Cervical Medial Branch Radiofrequency Ablation (TON, C3, C4, C5)

3

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Abstract

Cervical facet (zygapophyseal) joints are the only synovial joints in the spine and create the posterolateral articulation between vertebra. Facet joints are formed by the articulation of the inferior articular process of cervical vertebra with the superior articular process of the below vertebra. Each joint is innervated by articular branches derived from medial branches of the cervical dorsal rami. The medial branches run in a groove between the superior articular and transverse processes of each vertebra and innervate the interspinous muscle/ligaments, periosteum, and the multifidus muscle (Bogduk, Spine (Phila Pa 1976) 8(3):286–293, 1983). Of note, each facet joint below C2-C3 is dually innervated from the medial branch above and below. Additionally, a deep medial branch supplies the C3-C4 facet joint and a superficial medial branch of C3 known as the third occipital nerve (TON) supplies the C2-C3 facet joint.

Cervical medial branch blocks are indicated for axial neck pain that is refractory to conservative treatment with evidence suggesting facet joint involvement. Typically, two diagnostic blocks are performed on different days to ensure correct diagnosis of facet joint pain (Sehgal et al., Pain Physician 8(2):211–224, 2005). The patient can then be treated with radiofrequency ablation. TON neurectomy is an effective treatment for headache that has been identified to originate from the C2-C3 facet joint (Hamer and Purath, Headache 54(3):500–510, 2014).

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Keys to Procedure

- Understand positioning to optimize "opening" of facet joints.
- Be able to target the lateral groove or "waist" of the articular pillar.
- Ensure needle and lesions are parallel to the length of the medial branch.
- Be able to reposition the needle if complications arise.

See Images 3.1 and 3.2.

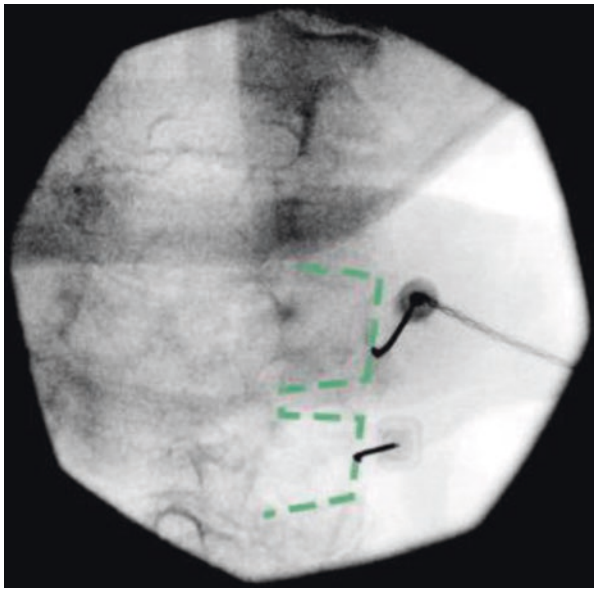

Image 3.1 AP view of final RFA needle positions. Highlighted shows the C4 articular pillar with needles adjacent

Image 3.2 Lateral view of the final RFA needle positions at C3, C4, and C5

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 ×3
- 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%
- Consider injecting Bupivacaine 0.25% (1 mL) + dexamethasone 10 mg split between three levels after RFA with 3 mL syringe.

Patient Positioning

- Procedure typically performed in supine or prone positions, generally not lateral.
- Supine approach:

  - Patient is placed in supine with the head in a neutral position and a true lateral view is obtained to locate the anatomic landmarks for a lateral approach to the lateral masses of the facets.
- Posterior approach:
  - Typically preferred for cervical medial branch blocks and radiofrequency ablations.
  - Patient is placed prone with a small headrest under the forehead to allow for airflow between the table and the patient's nose and mouth.

How to Perform the Procedure

Prone Position

1. Place the patient in prone position and confirm laterality and procedure.
2. Sterilely prep and drape the target area.
3. Tilt the C-arm image intensifier caudally until the facet joints "open" for the targeted segment; typically, 25–35° caudally from the axial plane.

4. Oblique the C-arm image intensifier up to 30° towards the symptomatic side (e.g., left C3 lateral mass).
5. The target of the electrode-tip is the lateral groove or "waist" of the articular pillar.
6. After identifying the initial target, anesthetize the skin with lidocaine 1%.

7. Insert the RFA cannula coaxial to the C-arm beam in a lateral to medial fashion.
   - Use AP and lateral views while advancing needle to ensure needle placement is not too ventral or dorsal.
8. After contacting bone at the appropriate aspect of the "waist," adjust needle to ensure electrode positioning parallel to the target medial branch nerve and be able to cover the maximal accessible portion of the medial branch nerve at that level.
9. Steps 6–10 are repeated at the "waist" of subsequent articular pillars for needle placement at their respective levels.
10. After appropriate needle placement at the respective levels, remove the stylet and insert the thermal unit into the RFA cannula (Images 3.1 and 3.2).
11. Assess impedance and perform sensory stimulation.
    - Patient should feel paresthesia in their neck with 0.3–0.7 V at 50 Hz.

12. Perform motor stimulation ensuring there is no upper extremity muscle contractions elicited with 1.5–2 V at 2 Hz.
13. Repeat sensory and motor stimulation for each subsequent level.
14. Administer Lidocaine 2% to anesthetize medial branch nerve prior to ablation.
15. Commence thermal ablation at 80 °C for 90 s at each level.
16. Remove needles, clean site, and place adhesive dressing at the end of the procedure.

Pitt Pain Pearls and Pitfalls:

- For radiofrequency lesioning, the needle is placed parallel to the nerves (rather than perpendicular in the diagnostic block).
- The goal is to make lesions parallel to the entire accessible length of the medial branch as it winds its way around the curved articular pillar compared to diagnostic MBB injection where the injectate is placed at the center of articular pillar.
- Prior to ablation, ensure no needle movement with needle manipulation for local anesthetic administration.
- Impedance levels will typically decrease following administration of local anesthetic (goal less than 400–500 Ω).
- During thermal ablation, the initial 10–20 s are typically most painful as probe heats up. If pain is not tolerable, pause ablation and verify location of probes.

References

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Further Reading

Atlas of image-guided intervention. 2nd ed. Rathmell.
Atlas of image-guided spinal procedures. 2nd ed. Furman.
Images from UPMC Division of Pain Medicine.
SIS practice guidelines for spinal diagnostic and treatment procedures. 2nd ed. Bogduk.