators in the differential diagnosis were systematically ruled out. He then underwent 2 fluoroscopically guided intra-articular SIJ injections. The patient had a brief but profound response. He was subsequently electively booked for percutaneous left-sided SIJ fusion with use of porous triangular implants (SI-BONE). After surgery, he experienced very significant relief of left-sided buttock pain. At long-term follow-up he was experiencing minimal pain and had a dramatically improved level of physical function.

useful treatment, particularly when the etiology of the pain is inflammatory. One study found that CT-guided corticosteroid injections resulted in a significant reduction in inflammatory back pain and sacroiliitis in patients with spondyloarthropathies.[68] Conversely, in cases of hypermobility or mechanical dysfunction, steroid injections may not afford durable relief.

Radiofrequency Ablation (RFA)

For patients who have SIJ pain refractory to non-operative measures, RFA of lateral branch nerves sacral nerves, innervating the SIJ has demonstrated short-term pain relief in some studies. RFA of the lateral branch nerves as a treatment for SIJ pain is particularly helpful in patients in whom nociceptive fibers have been pathologically activated. One meta-analysis found that at 3- and 6-month intervals, 60.1% and 49.9% of patients, respectively, experienced at least 50% pain relief. The diminished outcomes over time were likely attributable to the nerve regeneration and regrowth.[69]

