

CIGNA MEDICAL COVERAGE POLICIES - MUSCULOSKELETAL CMM-611: Sacroiliac Joint Fusion and Stabilization

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EviCore
By EVERNORTH

Instructions for use

The following coverage policy applies to health benefit plans administered by Cigna. Coverage policies are intended to provide guidance in interpreting certain standard Cigna benefit plans and are used by medical directors and other health care professionals in making medical necessity and other coverage determinations. Please note the terms of a customer's particular benefit plan document may differ significantly from the standard benefit plans upon which these coverage policies are based. For example, a customer's benefit plan document may contain a specific exclusion related to a topic addressed in a coverage policy.

In the event of a conflict, a customer's benefit plan document always supersedes the information in the coverage policy. In the absence of federal or state coverage mandates, benefits are ultimately determined by the terms of the applicable benefit plan document. Coverage determinations in each specific instance require consideration of:

1. The terms of the applicable benefit plan document in effect on the date of service
2. Any applicable laws and regulations
3. Any relevant collateral source materials including coverage policies
4. The specific facts of the particular situation

Coverage policies relate exclusively to the administration of health benefit plans. Coverage policies are not recommendations for treatment and should never be used as treatment guidelines.

This evidence-based medical coverage policy has been developed by EviCore, Inc. Some information in this coverage policy may not apply to all benefit plans administered by Cigna.

These guidelines include procedures EviCore does not review for Cigna. Please refer to the [Cigna CPT code list](#) for the current list of high-tech imaging procedures that EviCore reviews for Cigna.

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CMM-611: Sacroiliac Joint Fusion and Stabilization

CMM-611.1: General Guidelines

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Application of Guideline

- The determination of medical necessity for the performance of sacroiliac joint fusion and stabilization is always made on a case-by-case basis.
- For additional timing and documentation requirements, see **CMM-600.1: Prior Authorization Requirements**.

Health Equity Considerations

Health equity is the highest level of health for all individuals; health inequity is the avoidable difference in health status or distribution of health resources due to the social conditions in which individuals are born, grow, live, work, and age. Social determinants of health are the conditions in the environment that affect a wide range of health, functioning, and quality of life outcomes and risks. Examples include the following: safe housing, transportation, and neighborhoods; racism, discrimination, and violence; education, job opportunities, and income; access to nutritious foods and physical activity opportunities; access to clean air and water; and language and literacy skills.

CMM-611.2: Minimally Invasive Sacroiliac Joint Fusion and Stabilization Indications

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CMM-611.2: Minimally Invasive Sacroiliac Joint Fusion and Stabilization Indications

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Minimally invasive sacroiliac (SI) joint fusion and stabilization is considered **medically necessary** when ALL of the following criteria have been met:

- Performed for lumbopelvic pain originating from the SI joint
- Performed using structural devices/implants that traverse and transfix the SI joint with the intention to fuse the SI joint
- Diagnostic confirmation of the SI joint as a pain generator as evidenced by a positive response to two separate diagnostic SI joint injections
 - A positive response to a diagnostic SI joint injection is considered $\geq 75\%$ reduction in the reported pain for the duration of the local anesthetic.
 - **Note:** For diagnostic SI joint injections, see **CMM-203: Sacroiliac Joint Procedures**.
- Imaging studies include ALL of the following:
 - plain x-rays and/or cross-sectional imaging (CT or MRI) have been performed to exclude the presence of ANY of the following that would not be properly addressed by SIJ fusion:
 - destructive lesions (e.g., tumor, infection)
 - acute traumatic fracture and/or instability of the SI joint
 - plain x-rays of the pelvis (including the ipsilateral hip) have been performed to evaluate potential concomitant hip pathology as a potential more likely source for the individual's pain
 - cross-sectional imaging (e.g., CT or MRI) of the lumbar spine have been performed to evaluate potential concomitant neural compression or other degenerative conditions as a potential more likely source for the individual's pain
- Diagnostic testing has been performed to exclude the presence of systemic inflammatory arthropathy (e.g., ankylosing spondylitis, psoriatic arthritis, rheumatoid arthritis)
- Symptoms include ALL of the following:
 - individual localizes posterior pain to the posterior superior iliac spine (Fortin's point)
 - presence of non-radiating lumbopelvic pain caudal to L5, buttock, hip, and/or groin pain
 - SI joint pain interfering with activities of daily living

- Physical exam findings include ALL of the following:
 - localized tenderness to palpation over the sacral sulcus and posterior SI joint
 - absence of localized tenderness (of similar severity to palpation of the sacral sulcus and posterior SI joint) over the greater trochanter, lumbar spine, and coccyx
 - reproduction of localized sacroiliac joint pain on at least three (3) of the following provocative tests:
 - thigh thrust test (posterior pelvic pain provocation test)
 - sacroiliac joint compression test
 - Gaenslen's test
 - distraction test (gapping test)
 - FABER test (Patrick's test)
 - sacral thrust test
 - Yeoman's test
- Less than clinically meaningful improvement with ALL of the following (unless contraindicated):
 - a trial of at least one (1) therapeutic SI joint injection
 - **Note:** For therapeutic SI joint injections, see **CMM-203: Sacroiliac Joint Procedures**.
 - non-steroidal anti-inflammatory drugs (NSAIDs) for at least six (6) consecutive months
 - prescription medication optimization for at least six (6) consecutive months
 - activity modification for at least six (6) consecutive months
 - physician supervised/prescribed active physical therapy (including home exercise program) targeting lumbopelvic (core) area for at least six (6) consecutive months
 - **Note:** Chiropractic adjustments may be performed as an additional treatment option, but chiropractic adjustments are NOT required and are NOT considered a substitute for physical therapy.
- Absence of alternative diagnoses that are a more likely cause of the individual's ongoing pain or disability
- Absence of generalized pain behavior (e.g., somatoform disorder) or generalized pain disorders (e.g., fibromyalgia)
- Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
- Documentation of nicotine-free status with EITHER of the following:
 - individual is a never-smoker
 - individual has refrained from smoking, use of smokeless tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery validated by objective cotinine testing methods (serum, urinary, or saliva) verified

as within the normal range for the testing method and lab at which the test was performed

