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A Unique Cause of Sacral Radiculopathy After Minimally Invasive Sacroiliac Joint Fusion: A Case Report

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Background: New technologies for sacroiliac joint fusion (SIJF) have demonstrated improvements in pain and function. Sacral radiculopathy is a reported complication. We present a unique case of S1 radiculopathy after lateral transiliac minimally invasive SIJF. The patient provided Health Insurance Portability and Accountability Act (HIPAA)-compliant consent for the inclusion of their clinical information in this report.

Case Report: A 40-year-old woman with SI joint dysfunction underwent right-sided SIJF. She reported resolution of her preoperative symptoms but developed new pain radiating to the leg. A revision procedure provided initial relief, but her pain returned. Further imaging demonstrated displaced bone, rather than a misplaced implant, causing a narrowed S1 foramen. An open S1 foraminotomy was performed to further decompress the foramen, improving symptoms, allowing her to return to her previous activity level.

Conclusion: This case describes a previously unrecognized cause of S1 radiculopathy after minimally invasive SI fusion and supports open foraminotomy with neuronavigation as a potential method for treatment.

Key words: Case report, chronic pain, complications, sacroiliac joint dysfunction, sacroiliac joint fusion

BACKGROUND

Sacroiliac (SI) joint dysfunction is an increasingly recognized cause of pain (1). The annual prevalence of chronic low back pain is estimated to be between 15% to 45% (2-5), and between 15% to 30% of low back pain may be attributable to the SI joint (3,4). Newly developed minimally invasive methods have enhanced the applicability of SI joint fusion (SIJF) by demonstrating reduced risks and significant improvements in pain and function (6-8). A variety of devices for minimally invasive SIJF are available and involve a lateral transiliac, posterior, posterolateral, or combined approach (9). Occasional complications occur, of which infection, trochanteric bursitis, and hematoma formation are the most common (10). Sacral radiculopathy is an infrequent but reported complication often attributed to an implant placed deep enough to penetrate the wall of the S1 foramen. It is typically managed by repositioning or removing the offending implant (11-15). We present a case of persistent S1 radiculopathy following minimally invasive SIJF which was not relieved by repositioning of the implant. Careful review of imaging and exploration of the surgical site revealed a distorted S1 foramen with an inward protrusion of bone that had been displaced during the fusion. The patient required open posterior S1 foraminotomy for definitive improvement of her radiculopathy.

CASE

History and Presentation

A 40-year-old woman presented with a long-standing

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history of right-sided low back pain. The pain had first become bothersome 5 years prior and increased gradually with time. Her pain radiated into her right thigh and leg and was worse with sitting; she was unable to sit on her right side without exacerbation of the pain. Conservative management attempts included physical therapy, chiropractic care, injections, and nonsteroidal anti-inflammatory drugs (NSAIDS). In the neurosurgery clinic she had positive pain to palpation of her right SI joint, a positive Faber test, and a positive right thigh thrust test. She was referred for a diagnostic right SI joint injection which resulted in significant but short-lived improvement in her pain, signifying SI joint dysfunction.

Operative Procedure

She underwent a percutaneous, right SI joint fusion under fluoroscopic guidance with 3 implants placed across the right SI joint with the SI-BONE (Santa Clara, CA) iFuse Implant System using a lateral transiliac approach (Fig. 1). She reported almost complete resolution of her preoperative symptoms but reported some new right calf soreness after surgery. On postoperative day 2 she reported worsening pain in the right thigh, calf, and the bottom of her foot. She experienced some relief with administration of ketorolac and a steroid and was discharged to home. After her discharge the pain persisted, and she eventually presented to an outside emergency department for evaluation. Deep vein thrombosis was ruled out. Abdominal computed tomography (CT) was interpreted to have no acute findings (Fig. 2). Given the severity of her new radiculopathy, she was taken back to the operating room for revision surgery via the same transiliac lateral approach. The middle implant was removed, and the inferior implant was backed out. A navigation-assisted right S1 foraminotomy was performed by drilling down the trajectory of the removed implant. Following the removal and repositioning of the grafts, repeat O-arm navigation (Medtronic, Minneapolis, MN) was used to confirm decompression of the S1 foramen. Immediately postoperatively she experienced significant relief of her symptoms. Unfortunately, her pain returned within a few days. She again underwent conservative management to include a right S1 injection, NSAIDs, a steroid taper, and physical therapy with minimal improvement. A pelvic CT supported continued postsurgical encroachment of the S1 foramen (Fig. 3). After failing conservative management for 3 more months, an open S1 foraminotomy via a posterior approach was performed, again using O-arm navigation. Wide decompression of the foramen was obtained, and bony fragments were removed from the foramen (Fig. 4).

