

Retrospective Study

Comparative Outcomes of Posterior and Lateral Sacroiliac Joint Fusions from a Single Academic Pain Center

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Background: Sacroiliac (SI) joint dysfunction is a common source of chronic low back pain. Minimally invasive SI joint fusion techniques, including posterior interpositional and lateral transiliac approaches, have emerged as treatment options for patients who fail conservative management; however, comparative real-world outcome data, particularly from procedures performed by interventional pain physicians, are limited.

Objectives: We aimed to evaluate short-term outcomes, complication rates, and revision rates of posterior interpositional vs lateral transiliac SI joint fusion performed by interventional pain physicians at a single academic medical center.

Study Design: Retrospective cohort study.

Setting: Patients were treated at a pain management clinic within an academic medical center.

Methods: A retrospective review was performed of patients' records who underwent SI joint fusion from January 1, 2020 through May 23, 2025. Patients were identified using Current Procedural Terminology codes 27278 and 27279. Demographic data, procedural characteristics, perioperative outcomes, pain scores, and revision surgeries data were collected. Outcomes included preoperative and postoperative month one Visual Analog Scale scores, percentage of pain relief, estimated blood loss, complications, and need for revision surgery. Comparative analyses between posterior and lateral approaches were performed using appropriate statistical tests with statistical significance set at $P < 0.05$.

Results: Eighty patients were included; 33 had posterior interpositional fusion and 47 had lateral transiliac fusion. There were no statistically significant differences in baseline demographics between groups. Both approaches resulted in clinically meaningful short-term pain improvement, with mean Visual Analog Scale scores improving from a preoperative score of 6.6 cm to 3.4 cm at postoperative month one. The posterior interpositional group demonstrated a statistically significant higher revision rate due to loss of efficacy compared with the lateral transiliac group (18.2% vs 0%, $P = 0.003$). Estimated blood loss and complication rates were low for both approaches.

Limitations: Our study is limited by its retrospective design, small sample size, and variable follow-up duration. Standardized pain scores and percentage pain relief beyond the one-month postoperative visit were not consistently documented and therefore could not be reliably analyzed.

Conclusion: Both posterior interpositional and lateral transiliac SI joint fusion performed by interventional pain physicians provided meaningful short-term pain relief in appropriately selected patients. A higher revision rate was observed in the posterior interpositional group, suggesting potential differences in procedural durability. Prospective, adequately powered studies are needed to further define long-term outcomes and optimize procedural selection for managing SI joint-mediated pain.

Key words: Sacroiliac joint fusion, posterior sacroiliac joint fusion, lateral transiliac fusion, minimally invasive spine surgery, sacroiliac joint pain, sacroiliitis

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Sacroiliac (SI) joint pain is a common generator of low back pain, accounting for approximately 15%–30% of diagnosed cases (1-3). SI joint pain can be divided into intraarticular (infection, arthritis, spondyloarthropathy, malignancy) and extraarticular (enthesopathy, fracture, ligamentous injury, or myofascial injury) etiologies (1). Common risk factors for SI joint pain include—but are not limited to—trauma, scoliosis, previous lumbar arthrodesis, pregnancy, obesity, leg length discrepancy, and abnormal gait (1). A history of lumbar arthrodesis can result in adjacent segment disease, with the incidence of SI joint pain increasing in up to 40% of patients (1, 4-7).

Anatomically the SI joint is a 1 mm–2 mm diarthrodial synovial joint that connects the sacrum to the ilium. It is surrounded by a network of ligaments including the anterior, posterior, and interosseus ligaments, as well as additional accessory ligaments including the iliolumbar, sacrotuberous, and sacrospinous ligaments (1,8). The musculature surrounding the SI joint include the erector spinae, iliopsoas, quadratus lumborum, piriformis, and gluteal muscle complex (1). These ligaments and muscles provide stability and limit motion of the SI joint (1,8). While SI joint innervation is not clearly defined, the anterior portion of the SI joint is thought to be innervated by branches of the anterior rami of the L4 and L5 nerve roots, as well as the lumbosacral trunk. The posterior SI joint is innervated by the lateral branches of the dorsal rami of the L4–S3 nerve roots (1,8). Biomechanically, the SI joint is a trunk stabilizer that transmits axial load between the spine and lower extremities. Normal SI joint motion includes 2°–4° of nutation (anteroinferior) and counternutation (posteriosuperior) with less than 1–2 mm of translation in any plane (8,9).