CMM-611.3: Open Sacroiliac Joint Fusion Indications

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CMM-611.3: Open Sacroiliac Joint Fusion Indications

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Open sacroiliac (SI) joint fusion is considered **medically necessary** when ALL of the following criteria have been met:

- Plain x-rays and/or cross-sectional imaging (CT or MRI) identifies localized SI joint pathology concordant with the individual's history and physical exam.
- Performed for ANY of the following:
 - post-traumatic injury of the SI joint (e.g., following pelvic ring fracture)
 - as an adjunctive treatment for SI joint infection
 - management of sacral tumor (e.g., partial sacrectomy)
 - when performed as part of a multi-segmental long-fusion constructs for the correction of spinal deformity (e.g., idiopathic scoliosis, neuromuscular scoliosis)
 - failed prior percutaneous (minimally invasive) SI joint fusion
- Documentation of nicotine-free status with EITHER of the following:
 - individual is a never-smoker
 - individual has refrained from smoking, use of smokeless tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery validated by objective cotinine testing methods (serum, urinary, or saliva) verified as within the normal range for the testing method and lab at which the test was performed

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Not Medically Necessary

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Minimally Invasive or Percutaneous Sacroiliac (SI) Joint Fusion and Stabilization

- Minimally invasive or percutaneous SI joint fusion and stabilization using titanium triangular implants performed without meeting the criteria in the **General Guidelines** and the criteria in **Minimally Invasive Sacroiliac Joint Fusion or Stabilization Indications** is considered **not medically necessary**.
- Minimally invasive or percutaneous SI joint fusion and stabilization using titanium triangular implants is considered **not medically necessary** for EITHER of the following:
 - any condition that would prevent insertion of the implants
 - bilateral SI joint fusion and stabilization procedures on the same date of service
- Minimally invasive or percutaneous SI joint fusion and stabilization using products/implants that do NOT traverse and transfix the SI joint (e.g., allograft wedge between the sacrum and ilium, non-metallic implants) is considered **not medically necessary**.
- Minimally invasive or percutaneous SI joint fusion and stabilization performed without the intention of fusing the SI joint (i.e., joint distraction) is considered **not medically necessary**.

Open Sacroiliac (SI) Joint Fusion

- Open sacroiliac (SI) joint fusion performed without meeting the criteria in the **General Guidelines** and the criteria in **Open Sacroiliac Joint Fusion Indications** is considered **not medically necessary**.
- Open sacroiliac (SI) joint fusion is considered **not medically necessary** for ANY of the following conditions:
 - mechanical low back pain
 - sacroiliac joint syndrome
 - degenerative sacroiliac joint
 - radicular pain syndromes

Codes (CMM-611)

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Codes (CMM-611)

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The inclusion of any code in this table does not imply that the code is under management or requires prior authorization. Refer to the applicable health plan for management details. Prior authorization of a code listed in this table is not a guarantee of payment. The Certificate of Coverage or Evidence of Coverage policy outlines the terms and conditions of the member's health insurance policy.

Code	Code Description/Definitions
27278	Arthrodesis, sacroiliac joint, percutaneous, with image guidance, including placement of intra-articular implant(s) (e.g., bone allograft[s], synthetic device[s]), without placement of transfixation device
27279	Arthrodesis, sacroiliac joint, percutaneous or minimally invasive (indirect visualization), with image guidance, includes obtaining bone graft when performed, and placement of transfixation device
27280	Arthrodesis, sacroiliac joint, open, includes obtaining bone graft, including instrumentation, when performed

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Evidence Discussion (CMM-611)

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CMM-611: Sacroiliac Joint Fusion and Stabilization

Evidence Discussion (CMM-611)

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Sacroiliac Joint Fusion and Stabilization

Risks of minimally invasive sacroiliac (SI) joint fusion include, but are not limited to, the following: infection; neurovascular injury; persistent or incomplete relief of symptoms; possible need for more surgery; non-union; fracture; hemorrhage; hematoma; deep vein thrombosis; pulmonary embolus; and, death.^{77,115} Issues related to the implant (e.g., migration, loosening, breakage, malposition) are also possible.^{77,115} Complication rates for minimally invasive SI joint fusion have been reported in the literature to be as high as 16.4%.¹¹⁰ Given the potential possibility for significant complications, proper surgical candidacy selection is critical to minimize the risk benefit ratio.

As it can be challenging to identify the sacroiliac (SI) joint as the source of pain, the following are required: supportive subjective symptoms and physical exam findings; imaging findings to rule out other sources of pain; and, positive results of diagnostic injections.^{106,124,125} As multiple etiologies for low back pain exist, pain should be non-radicular and localized to the posterior superior iliac spine (Fortin's point).³⁸ Multiple articles have indicated that three or more of six provocation SI joint tests have the best predictive power when looking at physical exam findings.^{43,59,124} No imaging studies have been found to be accurate in diagnosing SIJ pain.⁷³ The North American Spine Society (NASS) (in *Coverage Policy Recommendations: Minimally Invasive Sacroiliac Joint Fusion*) recommends imaging (both X-ray and CT or MRI) to rule out as potential more likely sources of pain such as destructive lesions, lumbar spine neural compression, other degenerative conditions, and ipsilateral hip pathology.⁸⁰ Regarding diagnostic injections, studies have shown a single SI joint injection (with or without steroid) has a false positive rate of 20-54%.^{53,58,108} It is therefore recommended that confirmation of SI joint pain requires two separate diagnostic injections with at least 75% improvement.^{54,49,60,80,125}