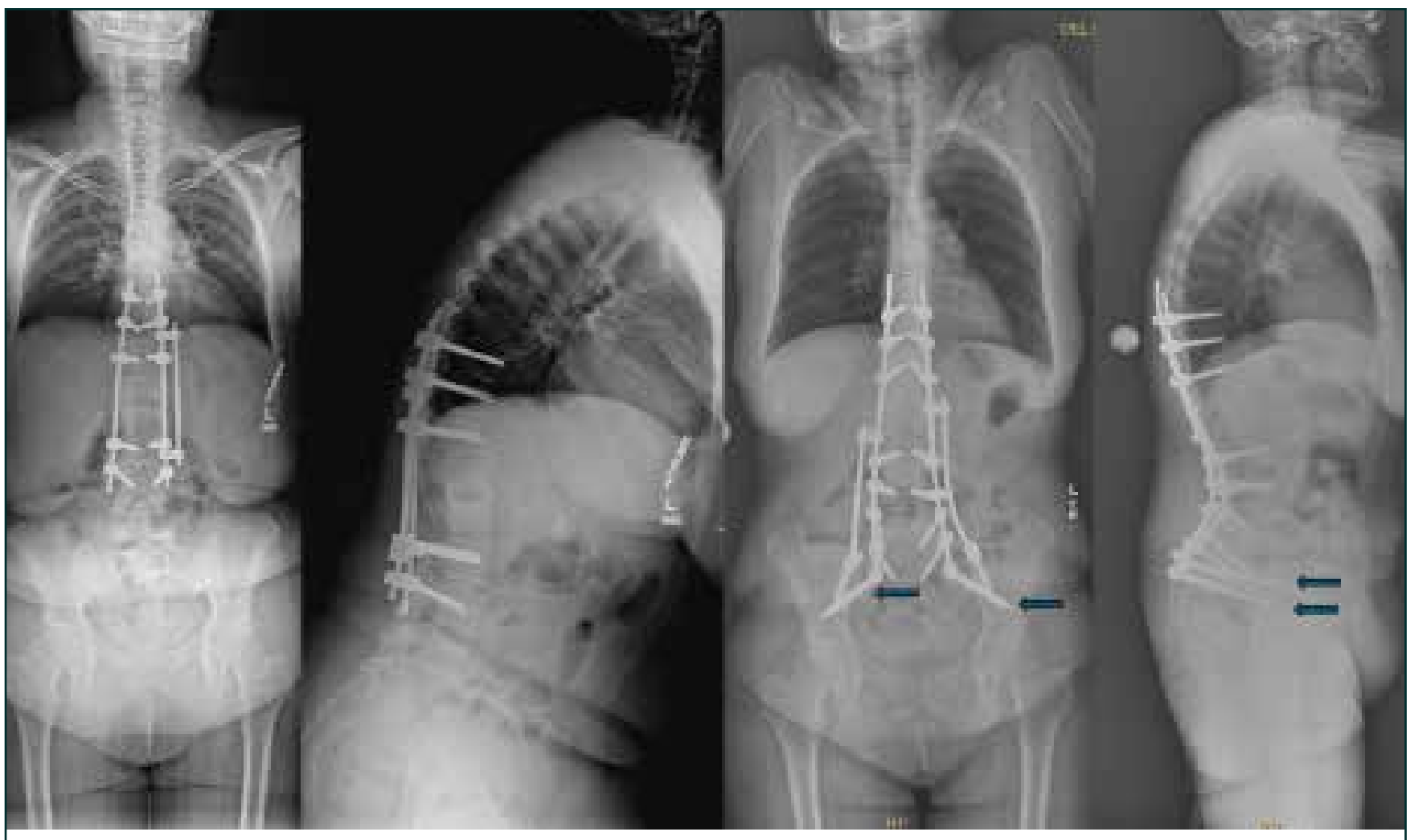

Figure 3: SIJF as a component of adult spinal deformity correction with fusion to pelvis. This 57-year-old female had previously undergone T9-L3 instrumented fusion for infection. After the infection had cleared, the patient was experiencing worsening back pain, bilateral buttock pain and difficulty standing upright. She was determined to have a spinal deformity that was amenable to surgical correction. She underwent revision deformity correction, and as part of fusion construct multiple screws were placed into the pelvis, including 2 porous titanium screws, which were inserted from the sacrum into the pelvis, across the SIJ. The inherent design of the screws is meant to allow for SIJF. Furthermore, the use of more than one point of fixation across the SIJ allows for rotational stabilization of this joint.

Overall, non-operative management is safe and typically associated with some reduction in pain although durability of relief may be variable. There are limitations. This approach is associated with substantial costs of care and may provide limited long-term benefit;[70-72] however, some patients certainly benefit from non-operative care and our recommendation is for a thorough course be attempted in all patients prior to the consideration of surgery.

Surgical Treatment

Surgical intervention may be considered for patients with clinically debilitating mechanical SIJ dysfunction who fail exhaustive non-operative therapy, though access remains limited in some regions.

Historically, external frame fixation was explored, but proved impractical and excessively morbid. This approach is not a currently accepted practice and is of academic interest only.[73]

More recently, procedures to stabilize and fuse the SIJ have been developed using implants such as triangular titanium rods (TTRs), porous fusion/fixation screws (PFFS) and sacropelvic fixation strategies. The most extensively studied technique is percutaneous SIJF, involving a lateral percutaneous approach with placement of porous triangular titanium implants across the synovial portion of the SIJ (see Figure 2). This method is gaining widespread traction as an evidence-based treatment, supported by Level I evidence, including two randomized controlled trials, multiple prospective cohort studies and over 100 peer-reviewed publications. Multiple prospective clinical trials have consistently demonstrated significant improvements in pain and disability scores.[70,74-77] Typically performed in the outpatient setting, this procedure has been associated with reduced opioid consumption, improved return-

KEY POINTS

1. The SI joint is a known contributor to low back pain
2. Non-surgical treatment remains the primary management approach for SIJ dysfunction
3. Diagnostic intra-articular injections performed under image guidance are considered the gold standard for confirming SIJ-mediated pain
4. For patients with clinically debilitating mechanical SIJ dysfunction who have failed an exhaustive course of non-operative treatment, surgical options may be considered

to-work rates, high patient satisfaction and sustained pain relief at 5 years. Operating times average 45-60 minutes, with minimal blood loss (see Figure 3). The technique has been shown to be cost-effective, with an estimated incremental cost effectiveness ratio (ICER) of $13,000 USD, comparable to total knee arthroplasty (ICER $12,000).[71] Complications include surgical site infection, gluteal pain, implant loosening or failure, mispositioning, pseudoarthrosis, nerve injury and persistent pain; however, complication rates are low overall and the safety profile for these procedures is generally favorable, with revision rates decreasing over time.[77-78] A recent meta-analysis confirmed that minimally invasive SIJF, particularly the lateral transiliac (LTI) approach, results in significant improvement in pain and disability, with low adverse event rates. In contrast, posterolateral (PLTI) and posterior intra-articular (PI) approaches are less studied and have less predictable results.[79]