Diagnosing SI joint pain can be established through clinical history, physical exam, and diagnostic injections (1,10). Provocative physical exam maneuvers for the SI joint include distraction, compression, flexion abduction and external rotation (FABER) test, the Gaenslen Maneuver, thigh thrust, and the Fortin Finger Test. When 3 or more of these tests are positive with at least one resulting from thigh thrust or sacroiliac compression, diagnostic accuracy improves, yielding a sensitivity of 85% and a specificity of 76% (1,10). Imaging is not required for diagnosis; however, it can be helpful in ruling out other serious conditions such as fracture or malignancy (1). Intraarticular injections with a local anesthetic and steroid may provide both diagnostic and therapeutic benefit (8). Conservative management for

chronic SI joint pain include avoiding pain-provoking activities, physical therapy, and medications, followed by minimally invasive procedures such as intraarticular steroid injections and radiofrequency ablation. When these treatments fail, minimally invasive surgical fusion can be considered (8).

SI joint surgical fixation was first described in 1921 by Smith-Petersen et al (11) as an open lateral transiliac subgluteal approach. In the late 1990s, Dr. Chipp Routt first described techniques for minimally invasive SI joint fusions that established the foundation of modern surgical approaches (12). Minimally invasive SI joint fixation was developed to improve patient outcomes, reduce operative morbidity, shorten postoperative recovery, and improve quality of life compared to open fixation (8,13). Intraarticular injections with a local anesthetic and steroid are commonly not only used to provide therapeutic benefits but also to assess for surgical candidacy. Patients can be considered surgical candidates for fusion after failing to respond to conservative management and followed by having a postinjection response of greater than 75% pain relief with the local anesthetic's duration on 2 separate occasions (8).

Three minimally invasive approaches are currently used for SI joint fusion, though debate persists regarding which approach yields superior outcomes (10). The lateral transiliac (LTI) approach is the most extensively studied; posterior techniques include posterior interpositional (PI) and posterolateral (PLI) fixation. Posterior approaches were developed with the intent of minimizing tissue disruption, reducing perioperative risk, and facilitating a faster return to activities of daily living (14,15).

The American Society of Pain and Neuroscience supports both lateral and posterior fixation approaches but acknowledges that there is limited comparative clinical evidence favoring one technique over another (8). The posterior approach is often considered less invasive because it avoids critical neurovascular structures potentially encountered with lateral trajectories (16). A retrospective series of direct posterior allograft fusion reported use of a 1.5 cm posterior midline incision and a mean operating-room time of 40.16 minutes (17).

Most of the published literature reports surgeon-based triangular implants, not minimally invasive surgical approaches with screws placed by interventional pain physicians. To our knowledge the only published data on the safety and efficacy of lateral transiliac screw-based approaches is the Weisbein et al study (18) that reported improvements in pain and function,

minimal blood loss, short operative times, and no serious device-related adverse events.

Given these considerations and the lack of definitive comparative data, further investigation was needed to clarify patient selection criteria and optimize outcomes. Accordingly, we present real-world outcomes from a single academic medical center comparing posterior and lateral SI joint fusion approaches with multiple systems, with emphasis on pain outcomes, perioperative safety, and revision rates.

METHODS

All patients who underwent SI joint fusion surgery at a single academic medical center from January 1, 2020 through May 23, 2025, were included in our study. Chart review and billing records were used to identify patients who underwent SI joint surgical procedures. Our study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and its subsequent amendments. Approval was obtained from the Institutional Review Board at the University of Kentucky prior to data collection and analysis (IRB Protocol #105426). All data were de-identified using the HIPAA Safe Harbor method before analysis to protect patient confidentiality. No identifiable personal information is included in this article. Our study posed no more than minimal risk to patients and involved no interventions or alterations to standard patient care.

