Radiofrequency Denervation of the Cervical and Lumbar Spine

Jessica Arias Garau, MD*

KEYWORDS

• Radiofrequency • Facet • Cervical • Lumbar • Medial branch • Third occipital nerve

KEY POINTS

- Facet joint nerve blocks help in the diagnosis of facet-related pain and are used to determine if patients are candidates for radiofrequency denervation.
- Radiofrequency denervation is a treatment modality that produces an electric current to coagulate and interrupt nerve transmission.
- Radiofrequency denervation can provide significant improvement in cervical and lumbar facet joint pain.

Facet or zygapophysial joint pain is a common cause of chronic neck and back pain in the population.[1] The prevalence of chronic neck pain in adults is approximately 15%.[2] A systematic review by Meucci and colleagues[3] demonstrated that the prevalence of chronic low back pain increases with age, particularly after 30 years of age, and is commonly seen in women. Facet joint pain occurs as a result of aging and degeneration. Degeneration causes dehydration of the discs, which results in decreased disc height, increased vertebral mobility, and increased shear forces on the facet joints.[4,5] Facetogenic pain is typically provoked on extension of the spine and may present clinically with axial, nonradicular pain affecting the cervical, thoracic, or lumbosacral spine. In 1941, Badgley[5] suggested that the facet joints could be primary sources of pain, independent of pain produced by spinal nerve compression. Multiple mechanisms have been proposed to explain facetogenic pain. Among these are stretching of the capsule around the facet joint, release of inflammatory mediators, synovial villi entrapment between articular surfaces, and nerve impingement by osteophytes.[6]

Facet joint pain is tested by performing a series of diagnostic blocks, which consist of injecting or bathing the facet joint nerve (medial branches) with local anesthetic.

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Advanced Orthopedics and Sports Medicine Institute, Pond View Professional Park, 301 Professional View Drive, Building 300, Freehold, NJ 07728, USA
* 2 Chelsea Avenue, Apartment 202, Long Branch, NJ 07740.
E-mail address: sinq09@yahoo.com

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A positive test increases the likelihood that the facet joints are a primary source of pain and might enable the selection of patients who might respond to radiofrequency neurotomy. A negative test will exclude them as pain generators.[5,7–9] Once the pain source has been determined, radiofrequency denervation or neurotomy can be performed.

Studies have shown that performing medial branch blocks is the most reliable and appropriate way to diagnose facet-related pain.[10] There is still controversy in regard to what is the standard diagnostic protocol to select patients for radiofrequency denervation. How many blocks should be performed and what is the ideal cutoff (in terms of numeric scale for percent relief) to label a block as positive are some of the questions that still need to be further established with more certainty. According to Holtz and Sehgal,[1] radiofrequency denervation showed improvement in pain and disability scores, but no correlation was found between the response to diagnostic medial branch blocks and pain relief after radiofrequency neurotomy. This study suggests that the criteria for the number of blocks needed in order to select patients for this modality of treatment is still unclear.

In general, patients receiving greater than 50% relief after a diagnostic block have a better outcome, in terms of pain relief, with radiofrequency ablation than those with less than 50%. Previous studies have shown no significant difference in terms of radiofrequency denervation outcomes between the 50% and 80% cutoff values. Local anesthetic blocks providing greater than 80% relief increase the number of true positives and screen out the false negatives and the patients who have multiple pain generators.[1,11–13] A systematic review by Manchikanti and colleagues[10] showed that the prevalence of the accuracy and reliability of diagnostic facet medial branch blocks in the low back was 27% to 41% with a false-positive rate of 25% to 44% and the prevalence for the cervical spine was 36% to 67% with a false-positive rate of 27% to 63%. The study also concluded that diagnosing facet joint pain with diagnostic blocks is reliable and that treatment with therapeutic techniques, such as medial branch blocks, intraarticular facet injections, and radiofrequency ablations, can provide a significant improvement in facet joint pain.[2,10]

EQUIPMENT

- Radiofrequency denervation consists of guiding an insulated needlelike cannula toward the bony landmarks of the target nerve, typically using fluoroscopy. This modality of treatment is thought to produce Wallerian degeneration of the afferent nerve fibers, causing interruption of the nerve's normal function.[14] Radiofrequency denervation has been used for many years in Europe and other countries. Although most studies have shown improvement of zygapophysial joint pain, more published studies are needed in order to better understand its efficacy in the spine.
- The radiofrequency denervation equipment consists of a generator that delivers an alternating current to the body through a dispersion pad (**Fig. 1**). It produces an electric current that alternates at the radiofrequency of radio waves to coagulate and interrupt nerve transmission. The distal tip of a specialized insulated cannula is placed parallel over the target nerve to produce a lesion at maximal length. The lesion is created in the form of an oblate spheroid, and it might extend up to 2 mm away from the active tip.[15,16] An electric field is produced, increasing the temperature of the surrounding tissues and resulting in denervation or Wallerian degeneration of myelinated and unmyelinated nerve fibers.[14] Radiofrequency neurotomy is thought to denature the chemical components of the Aδ