Sacroiliac Joint Bipolar Radiofrequency Ablation (RFA)

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Abstract

The sacroiliac (SI) joints are large bilateral synovial-fibrous joints located between the articular surfaces of the sacrum and ilium. The role of the SI joint is to provide stability to and absorb forces from the spine and lower extremities. SI joint dysfunction is often seen with conditions that asymmetrically load the hip such as limb length discrepancy and arthritis, with pregnancy, or simply with age related degeneration. Pain presents as low back pain that can radiate to the buttock and thigh.

The SI joint capsule is supported by the interosseous sacroiliac ligament as well as several muscles including the gluteus maximus, gluteus medius, erector spinae, biceps femoris, piriformis, transversus abdominus, and thoracolumbar fascia, making it a highly stable but poorly mobile joint. The SI joint is thought to be primarily innervated by some combination of L4–S3 and the superior gluteal nerve (Cox and Fortin, Pain Physician 17(5):459–464, 2014; Roberts et al., Reg Anesth Pain Med 39(6):456–464, 2014).

SI joint injections are indicated to diagnose pain originating from the SI joint as well as treat SI joint pain refractory to conservative treatment with oral anti-inflammatories or physical therapy. Typically, a diagnostic injection is performed if three or more provocative tests (such as FABER, pelvic compression, or Gaenslen's tests) are positive (Newman and Soto, Am Fam Physician 105(3):239–245, 2022).

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After a positive diagnosis of SI joint pain, a SI joint radiofrequency ablation (RFA) can provide long-lasting pain relief. This minimally invasive procedure interrupts nociceptive pain signals from the L5 dorsal ramus and the lateral branches of the S1, S2, and S3 nerve roots (Pastrak et al., Curr Pain Headache Rep 26(11):855–862, 2022). Techniques include conventional RFA, cooled RFA, bipolar RFA, pulsed radiofrequency denervation, and intra-articular pulsed radiofrequency.

Keys to Procedure

- Recognizing appropriate patient selection for procedure.
- Correctly identifying anatomical structures under fluoroscopy.
- Safely administering radiofrequency ablation technique after appropriate testing.

Anatomy Pearls

See Image 12.1.

- This procedure is also known as an ablation of the L5 dorsal rami and lateral branches of S1, S2, and S3 nerve roots.
- At the joint space connecting the sacrum to the iliacus is the sacroiliac joint that contains an interosseous sacroiliac ligament.
- Just medial to the joint are the L5 dorsal rami and S1, S2, and S3 lateral branches exiting from the lumbosacral foramen and traveling to the joint space laterally. The goal will be to ablate the small lateral branches of the nerve roots as they travel over the ligament.
- For this procedure, you will place four RFA probes along a path that separates the sacral foramen (where the nerves exit) and the sacroiliac joint in order to ablate the lateral nerve roots responsible for eliciting sacroiliac joint pain.

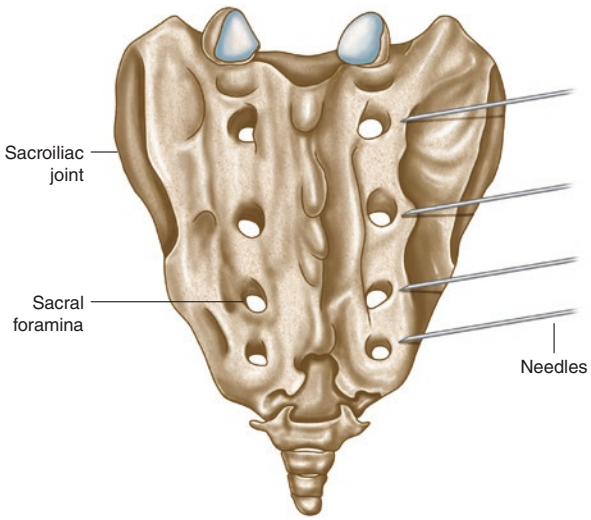

Image 12.1 Schematic of approximate target RFA cannula positions in relationship to foramen

What You Will Need

- Sterile towels.
- Half sheet drape.
- Chlorhexidine-based soap.
- RFA Generator that displays impedance, voltage, amperage, and temperature.
- Electrode grounding pad (connected to RFA Generator).
- RFA cannula with stylet × 4.
- Lidocaine 1% for skin—5 mL.
- Lidocaine 2%—3 mL.
- 25G 1.5″ needle for skin local.
- 18G 1.5″ needle to draw up medications.
- 5 mL syringe with 25G 1.5″ needle for skin local.
- 3 mL syringe for Lidocaine 2%.

Patient Positioning

- Prone with a pillow under the pelvis to help with anatomic visualization.

How to Perform the Procedure

1. Sterilely prep and drape the area with sterile towels.
2. Obtain a true AP view of the pelvis to visualize the targeted sacroiliac joint.
3. To obtain the best image of the posterior SI joint, tilt the C-arm 10–15° cephalad to elongate the posterior plane of the joint and oblique the C-arm 10–20° contralateral to optimize the inferior region of the joint.
   (a) The sacral foramen (S1, S2, S3, S4) should be visible just medial to the sacroiliac joint space.
   (b) The target for the needle is along the path between the sacral foraminal openings and the sacroiliac joint, overlying the lateral branches (Image 12.1).
4. Start at the: superior aspect of the joint space and identify the L5 dorsal ramus at the sacral ala.

5. Anesthetize the skin with Lidocaine 1% and insert the RFA cannula with stylet coaxial to the fluoroscopic beam to the sacral ala until bone is contacted.
6. Repeat Step 5 with targets for the RFA cannulas with stylets 7–10 mm lateral to the S1, S2, and S3 neural foramen.
7. Obtain a lateral view of the RFA cannulas to confirm the position and verify the cannula has not slipped into the foramen.
8. Assess impedance and perform sensory stimulation (if desired) at each level.
   (a) The patient should feel paresthesia only at the location of RFA cannula with 0.3–0.7 V at 50 Hz.
9. Perform motor stimulation at each level. Ensure no lower extremity muscle contractions are elicited with 1.5–2 V at 2 Hz. Muscle contraction observed distally in the lower extremity indicates the RFA cannula is in close proximity to sacral spinal nerves.

10. Administer 0.5 mL Lidocaine 2% to anesthetize lateral branch nerves prior to bipolar ablation. Ensure no needle movement with needle manipulation for local anesthetic administration prior to proceeding with ablation.
11. Commence bipolar thermal ablation at 80 °C for 90 s between adjacent RFA cannulas at each level.
12. Remove: needles, clean the site, and place an adhesive dressing.

Checkpoints to Mastery

Beginner

- Understand the physics and mechanisms of radiofrequency procedures.
- Understand the set up and safety precautions taken for radiofrequency procedures (grounding pad, machine settings: temperature, time).
- Identify the sacroiliac joint and location where the L5 dorsal rami lies.

Intermediate

- Identify the S1, S2, and S3 foramina under fluoroscopic guidance.
- Understand and perform correct needle placement and testing.

Advanced

- Commence with radiofrequency procedure ensuring patient safety.
- Recognize and manage complications of radiofrequency use.

Pearls and Pitfalls

- Consider always performing the diagnostic test in the same manner as the radiofrequency procedure prior to radiofrequency patient selection.
- It is safest to provide local analgesia for the procedure or mild sedation to allow for patient feedback to ensure no injury to a nerve or dorsal ramus occurs.
- Impedance levels will typically decrease following administration of local anesthetic (goal less than 400–500 ohms).
- Pause the ablation if pain to the patient is either not tolerable or radiating down the leg and verify the location of probes.

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