Given the risks of surgery and difficulty of definitively identifying the SI joint as a pain generator, it is generally accepted to start treatment with conservative measures including NSAIDs and other medications, activity modifications, therapeutic injections, and physical therapy.^{5,37,106} Surgical treatment may be considered when an individual has persistent moderate to severe pain, functional impairment, and failed a minimum of six (6) months of conservative care.^{5,37,80,106}

Literature has shown poorer outcomes and higher complication rates in individuals with unmanaged psychosocial disorders or smoking history and that are undergoing fusion.^{9,17,30,48,58,88,126} Proper identification and treatment of these conditions prior to

surgery may significantly improve many outcome measures. Evidence supports that the various methods of cotinine testing (serum, saliva, urinary) are sufficiently equivalent in accuracy to confirm nicotine abstinence. Serum testing cutoff values ranged from 3.0ng/mL to 20ng/mL. Salivary testing cutoff values ranged from 10ng/mL to 44ng/mL. Urinary testing cutoff is 10ng/mL.^{1,8,24,57}

Contraindications to minimally invasive SI joint fusion, as noted by the North American Spine Society (NASS) (in *Coverage Policy Recommendations: Minimally Invasive Sacroiliac Joint Fusion*), include the presence of systemic arthropathy such as ankylosing spondylitis or rheumatoid arthritis, the presence of generalized pain behavior or generalized pain disorder, or the presence of infection or tumor.⁸⁰

Indications for open SI joint fusion include severe traumatic injuries associated with pelvic ring disruption, multi-segment spinal constructs extending to the ilium, management of sacral tumors, or adjunctive use to the medical treatment of sacroiliac joint infection.^{26,42,46,50,79,98,137}

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1. Achiliu H, Feng J, Wang L, Bernert JT. Tobacco use classification by inexpensive urinary cotinine immunoassay test strips. *J Anal Toxicol.* 2019;43(2):149-153. doi:10.1093/jat/bky075.
2. Ackerman S, Cummings J, Polly D, Knight T, Schneider K, Holt T. Comparison of the costs of nonoperative care to minimally invasive surgery for sacroiliac joint disruption and degenerative sacroiliitis in a United States Medicare population: potential economic implications of a new minimally-invasive technology. *Clin Outcomes Res.* 2013;2013(5):575-587.
3. Al-Khayer A, Hegarty J, Hahn D, Grevitt MP. Percutaneous sacroiliac joint arthrodesis: a novel technique. *J Spinal Disord Tech.* 2008;21(5):359-363.
4. Amer MH, Elnahal WA, Khaled SA, et al. Minimally invasive sacroiliac fusion, a case series, and a literature review. *SICOT J.* 2022;8:42. doi:10.1051/sicotj/2022042.
5. Aranke M, McCrudy G, Rooney K, et al. Minimally invasive and conservative interventions for the treatment of sacroiliac joint pain: a review of recent literature. *Orthop Rev (Pavia).* 2022;14(4):34098. doi:10.52965/001c.34098.
6. Ashman B, Norvell D, Hermsmeyer J. Chronic sacroiliac joint pain: fusion versus denervation as treatment options. *Evid-Based Spine-Care J.* 2010;1(03):35-44.
7. Belanger TA, Dall BE. Sacroiliac arthrodesis using a posterior midline fascial splitting approach and pedicle screw instrumentation: a new technique. *J Spinal Disord.* 2001;14(2):118-124.
8. Benowitz NL, Bernert JT, Foulds J, et al. Biochemical verification of tobacco use and abstinence: 2019 update. *Nicotine Tob Res.* 2020;22(7):1086-1097. doi:10.1093/ntr/ntz132.
9. Berman D, Oren JH, Bendo J, Spivak J. The effect of smoking on spinal fusion. *Int J Spine Surg.* 2017;11(4):29. doi:10.14444/4029.
10. Bernard TN, Kirkaldy-Willis WH. Recognizing specific characteristics of nonspecific low back pain. *Clin Orthop.* 1987;(217):266-280.
11. Boradhurst NA, Bond MJ. Pain provocation tests for the assessment of sacroiliac joint dysfunction. *J Spinal Disord.* 1998;11(4):341-345.
12. Bornemann R, Roesler PP, Straus AC, et al. Two-year clinical results of patients with sacroiliac joint syndrome treated by arthrodesis using a triangular implant system. *Technol Health Care.* 2017;25(2):319-325. doi:10.3233/THC-161272.
13. Buchowski JM, Kebaish KM, Sinkov V, Cohen DB, Sieber AN, Kostuik JP. Functional and radiographic outcome of sacroiliac arthrodesis for the disorders of the sacroiliac joint. *Spine J.* 2005;5(5):520-528.
14. Calodney A, Azeem N, Buchanan P, et al. Safety, efficacy, and durability of outcomes: results from SECURE: a single arm, multicenter, prospective, clinical study on a minimally invasive posterior sacroiliac fusion allograft implant. *J Pain Res.* 2024;17:1209-1222. doi:10.2147/JPR.S458334.
15. Capobianco R, Cher D. Safety and effectiveness of minimally invasive sacroiliac joint fusion in women with persistent post-partum posterior pelvic girdle pain: 12-month outcomes from a prospective, multi-center trial. *SpingerPlus.* 2015;4(1):570.
16. Chang E, Rains C, Ali R, Wines R, Kahwati L. Minimally invasive sacroiliac joint fusion for chronic sacroiliac joint pain: a systematic review. *Spine J.* 2022;22(8):1240-1253. doi:10.1016/j.spinee.2022.01.005.
17. Chapin L, Ward K, Ryken T. Preoperative depression, smoking, and employment status are significant factors in patient satisfaction after lumbar spine surgery. *Clin Spine Surg.* 2017;30(6):E725-E732. doi:10.1097/BSD.0000000000000331.
18. Cher DJ, Frasco MA, Arnold RJ, Polly DW. Cost-effectiveness of minimally invasive sacroiliac joint fusion. *Clin Outcomes Res CEOR.* 2016;8:1-14.
19. Cher DJ, Polly D, Berven S. Sacroiliac joint pain: burden of disease. *Med Devices Evid Res.* 2014;7:73-81.
20. Cher DJ, Reckling WC. Quality of life in preoperative patients with sacroiliac dysfunction is at least as depressed as in other lumbar spinal conditions. *Med Devices Evid Res.* 2015;8:395-403.