Failure to respond to conservative management prior to surgery was defined as completing physical therapy, medication trials, and at least 2 fluoroscopically guided selective sacroiliac joint injections of a local anesthetic and corticosteroid that provided greater than 70% pain relief for the duration of the local anesthetic, but no additional sustained benefit from the corticosteroid; this was determined through shared decision-making. Demographic and clinical data collected were age, gender, body mass index (BMI, kg/m²), preoperative Visual Analog Scale (VAS) score, injection laterality (left, right, or bilateral), pain relief percentage following an intraarticular local anesthetic injection, initial surgical side treated (left, right, or bilateral), initial fusion approach (posterior or lateral), need for subsequent contralateral SI joint surgery, estimated blood loss, intraoperative and postoperative complications, revision surgery due to recurrence of pain in a previously treated joint, time to revision surgery, and pain relief percentage at postoperative month one.

All statistical analyses were performed using IBM SPSS Statistics 31.0 (IBM Corporation). Categorical vari-

ables were analyzed using the Pearson χ^2 test or the Fisher exact test, as appropriate, and are reported as counts and percentages. Continuous variables were analyzed using independent samples t tests or Mann-Whitney U tests, as appropriate, and are reported as means (SD) or medians with interquartile ranges (IQR), respectively. Pearson correlation coefficients were calculated to assess associations between continuous variables. A 2-sided α of 0.05 was used to determine statistical significance.

RESULTS

Billing records were reviewed to identify 80 patients who underwent sacroiliac joint surgical fixation performed by four physicians at a single academic medical center, using Current Procedural Terminology codes 27278 and 27279. Of these patients, 27/80 (33.75%) were men and 53/80 (66.25%) were women, with a mean (SD) age of 57.9 (13.6) years. Their mean (SD) BMI was 31.47 (6.03). Their mean (SD) preoperative VAS score was 6.6 (1.5).

Prior to surgery, 17/80 (21.25%) patients underwent left-sided injections, 26/80 (32.50%) underwent right-sided injections, and 37/80 (46.25%) underwent bilateral injections. The mean (SD) percentage of pain relief following the intraarticular local anesthetic injection was 95% (8%). For the entire cohort, 48/80 (60.00%) patients underwent right-sided surgery, 21/80 (26.25%) underwent left-sided surgery, and 11/80 (13.75%) underwent bilateral procedures as the initial operative intervention. The mean (SD) documented pain relief at postoperative month one was 83.1% (19.5%), with a mean (SD) postoperative VAS score of 3.4 (2.2).

In the patients who had posterior interpositional fusion (Group PIF), 11/33 (33.33%) were men and 22/33 (66.67%) were women, with a mean (SD) age of 59.8 (12.2) years (SEM 2.13). In the patients who had lateral transiliac fusion (Group LTF), 16/47 (34.00%) patients were men and 31/47 (66.00%) were women, with a mean (SD) age of 56.6 (14.4) years (SEM 2.11). There was no statistically significant difference in age between groups ($P = 0.302$) and gender ($P = 0.947$). There was no statistically significant difference between median BMI in the 2 groups: 30.0 (IQR, 25.8–32.1) in Group PIF and 32.3 (IQR, 29.2–35.4) in Group LTF ($P = 0.055$). The mean (SD) preoperative VAS score was 6.4 (1.6) in Group PIF and 6.7 (1.4) in Group LTF; there was no statistically significant difference between groups ($P = 0.384$) (Table 1).

The median percentage pain relief following intraarticular local anesthetic injection was 95% (IQR, 85%–100%) in Group PIF and 100% (IQR, 95%–100%) in Group LTF (Table 1). At postoperative month one, the median reported pain relief was 80% (IQR, 65%–100%) in Group PIF and 90% (IQR, 80%–100%) in Group LTF. The median postoperative month one VAS score was 2.0 (IQR, 2.0–4.0) in Group PIF and 3.0 (IQR, 1.5–6.5) in Group LTF. Estimated blood loss (EBL) data were available for 25 of 33 patients in Group PIF and 40 of 47 patients in Group LTF. Among patients with available data, EBL in Group PIF was 5 mL in 24/25 patients (96.0%) and 10 mL in one patient (4.0%). In Group LTF, EBL was 5 mL in 39/40 patients (97.5%) and 10 mL in one patient (2.5%) (Table 2).