Postoperative Course

Postoperative CT confirmed clearance of the offending bone and further decompression of the S1 foramen

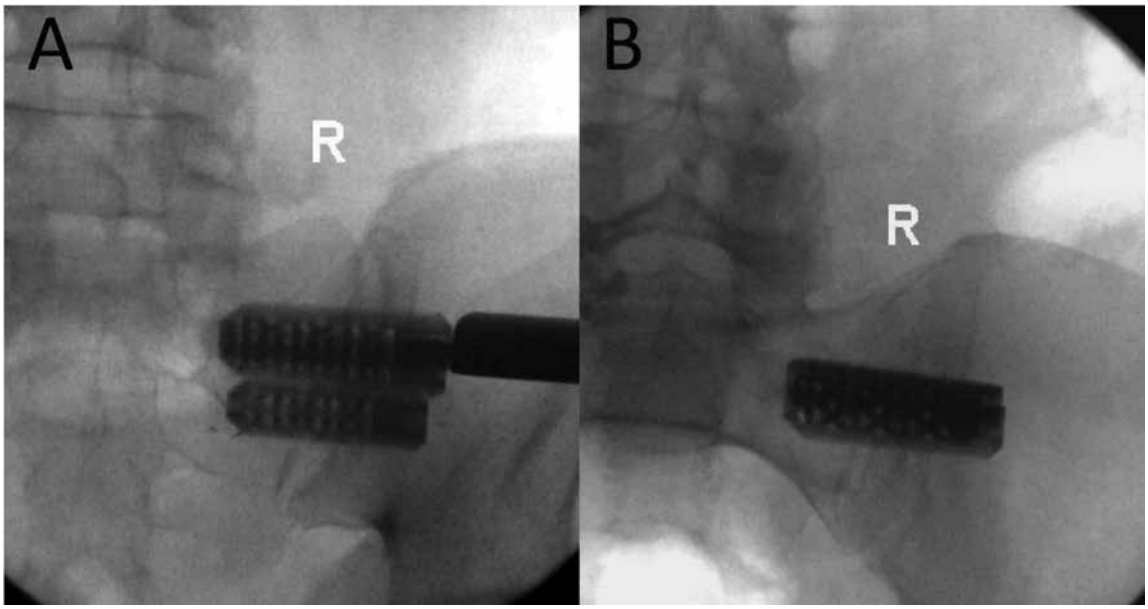


Fig. 1. Intraoperative fluoroscopy showing pelvic outlet (A) and pelvic inlet (B) views of initial SIJF

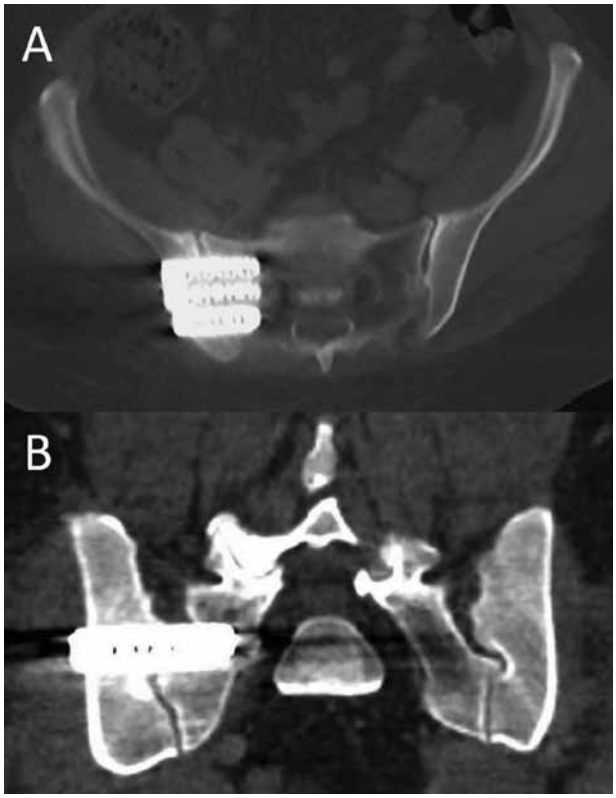


Fig. 2. Abdominal CT with axial (A) and coronal (B) views showing bony narrowing of right S1 foramen during patient emergency department visit after initial SIJF