21. Cher DJ, Reckling WC, Capobianco RA. Implant survivorship analysis after minimally invasive sacroiliac fusion using the iFuse Implant System. *Med Devices Evid Res.* 2015;8:485-492.
22. Cohen SP, Strassels SA, Kurihara C, et al. Outcome predictors for sacroiliac joint (lateral branch) radiofrequency denervation. *Reg Anesth Pain Med.* 2009;34(3):206-214.
23. Cohen SP, Hurley RW, Buckenmaier CC, Kurihara C, Morlando B, Dragovich A. Randomized placebo-controlled study evaluating lateral branch radiofrequency denervation for sacroiliac pain. *Anesthesiology.* 2008;109(2):279-288.
24. Cooke F, Bullen C, Whittaker R, McRobbie H, Chen MH, Walker N. Diagnostic accuracy of NicAlert cotinine test strips in saliva for verifying smoking status. *Nicotine Tob Res.* 2008;10(4):607-612. doi:10.1080/14622200801978680.
25. Cummings J Jr, Capobianco RA. Minimally invasive sacroiliac joint fusion: one-year outcomes in 18 patients. *Ann Surg Innov Res.* 2013;7(1):12.
26. Davidson D, Letts M, Khoshhal K. Pelvic osteomyelitis in children: a comparison of decades from 1980-1989 with 1990-2001. *J Pediatr Orthop.* 2003;23(4):514-521.
27. Dengler J, Duhon B, Whang P, et al. Predictors of outcome in conservative and minimally invasive surgical management of pain originating from the sacroiliac joint: a pooled analysis. *Spine (Phila Pa 1976).* 2017;42(21):1664-1673. doi:10.1097/BRS.0000000000002169.
28. Dengler J, Kools D, Pflugmacher R, et al. Randomized trial of sacroiliac joint arthrodesis compared with conservative management for chronic low back pain attributed to the sacroiliac joint. *J Bone Joint Surg Am.* 2019;101(5):400-411. doi:10.2106/JBJS.18.00022.
29. Dengler J, Stureson B, Kools D, et al. Referred leg pain originating from the sacroiliac joint: 6-month outcomes from the prospective randomized controlled iMIA trial. *Acta Neurochir (Wien).* 2016;158(11):2219-2224. doi:10.1007/s00701-016-2953-7.
30. Dengler JD, Kools D, Pflugmacher R, et al. 1-year results of a randomized controlled trial of conservative management vs. minimally invasive surgical treatment for sacroiliac joint pain. *Pain Physician.* 2017;20:537-550.
31. DePalma MJ, Ketchum JM, Saullo TR. Etiology of chronic low back pain in patients having undergone lumbar fusion. *Pain Med.* 2011;12(5):732-739. doi:10.1111/j.1526-4637.2011.01098.x.
32. Duhon B, Bitan F, Lockstadt H, et al.; SIFI Study Group. Triangular titanium implants for minimally invasive sacroiliac joint fusion: 2-year follow-up from a prospective multicenter trial. *Int J Spine Surg.* 2016;10:13. doi:10.14444/3013.
33. Duhon BS, Cher DJ, Wine KD, Kovalsky DA, Lockstadt H; SIFI Study Group. Triangular titanium implants for minimally invasive sacroiliac joint fusion: a prospective study. *Glob Spine J.* 2016;6(3):257-269. doi:10.1055/s-0035-1562912.
34. Duhon BS, Cher DJ, Wine KD, Lockstadt H, Kovalsky D, Soo C-L. Safety and 6-month effectiveness of minimally invasive sacroiliac joint fusion: a prospective study. *Med Devices (Auckl).* 2013;6:219-229. doi:10.2147/MDER.S55197.
35. Endres S, Ludwig E. Outcome of distraction interference arthrodesis of the sacroiliac joint for sacroiliac arthritis. *Indian J Orthop.* 2013;47(5):437-442.
36. Eno JJ, Boone C, Bellino M, Bishop J. The prevalence of sacroiliac joint degeneration in asymptomatic adults. *J Bone Joint Surg AM.* 2015;97(11):932-936.
37. Falowski S, Sayed D, Pope J, et al. A review and algorithm in the diagnosis and treatment of sacroiliac joint pain. *J Pain Res.* 2020;13:3337-3348. doi:10.2147/JPR.S279390.
38. Fortin JD, Aprill CN, Ponthieux B, Pier J. Sacroiliac joint pain referral maps upon applying a new injection/arthrography technique. Part II: Clinical evaluation. *Spine (Phila Pa 1976).* 1994;19:1483-1489.
39. Fortin JD, Dwyer AP, West S, Pier J. Joint: pain referral maps upon applying a new injection/arthrography technique. Part I. asymptomatic volunteers. *Spine.* 1994;19:1475-1482.
40. Gaetani P, Miotti D, Risso A, et al. Percutaneous arthrodesis of sacroiliac joint: a pilot study. *J Neurosurg Sci.* 2013;57(4):97-301.
41. Graham Smith A, Capobianco R, Cher D, et al. Open versus minimally invasive sacroiliac fusion: a multi-center comparison of perioperative measures and clinical outcomes. *Ann Surg Innov Res.* 2013;7(1):14.
42. Griffin DR, Starr AJ, Reinert CM, Jones AL, Whitlock S. Vertically unstable pelvic fractures fixed with percutaneous iliosacral screws: does posterior injury pattern predict fixation failure?. *J Orthop Trauma.* 2006;20(1 Suppl):S30-S36.