Surgical SIJF may be beneficial for patients undergoing spinal deformity correction surgery or long lumbar fusions to the sacrum in pelvis. These conditions include significant deformity corrections, fusions of L2 or higher to sacrum, lumbosacral fusions in patients with a diagnosis of SIJ pain and lumbosacral fusion in patients with increased BMI. In these patients, mechanical stresses imparted to the SIJ substantially increases, resulting in an increased risk of subsequent SIJ dysfunction. Fusing the SIJ may prevent pelvic screw loosening or rod fracture, because there is a high rate of mechanical com-

CLINICAL PEARLS

1. SIJ dysfunction is a known contributor to low back pain, accounting for approximately 15-30% of LBP cases in the outpatient setting.
2. While imaging plays a role in excluding alternative diagnoses, no imaging modality has demonstrated reliable diagnostic utility for mechanical SIJ dysfunction although there is some utility of MRI in the setting of inflammatory sacroiliitis.
3. Patients with SIJ pain typically report symptoms consistently localized to an area within 1cm inferomedial to the posterior superior iliac spine (PSIS) that may radiate into the buttocks, groin, posterior thigh or even past the knee and into the foot.
4. Diagnosis is by physical examination which should include a variety of SIJ-specific provocation tests. Three or more positive results out of five standardized maneuvers is supported by Level 1 evidence for a Clinical Diagnostic Rule.

Post-test Quiz

1. Which of the following is considered the gold standard for confirming sacroiliac joint (SIJ)-mediated pain?
2. Which of the following is a known risk factor for developing mechanical SIJ dysfunction?
3. What is the primary mechanism by which pregnancy may contribute to SIJ dysfunction?
4. Which of the following statements is TRUE regarding imaging in the evaluation of mechanical SIJ dysfunction?
5. Which imaging modality is considered most sensitive for identifying sacroiliitis but has limited utility in mechanical SIJ dysfunction?

plications in these patients at long-term follow up.[80-82]

Defining ideal surgical candidates remains a challenge. Current criteria include ≥3 positive SIJ provocative tests, diagnostic pain relief from two image-guided SIJ injections and exclusion of other pain sources. Thresholds for diagnostic response to SIJF vary from 50-90% pain relief; 75% is most commonly used, but some suggest 50% may be more appropriate in patients with multiple pain generators, such as spinal degenerative disease.[9,21,31,49,50] Polly *et al.* cautioned against overly stringent thresholds (75% or higher) to determine surgical candidacy, because this may exclude patients who would otherwise benefit from surgical intervention.

From a broader perspective, there may be some patients with multiple sources of pain, in whom SIJF may afford significant pain relief; however, these patients may describe a lower percentage of pain relief than the previously described 75% threshold. In a subgroup analysis of 320 subjects from multiple centers who failed non-surgical management, authors found that the degree of acute pain relief from diagnostic SIJ injections did not correlate with improved pain or function at 6 or 12 months post-SIJF.[81] As such, ongoing refinements of clinical cut-off points for surgical eligibility require further investigation as do clinical outcomes before widespread adoption of these surgical techniques are seen.

Future Directions

Future research directions include the ongoing SILVIA randomized controlled trial, evaluating concurrent SIJF during multilevel spine reconstructions. Despite growing evidence supporting isolated percutaneous SIJF, further study is needed to refine patient selection criteria, and determine best practices for patients with complex spinopelvic pathologies. This approach remains an active area of investigation.

Conclusions

SIJ dysfunction is an underdiagnosed yet frequent cause of LBP. Careful clinical evaluation, supported by diagnostic injections, is critical for accurate identification. While non-surgical therapies are appropriate initial strategies, some patients may fail an exhaustive course and ultimately may benefit from SIJF. As our understanding of SIJ

pathology continues to expand, the optimization of diagnostic and therapeutic pathways promises to further improve outcomes for treating patients with this SIJ-related pain.

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