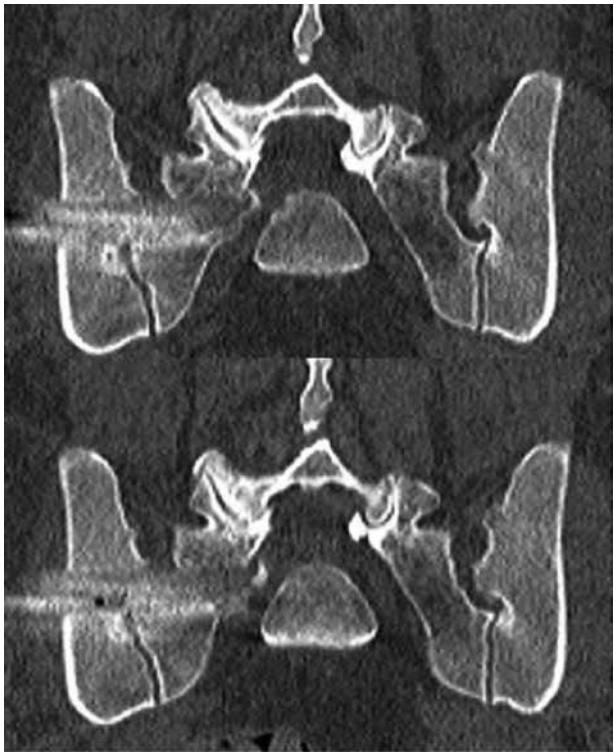


Fig. 3. Pelvic CT coronal reconstructions confirming bony narrowing of right S1 foramen before second revision

(Fig. 4). She recovered well from this surgery with significant reduction in pain and could return to her previous level of activity. Three years after the second revision procedure, she still had mild residual pain in the right leg but had resumed working full-time.

DISCUSSION

SI dysfunction is often underdiagnosed or misdiagnosed, leading many patients to endure years of pain before receiving successful intervention (16). However, in recent years it has gained more recognition and there has been rapid development of new devices for minimally invasive, or percutaneous, SIJF (17). New approaches offer a less invasive alternative to open methods. Most percutaneous SIJF procedures involve a lateral transiliac approach with either cannulated screws or triangular titanium implants placed through the ilium and into the sacrum. Some involve a posterior allograft approach involving bone graft filled implants placed in the SI joint, and others utilize a posterolateral or combined approach with cannulated screws (9). The lateral transiliac approach that our center has employed involves drilling across the SI joint and placing at least 2 and preferably 3 implants. It is commonly performed under fluoroscopic imaging, while some surgeons in our institution also use O-Arm navigation. Studies of percutaneous SIJF have demonstrated decreased pain, decreased disability, improved quality of life, and decreased opioid use postoperatively, with patient satisfaction as high as 90% (6,12,18,19). However, most of the limited literature on percutaneous SIJF has been industry-sponsored and limited to triangular titanium implants manufactured by SI-BONE (Santa Clara, CA).

Percutaneous methods of SIJF have a complication profile that differs from open SIJF (20). An analysis of 2 clinical trials of minimally invasive SIJF reported that 38.4% of revisions were related to implant malposition (21). A systematic review of minimally invasive SIJF by Shamrock et al (10) incorporated 14 studies of a total of 720 patients who had the procedure and reported an overall complication rate of 11%. Of note, 12 of the 14 studies involved triangular titanium implants while the other 2 used hollow modular anchorage screws (14,22).

Of device-related complications, nerve root impingement was the most common with a rate of 1.8% (10). Revision for this complication consists of removing or backing out the offending implant (10,23).