43. Hancock MJ, Maher CG, Latimer J, et al. Systematic review of tests to identify the disc, SIJ or facet joint as the source of low back pain. *Eur Spine J*. 2007;16(10):1539-1550. doi:10.1007/s00586-007-0391-1.
44. Heiney J, Capobianco R, Cher D. Systemic review of minimally invasive sacroiliac joint fusion using a lateral transarticular approach. *Int J Spine Surg*. 2015;9:40. doi:10.14444/2040.
45. Horton I, McDonald J, Verhaegen J, et al. Sacroiliac joint: function, pathology, treatment, and contribution to outcomes in spine and hip surgery. *J Bone Joint Surg Am*. 2025;107:305-320 doi:10.2106/JBJS.24.00380.
46. Hsu JR, Bear RR, Dickson KF. Open reduction internal fixation of displaced sacral fractures: technique and results. *Orthopedics*. 2010;33(10):730. doi:10.3928/01477447-20100826-07.
47. Irwin RW, Watson T, Miick RP, Ambrosius WT. Age, body mass index, and gender differences in sacroiliac joint pathology. *Am J Phys Med Rehabil*. 2007;86(1):37-44.
48. Jackson KL, Rumley J, Griffith M, Agochukwu U, DeVine J. Correlating psychological comorbidities and outcomes after spine surgery. *Global Spine J*. 2020;10(7):929-939. doi:10.1177/2192568219886595.
49. Jung MW, Schellhas K, Johnson B. Use of diagnostic injections to evaluate sacroiliac joint pain. *Int J Spine Surg*. 2020;14(Suppl 1):30-34. doi:10.14444/6081.
50. Kanakaris NK, Psarakis S, Chalidis B, Kontakis G, Giannoudis PV. Management of pelvic instability secondary to chronic pyogenic sacroiliitis: case report. *Surg Infect (Larchmt)*. 2009;10(4):353-358. doi:10.1089/sur.2007.094.
51. Kancherla VK, McGowan SM, Audley BN, Sokunbi G, Puccio ST. Patient reported outcomes from sacroiliac joint fusion. *Asian Spine J*. 2017;11(1):120-126.
52. Katz V, Schofferman J, Reynolds J. The sacroiliac joint: a potential cause of pain after lumbar fusion to the sacrum. *J Spinal Disord Tech*. 2003;16(1):96-99.
53. Kennedy DJ, Engel A, Kreiner DS, Nampiaparampil D, Duszynski B, MacVicar J. Fluoroscopically guided diagnostic and therapeutic intra-articular sacroiliac joint injections: a systematic review. *Pain Med*. 2015;16(8):1500-1518. doi:10.1111/pme.12833.
54. Khurana A, Guha AR, Mohanty K, Ahuja S. Percutaneous fusion of the sacroiliac joint with hollow modular anchorage screws: clinical and radiological outcome. *JBJS Br*. 2009;91(5):627-631.
55. Kim BY, Concannon TA, Barboza LC, Khan TW. The role of diagnostic injections in spinal disorders: a narrative review. *Diagnostics (Basel)*. 2021;11(12):2311. doi:10.3390/diagnostics11122311.
56. Kim JT, Rudolf LM, Glaser JA. Outcome of percutaneous sacroiliac joint fixation with porous plasma-coated triangular titanium implants: an independent review. *Open Orthop J*. 2013;7:51-56.
57. Kim S. Overview of cotinine cutoff values for smoking status classification. *Int J Environ Res Public Health*. 2016;13(12):1236. Published 2016 Dec 14. doi:10.3390/ijerph13121236.
58. Kube RA, Muir JM. Sacroiliac joint fusion: one year clinical and radiographic results following minimally invasive sacroiliac joint fusion surgery. *Open Orthop J*. 2016;10. doi:10.2174/1874325001610010679.
59. Laslett M, Aprill CN, McDonald B, Young SB. Diagnosis of sacroiliac joint pain: validity of individual provocation tests and composites of tests. *Man Ther*. 2005;10(3):207-218. doi:10.1016/j.math.2005.01.003.
60. Le Huec JC, Bourret S, Thompson W, Daulouede C, Cloché T. A painful unknown: sacroiliac joint diagnosis and treatment. *EFORT Open Rev*. 2020;5(10):691-698. doi:10.1302/2058-5241.5.190081.
61. Ledonio CGT, Polly DW, Swiontkowski MF. Minimally invasive versus open sacroiliac joint fusion: are they similarly safe and effective? *Clin Orthop*. 2014;472(6):1831-1838.
62. Ledonio C, Polly D, Swiontkowski MF, Cummings J. Comparative effectiveness of open versus minimally invasive sacroiliac joint fusion. *Med Devices Evid Res*. 2014;(7):187-193.
63. Lee BS, Nault R, Grabowski M, et al. Utility of repeat magnetic resonance imaging in surgical patients with lumbar stenosis without disc herniation. *Spine J*. 2019;19:191-198.
64. Lee DW, Patterson DG, Sayed D. Review of current evidence for minimally invasive posterior sacroiliac joint fusion. *Int J Spine Surg*. 2021;15(3):514-524. doi:10.14444/8073.
65. Liliang PC, Lu K, Weng HC, Liang CL, Tsai YD, Chen HJ. The therapeutic efficacy of sacroiliac joint blocks with triamcinolone acetonide in the treatment of sacroiliac joint dysfunction without spondyloarthropathy. *Spine*. 2009;34(9):896-900.
66. Liliang PC, Lu K, Liliang CL, Tsai YD, Wank KW, Chen HJ. Sacroiliac joint pain after lumbar and lumbosacral fusion: findings using dual sacroiliac joint blocks. *Pain Medicine*. 2011;12(4):565-570.
67. Lindsey DP, Kiapour A, Yerby SA, Goel VK. Sacroiliac joint fusion minimally affects adjacent lumbar segment motion: a finite element study. *Int J Spine Surg*. 2015;9:64.