Among posterior approach procedures, the devices used were PainTEQ® LINO® (PainTEQ) in 23/33 patients (69.7%) cases, CornerLoc™ GRAFTS (FOUNDATION FUSION SOLUTIONS, LLC) in 8/33 patients (24.2%), and Nevro1™ (Nevro Corp) in 2/33 patients (6.1%) (Table 3). For posterior procedures, 7/33 (21.2%) were left-sided, 16/33 (48.5%) were right-sided, and 10/33 (30.3%) were bilateral (Table 1).

For lateral approach procedures, the devices used were SI-BONE iFuse TORQ® implants (SI-BONE, Inc) in 44/47 patients (93.6%) and Alevio® SI-Cure™ (Alevio, LLC) implants in 3/47 patients (6.4%) (Table 3). Among lateral procedures, 14/47 (29.8%) were left-sided, 32/47 (68.1%) were right-sided, and one (2.1%) was bilateral (Table 1).

Among patients who initially underwent unilateral

surgery, 4/80 (5.0%) subsequently required contralateral SI joint fusion. Of these, one (3.0%) occurred in Group PIF and 3/47 (6.4%) in Group LTF; there was no statistically significant difference between approaches ($P = 0.642$). The revision rate for posterior SI joint fusion due to loss of pain relief in Group PIF was 6/33 (18.2%). Revisions occurred exclusively in the Group PIF patients, with a mean (SD) time to revision of 16.8 (12.2 months) (median 14 months; IQR, 6–29, range 4–34). There were no revisions in Group LTF patients, resulting in a statistically significant difference in revision rates between approaches ($P = 0.003$) (Table 2).

DISCUSSION

Following the introduction of PI and PLI SI joint fixation approaches, the literature began to report favorable outcomes for both posterior techniques (2,19). These approaches were developed to reduce adverse events, minimize surgical risk and blood loss, and facilitate a quicker return to activities of daily living when compared with LTI and open SI joint fusion techniques (10,13). The American Society of Pain and Neuroscience currently supports LTI, PI, and PLI fixation approaches; however, limited comparative clinical evidence exists to establish the superiority of one technique over another.

Our study aimed to contribute real-world data to this evolving evidence base by evaluating outcomes of SI joint fusion performed by interventional pain physicians at a single academic center. In this cohort of 80 patients, no statistically significant differences were observed in baseline demographics, including age, gender, or BMI, suggesting that postoperative outcomes were unlikely to be driven by preoperative selection bias. Although our study was not designed or powered to determine procedural superiority, both approaches showed clinically meaningful short-term pain relief when applied to appropriately selected patients. Both PI and LTI techniques resulted in substantial early pain improvement, with mean VAS scores decreasing from 6.6 preoperatively to 3.4 at postoperative month one. Additionally, preoperative diagnostic intraarticular injections provided patients with an average of 95% pain relief, reinforcing the importance of diagnostic rigor and patient selection emphasized in published algorithms and clinical guidelines (20).

When comparing Group PIF and Group LTF, there was a statistically significant difference in procedural durability ($P = 0.003$). In Group PIF, 6/33 patients (18.2%) required revision with an LTI approach due to a loss of efficacy, defined as the recurrence of previously

Table 1. Baseline patient characteristics by surgical approach.