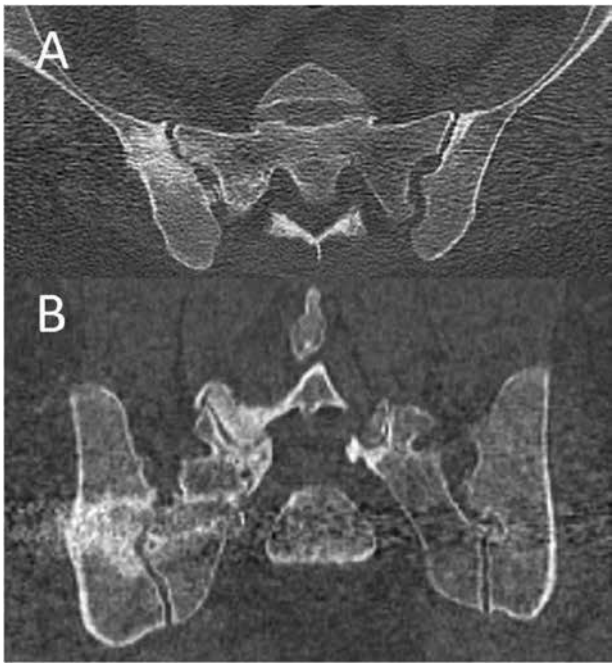
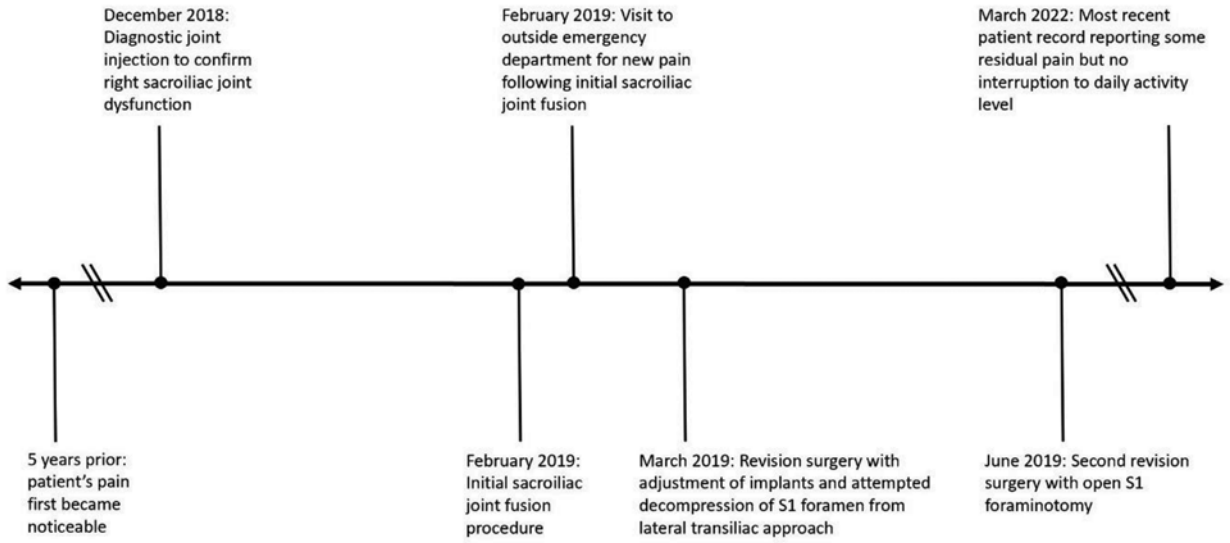


Fig. 4. Pelvic CT with axial (A) and coronal (B) views showing decompression of the right S1 foramen after open foraminotomy
Abbreviations: CT, computed tomography; SIJF, sacroiliac joint fusion

Typically, lumbosacral radiculopathy from minimally invasive SI fusion is due to implant penetration of the S1 foramen and easily identifiable on imaging. In this case, review of imaging was not as straightforward since the displaced bone, rather than the hardware, was impinging on the nerve root. When placing the implants across the joint space, it is possible for bone to be pushed inwards by the implant without the implant breaching the foramen. It is the senior author's impression that this complication is more likely in young patients due to denser bone quality. Assessment of imaging for distortion of foramen shape could help predict nerve root impingement but can be complicated by artifact from the metal implants. While an attempt was made to decompress the foramen, the lateral approach used during the initial revision surgery was not ideal for access or visualization and an open posterior approach was ultimately required. In the case of foraminal narrowing from bone being pushed inward, complete removal of the implant may not alleviate radicular pain since foraminal narrowing may persist due to bone presence in the foramen. To our knowledge there are no other reported cases of narrowing of the S1 foramen after SIJF causing radiculopathy in the absence of implant penetration into the foramen. However, one reported case of traumatic sacral fracture and fragmentation into the S1 foramen with radiculopathy was successfully resolved by decompressive S1 foraminotomy, similarly used our case (24).



Timeline

Because triangular titanium implants are the most thoroughly investigated, reports of complication rates are not representative of all minimally invasive SIJF devices. Other posterior and posterolateral SIJF technologies may have differing rates of radiculopathy. The lateral transiliac approach may carry a greater risk for foraminal narrowing since the implants point towards the sacral foramina and can penetrate or push bone into a foramen. Our institution continues to use the lateral transiliac approach with triangular titanium implants as it is currently the only minimally invasive SIJF technology with level I evidence. It is our opinion that this complication might be avoided by more extensive drilling of bone prior to broaching an implant as well as avoiding placement of implants in direct line with the sacral foramina.

CONCLUSION

This case provides an example of an uncommon etiology for sacral radiculopathy following minimally invasive SIJF that appears to be previously unreported. Although percutaneous SIJF has become a successful and evidence-based intervention, further research on new devices and approaches is needed to reveal their comparative risks and benefits.

Author Contributions

JN is the corresponding author and contributed to writing and editing of the manuscript. NE contributed to writing and editing of the manuscript. RB contributed to editing of the manuscript. NT and DA are surgeons who collaborated to perform this patient's procedures. NT contributed to editing of the manuscript.

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