68. Lindsey D, Perez-Orribo L, Rodriquez-Martinez N, et al. Evaluation of a minimally invasive procedure for sacroiliac joint fusion – an in vitro biomechanical analysis of initial and cycled properties. *Med Devices Evid Res.* 2014;(7):131-137.
69. Lingutla KK, Pollock R, Ahuja S. Sacroiliac joint fusion for low back pain: a systematic review and meta-analysis. *Eur Spine J.* 2016:1-8.
70. Lorio M, Kube R, Araghi A. International Society for the Advancement of Spine Surgery policy 2020 update —minimally invasive surgical sacroiliac joint fusion (for chronic sacroiliac joint pain): coverage indications, limitations, and medical necessity. *Int J Spine Surg.* 2020:7156. doi:10.14444/7156.
71. Lorio M, Polly D, Ninkovic I, et al. Utilization of Minimally Invasive Surgical Approach for Sacroiliac Joint Fusion in Surgeon Population of ISASS and SMISS Membership. *Open J Orthop.* 2014;8(1):1-6.
72. Maingne JY, Aivaliklis A, Pfefer F. Results of sacroiliac joint double block and value of sacroiliac pain provocation tests in 54 patients with low back pain. *Spine (Phila Pa 1976).* 1996;21(16):1889-1892. doi:10.1097/00007632-199608150-00012.
73. Manchikanti L, Abdi S, Atluri S, et al. An update of comprehensive evidence-based guidelines for interventional techniques in chronic spinal pain. Part II: guidance and recommendations. *Pain Physician.* 2013;16(2 Suppl):S49-S283.
74. Mason, LW, Chopra I, Mohanty K. The percutaneous stabilization of the sacroiliac joint with hollow modular anchorage screws: a prospective outcome study. *Eur Spine J.* 2013;22(10):2325-2331.
75. McGuire RA, Chen Z, Donahoe K. Dual fibular allograft technique for sacroiliac joint arthrodesis. *Evid Based Spine Care J.* 2012;3(3):21-28.
76. Miller LE, Block JE. Minimally invasive arthrodesis for chronic sacroiliac joint dysfunction using the SImmetry SI Joint Fusion system. *Med Devices Evid Res.* 2014;7:125-130.
77. Miller LE, Reckling WC, Block JE. Analysis of postmarket complaints database for the iFuse SI joint fusion system: a minimally invasive treatment for degenerative sacroiliitis and sacroiliac disruption. *Med Devices (Auckl).* 2013;6:77-84. doi:10.2147/MDER.S44690.
78. National Institute for Health and Care Excellence (NICE). *Interventional Procedures Guidance [IPG578]: Minimally Invasive Sacroiliac Joint Fusion Surgery for Chronic Sacroiliac Pain.* April 2017. London, UK. © NICE. Available at: <https://www.nice.org.uk/guidance/ipg578>.
79. Newman CB, Keshavarzi S, Aryan HE. En bloc sacrectomy and reconstruction: technique modification for pelvic fixation. *Surg Neurol.* 2009;72(6):752-756. doi:10.1016/j.surneu.2009.02.008.
80. North American Spine Society (NASS). *Coverage Policy Recommendations: Minimally Invasive Sacroiliac Joint Fusion.* 2021. Burr Ridge, IL. © North American Spine Society (NASS). Available at: <https://www.spine.org>.
81. North American Spine Society (NASS). *Coverage Policy Recommendations: Percutaneous Sacroiliac Joint Fusion.* 2015. Burr Ridge, IL. © North American Spine Society (NASS). Available at: <https://www.spine.org>.
82. Ohtori S, Sainoh T, Takaso M, et al. Clinical incidence of sacroiliac joint arthritis and pain after sacropelvic fixation for spinal deformity. *Yonsei Med J.* 2012;53(2):416.
83. Ou-Yang DC, York PJ, Kleck CJ, Patel VV. Current concepts review: diagnosis and management of sacroiliac joint dysfunction. *J Bone Joint Surg Am.* 2017;99:2027-2036.
84. Panagopoulos J, Hush J, Steffens D, Hancock MJ. Do MRI findings change over a period of up to 1 year in patients with low back pain and/or sciatica?. *Spine.* 2017;42(7):504-512. doi:10.1097/brs.0000000000001790.
85. Patel N. Twelve-month follow-up of a randomized trial assessing cooled radiofrequency denervation as a treatment for sacroiliac region pain. *Pain Pract.* 2016;16(2):154-167. doi:10.1111/papr.12269.
86. Patel N, Gross A, Brown L, Gekht G. A randomized, placebo-controlled study to assess the efficacy of lateral branch neurotomy for chronic sacroiliac joint pain. *Pain Med.* 2012;13(3):383-398. doi:10.1111/j.1526-4637.2012.01328.x.
87. Patel V, Meyer SC, Kovalsky D, et al. Prospective trial of sacroiliac joint fusion using 3d-printed triangular titanium implants: five-year follow-up. *Spine (Phila Pa 1976).* 2025;50(9):620-627. doi:10.1097/BRS.0000000000005170.
88. Polatin PB, Kinney RK, Gatchel RJ, Lillo E, Mayer TG. Psychiatric illness and chronic low-back pain. the mind and the spine--which goes first?. *Spine (Phila Pa 1976).* 1993;18(1):66-71. doi:10.1097/00007632-199301000-00011.
89. Polly D, Cher D, Whang PG, Frank C, Sembrano J. for the INSITE Study Group. Does level of response to SI Joint block predict response to SI joint fusion?. *Int J Spine Surg.* 2016;10:4. doi:10.14444/3004.