	Posterior	Lateral	P Value
Age - Mean (SD)	59.8 (12.1)	56.6 (14.4)	0.302
Gender - n (%)			
Men	11 (33%)	16 (34%)	
Women	22 (66%)	31 (66%)	
BMI - Median (IQR)	30.0 (25.8–32.1)	32.3 (29.2–35.4)	0.055
Pre-op VAS - Mean (SD)	6.4 (1.6)	6.7 (1.4)	0.384
Injection Percent Relief - Median (IQR)	95% (85%–100%)	100% (95%–100%)	
Initial Surgical Side - n (%)			
Right	16 (48.5%)	32/47 (68.1%)	
Left	7 (21.2%)	14 (29.8%)	
Bilateral	10 (30.3%)	1 (2.1%)	

BMI, body mass index (kg/m^2); IQR, interquartile range; VAS, Visual Analog Scale

treated SI joint pain, occurring between 4 and 34 months post the initial PI procedure. Among these revisions, one patient had undergone fixation with CornerLoc GRAFTS, while 5 had been treated with PainTEQ LINQ devices. In contrast, none of the 47 patients in Group LTF required revision for loss of efficacy. At the time of data collection, follow-up duration in Group LTF ranged from 7 to 31 months. While the sample size was small and underpowered to support definitive conclusions, the observed revision rate in Group PIF is notable and significant in our patient population when compared with previously published revision rates of approximately 0.6% for PI and 2.4% for LTI approaches.

Much of the published comparative literature evaluating lateral SI joint fusion has focused on triangular titanium implants placed by spine surgeons. While these systems have demonstrated superiority over conservative management, they have also been associated with implant-related complications such as implant malposition, neurologic symptoms, vascular injury, nonunion, and revision surgery (10). These studies are frequently cited in comparisons with posterior approaches; however, they may not reflect lateral fixation techniques commonly utilized by interventional pain physicians. In our study, lateral fixation was performed using self-tapping and self-drilling iFuse TORQ implants in 44/47 patients (93.6%) and self-harvesting Alevio SI-Cure implants in 3/47 patients (6.4%).

A comparable study by Gheith, et al (21) evaluated 115 patients undergoing either posterior or lateral SI joint fusion. In that study, posterior fixation was performed using CornerLoc GRAFTS, while lateral fixation used the Zavation SI Screw System (Zavation Medical Products, LLC). Patients in the lateral fusion group demonstrated significantly greater procedural durability, defined by sustained improvements in VAS or Oswestry Disability Index (ODI) scores, compared with those in the posterior group (mean 21.2 months vs 16.2 months; $P = 0.009$) (21). Additionally, lateral approaches were associated with a 70% lower risk of symptom recurrence (risk ratio 0.3; 95% CI, 0.1–0.8). Two patients in the lateral group required hardware removal: one for pseudoarthrosis and one for implant-related pain intolerance, both within 2 months of surgery (21).

Table 2. *Early postoperative outcomes and revision rates by surgical approach.*

	Posterior	Lateral	P Value
Postoperative Month One Relief Percentage - Median (IQR)	80% (65%-100%)	90% (80-100%)	
Postoperative Month One VAS - Median (IQR)	2.0 (2.0-4.0)	3.0 (1.5-6.5)	
Documented EBL 5mL - n (%)	24/25 (96%)	39/40 (97.5%)	
Documented EBL 10mL - n (%)	1/25 (4%)	1/40 (2.5%)	
Required Contralateral Surgery - n (%)	1/33 (3.0%)	3/47 (6.4%)	0.642
Revision Rate - n (%)	6/33 (18.2%)	0 (0%)	0.003
Time Until Revision (months) - Mean (SD)	16.8 (12.2)	0 (0)	0.003

IQR, interquartile range; EBL, estimated blood loss.

Table 3. *Distribution of implant systems by surgical approach.*

	Posterior	Lateral
PainTeq LinQ - n (%)	23 (69.7%)	
CornerLoc GRAFTS - n (%)	8 (24.2%)	
Nevro1 - n (%)	2 (6.1%)	
SI-BONE iFuse TORQ - n (%)		44 (93.6%)
Alevio SI-Cure - n (%)		3 (6.4%)

In our cohort, using multiple device platforms, intraoperative complication data were available for 31 of 33 patients in Group PIF and 44 of 47 patients in Group LTF. Among patients with available data, the intraoperative complication rate was 0/31 in Group PIF and 1/44 in Group LTF. The lateral approach complication was a superficial hematoma identified in the postanesthesia care unit. It was thought to be from muscular disruption during initial dilation and fuse of the tissue spreader, not due to vascular injury. This was resolved with surgical evacuation and the patient recovered without further sequelae. Postoperatively, one patient in the Group LTF developed a superficial surgical site infection that required antibiotic therapy, incision, drainage, and wound vacuum placement, with complete resolution. These complications contrast with the 56 lateral approach patients in the Gheith, et al study (21) as none of the patients in our study had a complication related to the implants themselves. In Group PIF, 2 patients were incidentally noted to have posterior grafts within the ilium on computed tomography imaging that was obtained for unrelated indications. Both patients elected against revision surgery.