90. Polly DW, Cher DJ, Wine KD, et al. Randomized controlled trial of minimally invasive sacroiliac joint fusion using triangular titanium implants vs nonsurgical management for sacroiliac joint dysfunction: 12-month outcomes. *Neurosurgery*. 2015;77(5):674-691. doi:10.1227/NEU.0000000000000988.
91. Polly DW, Swofford J, Whang PG, et al. Two-year outcomes from a randomized controlled trial of minimally invasive sacroiliac joint fusion vs non-surgical management for sacroiliac joint dysfunction. *Int J Spine Surg*. 2016;10:28. doi:10.14444/3028.
92. Rappaport LH, Luna IY, Joshua G. Minimally invasive sacroiliac joint fusion using a novel hydroxyapatite-coated screw: preliminary 1-year clinical and radiographic results of a 2-year prospective study. *World Neurosurg*. 2017;101:493-497.
93. Rashbaum RF, Ohnmeiss DD, Lindley EM, Kitchel SH, Patel VV. Sacroiliac joint pain and its treatment. *Clin Spine Surg*. 2016;29(2):42-48.
94. Ries ZG, Glassman SD, Vasilyev I, Metcalfe L, Carreon LY. Updated imaging does not affect revision rates in adults undergoing spine surgery for lumbar degenerative disease. *J Neurosurg Spine*. Published online Nov 2018. 2019;30(2):228-223. doi:10.3171/2018.8.spine18586.
95. Rudolf L. MIS fusion of the SI joint: does prior lumbar spinal fusion affect patient outcomes?. *Open Orthop J*. 2013;7:163-168.
96. Rudolf L. Sacroiliac joint arthrodesis – MIS technique with titanium implants: report of the first 50 patients and outcomes. *Open Orthop J*. 2012;6(1):495-502.
97. Rudolf L, Capobianco R. Five-year clinical and radiographic outcomes after minimally invasive sacroiliac fusion using triangular implants. *Open Orthop J*. 2014;8:375-383.
98. Rysavý M, Pavelka T, Khayarin M, Dzupa V. Iliosacral screw fixation of the unstable pelvic ring injuries. *Acta Chir Orthop Traumatol Cech*. 2010;77(3):209-214.
99. Sachs D. Minimally invasive versus open sacroiliac joint fusion: a comparison of process measures and description of technique. *Int J Spine Surg*. 2013:187.
100. Sachs D, Capobianco R. Minimally invasive sacroiliac joint fusion: one-year outcomes in 40 patients. *Adv Orthop*. 2013;2013:536128. doi:10.1155/2013/536128.
101. Sachs D., Capobianco R. One year successful outcomes for novel sacroiliac joint arthrodesis system. *Ann Surg Innov Res*. 2012;6(13):1-4.
102. Sachs D, Capobianco R, Cher D, et al. One-year outcomes after minimally invasive sacroiliac joint fusion with a series of triangular implants: a multicenter, patient-level analysis. *Med Devices Evid Res*. 2014;7:299-304.
103. Sachs D, Kovalsky D, Redmond A, et al. Durable intermediate to long-term outcomes after minimally invasive transiliac sacroiliac joint fusion using triangular titanium implants. *Med Devices Evid Res*. 2016;9:213-222.
104. Sayed D, Amirdelfan K, Hunter C, Raji OR. Posterior intra-articular fixation stabilizes both primary and secondary sacroiliac joints: a cadaveric study and comparison to lateral trans-articular fixation literature. *J Orthop Surg Res*. 2023;18(1):406. doi:10.1186/s13018-023-03886-3.
105. Sayed D, Balter K, Pyles S, Lam CM. A multicenter retrospective analysis of the long-term efficacy and safety of a novel posterior sacroiliac fusion device. *J Pain Res*. 2021;14:3251-3258. doi:10.2147/JPR.S326827.
106. Schmidt GL, Bhandutia AK, Altman DT. Management of sacroiliac joint pain. *J Am Acad Orthop Surg*. 2018;26(17):610-616. doi:10.5435/JAAOS-D-15-00063.
107. Schneider B, Rosati R, Zheng P, McCormick Z. Challenges in diagnosing sacroiliac joint pain: a narrative review. *PMR*. 2019;11(S1):S40-S45. doi:10.1002/pmrj.12175.
108. Schneider BJ, Huynh L, Levin J, Rinkaekan P, Kordi R, Kennedy DJ. Does immediate pain relief after an injection into the sacroiliac joint with anesthetic and corticosteroid predict subsequent pain relief? [published correction appears in *Pain Med*. 2022;23(6):1197. doi:10.1093/pm/pnac026]. *Pain Med*. 2018;19(2):244-251. doi:10.1093/pm/pnx104.
109. Schoell K, Buser Z, Jakoi A, et al. Postoperative complications in patients undergoing minimally invasive sacroiliac fusion. *Spine J*. 2016;16(11):1324-1332. doi:10.1016/j.spinee.2016.06.016.
110. Schofferman J, Reynolds J, Herzog R, Covington E, Dreyfuss P, O'Neill C. Failed back surgery: etiology and diagnostic evaluation. *Spine J*. 2003;3(5):400-403.
111. Schroader JE, Cunningham ME, Ross T, Boachie-Adjei O. Early results of sacro-iliac joint fixation following long fusion in the sacrum in adult spine deformity. *Hosp Spec Surg J*. 2013;10(1):30-35.
112. Schwarzer AC, Aprill CN, Bogduk N. The sacroiliac joint in chronic low back pain. *Spine*. 1995;20(1):31-37.
113. Sembrano JN, Polly DW. How often is low back pain not coming from the back? *Spine*. 2009;34(1):E27-E32.