These distinctions in lateral implant selection are important when interpreting prior meta-analyses such as those by Xu, et al (22) and Whang, et al (4) which reported lower complication rates for posterior approaches compared with lateral techniques. Although

Xu, et al (22) specifically noted the absence of direct head-to-head comparisons, inferences are often drawn from these data. In contrast, our study compares outcomes across fixation strategies performed by the same group of interventional pain physicians, using multiple posterior devices and 2 minimally invasive lateral screw-based systems. As such, the existing literature may not fully reflect contemporary pain-physician led SI joint fusion practices. This knowledge gap represents a key rationale for our investigation. While limited by sample size, the absence of revisions for loss of efficacy in Group LTF, contrasted with the revision rate observed in Group PIF, underscores the need for further evaluation of procedural durability.

Prospective data from the STACI trial by Weisbein, et al (18) showed that self-tapping and self-drilling lateral screws implanted by interventional pain physicians resulted in clinically significant improvements in pain and function, with minimal blood loss, short operative times, and no serious device-related adverse events. Reported complications included one postoperative hematoma and one superficial infection (18). These findings further support the concept that minimally invasive lateral screw-based fusion performed by interventional pain physicians may have a distinct safety and complication profile compared with triangular implant systems placed by spine surgeons.

Limitations

Our study has several limitations that should be considered when interpreting the results. Its retrospective chart review design introduces the potential for selection bias, incomplete data capture, and unmeasured confounding. In addition, procedural approaches and device selection were not randomized but instead were based on physician preferences. Our sample size was small, and Group analyses were underpowered and unable to establish procedural superiority. The differing follow-up durations between Groups may underestimate late failures, particularly in Group LTF. Importantly, standardized pain scores and documented percentage pain relief beyond the one-month postoperative follow-up visit were not consistently available in the medical record; this precluded reliable reporting of longer-term patient-reported outcomes in our analysis. Outcomes therefore relied on early postoperative pain assessments, and longer-term clinical responses may be under- or overestimated. Additionally, outcomes were primarily based on patient-reported pain measures, which are subject to reporting variability; standardized

functional outcome measures, such as ODI, were not consistently obtained. Including multiple device platforms within each approach introduces treatment heterogeneity, limiting device-specific conclusions while the single-center experience of interventional pain physicians may reduce generalizability. Finally, revision surgery was defined by recurrence of pain rather than standardized radiographic or functional criteria, which may underestimate subclinical failure or overestimate clinically meaningful revision.

Taken together, the findings of our study reinforce the growing consensus that SI joint fusion can provide clinically meaningful pain relief in carefully selected patients who have failed conservative and less invasive therapies. Future prospective, adequately powered studies directly comparing PI and minimally invasive LTI fusion performed by interventional pain physicians are needed to better define long-term efficacy, revision rates, and complication profiles across fixation strategies.

CONCLUSION

In our single-center retrospective analysis, both posterior interpositional and lateral transiliac sacroiliac joint fusion approaches performed by interventional pain physicians provided clinically meaningful short-term pain relief in carefully selected patients who had failed conservative management. Early postoperative improvements were substantial across both techniques, supporting the role of minimally invasive SI joint fusion as an effective treatment option within a comprehensive pain management algorithm.

Notably, a higher revision rate due to loss of efficacy was observed in Group PIF compared with Group LTF, while overall complication rates and intraoperative blood loss remained low for both approaches. Although limited by sample size, retrospective design, and variable follow-up duration, these findings suggest potential differences in procedural durability that warrant further investigation given the currently published rates in the literature.

Author Contributions

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