114. Shamrock AG, Patel A, Alam M, Shamrock KH, Al Maaieh M. The safety profile of percutaneous minimally invasive sacroiliac joint fusion. *Global Spine J*. 2019;9(8):874-880. doi:10.1177/2192568218816981.
115. SI-BONE® Instructions for Use – iFuse Implant System®. Available at: https://assets.si-bone.com/doc/500131-en-Rev-N-English-iFuse-OUS-IFU_AU-NZ-CI.pdf?mtime=20210216093819&focal=none. Accessed May 31, 2024.
116. Smith AG, Capobianco R, Cher D, et al. Open versus minimally invasive sacroiliac joint fusion: a multi-center comparison. *Ann Surg Innov Res*. 2013;7:14.
117. Soriano-Baron H, Lindsey DP, Rodriguez-Martinez N, et al. The effect of implant placement on sacroiliac joint range of motion: posterior vs trans-articular. *Spine*. 2015;40(9): E525-E530.
118. Spain K, Holt T. Surgical revision after sacroiliac joint fixation or fusion. *Int J Spine Surg*. 2017;11(1):5. doi:10.14444/4005.
119. Spiker WR, Lawrence BD, Raich AI, Skelly AC, Brodke DS. Surgical versus injection treatment for injection-confirmed chronic sacroiliac pain. *Evid-Based Spine-Care J*. 2012;3(4): 41-53.
120. Stuge B, Laerum E, Kirkesola G, Volestad N. The efficacy of a treatment program focusing on specific stabilizing exercises for pelvic girdle pain after pregnancy: a randomized controlled trial. *Spine*. 2004;29(4):351-359.
121. Stureson B, Kools D, Pflugmacher R, Gasbarrini A, Prestamburgo D, Dengler J. Six-month outcomes from a randomized controlled trial of minimally invasive SI joint fusion with triangular titanium implants vs. conservative management. *Eur Spine J*. 2017;26(3):708-719.
122. Szadek KM, Hoogland PV, Zuurmond WW, de Lange JJ, Perez RS. Nociceptive nerve fibers in the sacroiliac joint in humans. *Reg Anesth Pain Med*. 2008;33(1):36-43.
123. Szadek KM, van der Wurff P, van Tulder MW, Zuurmond WW, Perez RSGM. Diagnostic validity of criteria for sacroiliac joint pain: a systematic review. *J Pain*. 2009;10(4):354-368.
124. Telli H, Telli S, Topal M. The validity and reliability of provocation tests in the diagnosis of sacroiliac joint dysfunction. *Pain Physician*. 2018;21(4):E367-E376.
125. Thawrani DP, Agabegi SS, Asghar F. Diagnosing sacroiliac joint pain. *J Am Acad Orthop Surg*. 2019;27(3):85-93. doi:10.5435/JAAOS-D-17-00132.
126. Thayer LS, Tiffany EM, Carreira DS. Addressing smoking in musculoskeletal specialty care. *J Bone Joint Surg Am*. 2021;103(22):2145-2152. doi:10.2106/jbjs.21.00108.
127. Vanaclocha V, Herrera JM, Siz-Sapena N, Rivera-Paz M, Verdu-Lopez F. Minimally invasive sacroiliac joint fusion, radiofrequency denervation, and conservative management for sacroiliac joint pain: 6-year comparative case series. *Neurosurgery*. 2018;82(1):48-55. doi:10.1093/neuros/nyx185.
128. Vanaclocha VV, Verdu-Lopez F, Sanchez-Pardo M, et al. Minimally invasive sacroiliac joint arthrodesis: experience in a prospective series with 24 patients. *J Spine*. 2014;3(5).
129. Waisbrod H, Krainick JU, Gerbershagen HU. Sacroiliac joint arthrodesis for chronic lower back pain. *Arch Orthop Trauma Surg Arch*. 1987;106(4):238-240.
130. Whang PG, Cher D, Polly D, et al. Sacroiliac joint fusion using triangular titanium implants vs non-surgical management: six-month outcomes from a prospective randomized controlled trial. *Int J Spine Surg*. 2015;9:6. doi:10.14444/2006.
131. Whang PG, Darr E, Meyer SC, et al. Long-term prospective clinical and radiographic outcomes after minimally invasive lateral transiliac sacroiliac joint fusion using triangular titanium implants. *Med Devices (Auckl)*. 2019;12:411-422. doi:10.2147/mder.s219862.
132. Wise CL, Dall BE. Minimally invasive sacroiliac arthrodesis: outcomes of a new technique. *J Spinal Disord Tech*. 2008;21(8):579-584.
133. Yang AJ, McCormick ZL, Zheng PZ, Schneider BJ. Radiofrequency ablation for the posterior sacroiliac joint complex pain: a narrative review. *PMR*. 2019;11(Suppl 1):S105–S113. doi:10.1002/pmrj.12200.
134. Yson SC, Sembrano JN, Polly DW Jr. Sacroiliac joint fusion: approaches and recent outcomes. *PMR*. 2019;11(Suppl 1):S114–S117. doi:10.1002/pmrj.12198.
135. Yoshihara H. Sacroiliac joint pain after lumbar/lumbosacral fusion: current knowledge. *Eur Spine J*. 2012;21(9):1788-1796.
136. Zaidi HA, Montoure AJ, Dickman CA. Surgical and clinical efficacy of sacroiliac joint fusion: a systematic review of the literature. *J Neurosurg Spine*. 2015;23(1):59-66. doi:10.3171/2014.10.SPINE14516.

137. Zhang HY, Thongtrangan I, Balabhadra RS, Murovic JA, Kim DH. Surgical techniques for total sacrectomy and spinopelvic reconstruction. *Neurosurg Focus*. 2003;15(2):E5. doi:10.3171/foc.2003.15.2.5.
138. Zheng P, Schneider BJ, Yang A, McCormick ZL. Image-guided sacroiliac joint injections: an evidence-based review of best practices and clinical outcomes. *PMR*. 2019;11(Suppl 11):S98–S104. doi:10.1002/pmrj.12191.