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Abstract

Low back pain is the most common pain syndrome and a global health burden. The etiology in most cases is multifactorial and the facet joints can be a source of low back pain. The facet joint is innervated by the medial branch of the dorsal ramus of the spinal nerve. Facet joint disturbances can be responsible for 10% to 50% of all cases of chronic lumbar pain. In the absence of predictive clinical or radiologic findings, nerve blocks are considered to be the best way of diagnosing presumed facet-mediated pain. Radiofrequency ablation to induce thermal necrosis of the facet neural fibers has been reported to provide significant pain reduction in patients for 6–12 months. A radiofrequency neurotomy is a type of injection procedure used to treat facet joint pain caused by arthritis or other degenerative changes, or from an injury. In this procedure, a heat lesion is created on certain nerves with the goal of interrupting the pain signals to the brain, thus eliminating pain. Medial Branch Neurotomy could be considered an option for patients suffering persistent axial and referred non-radicular leg pain unresponsive to less invasive conservative measures.

INTRODUCTION

Low back pain is the most common pain syndrome and a global health burden. The etiology in most cases is multifactorial and the facet joints can be a source of low back pain. As first described by Goldtwaith in 1911 the facet joints can be a source of low back pain *(1).* The facet joint is part of the motion segment and consists of two articular surfaces, which are orientated almost vertically in the lumbar spine. Both the synovial folds and the capsule contain nociceptive nerve endings. The facet joint is innervated by the medial branch of the dorsal ramus of the spinal nerve *(2).* Each facet joint receives nerve endings from two heights. For example the facet joint L4–L5 receives nerve endings from the dorsal ramus from the 4th spinal nerve for the upper parts und from the 5th spinal nerve from the lower parts *(3).* The contribution of facet joints to low back pain is thought to linked to intervertebral disc degeneration in the concept of 'segmental instability'. As with degenerative changes the height of the intervertebral disc lowers there is more stress on the facet joints and the joint capsule with occurring osteoarthritic changes of the facet joint and possible pain generation *(4).* As degenerative changes occur in almost every person, facet joint osteoarthritis can be found in about 90% of all patients older than 50 years, but like in other locations there is little correlation between the extent of osteoarthritic changes and perceived grief *(5).* Between 8% and 12% of all patients with lumbar pain comprise chronic cases, with complaints last-

Figure 1. *Radiofrequency denervation in the operating room under the control of fluoroscopy and with the monitoring of patients.*

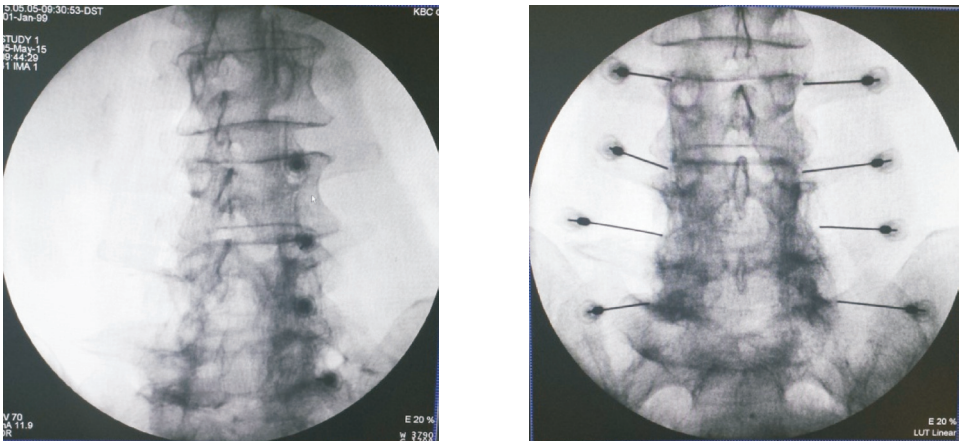
ing longer than three months *(6, 7)*. Facet joint disturbances can be responsible for 10% to 50% of all cases of chronic lumbar pain *(8–11)*. However, clinical history or physical examination cannot identify facet joint alterations as the origin of pain nor does imaging (e.g., radiography, computed tomography or magnetic resonance imaging *(12–20)*. In the absence of predictive clinical or radiologic findings, nerve blocks are considered to be the best way of diagnosing presumed facet-mediated pain *(21–25)*. Diagnostic blocks remain the mainstay in the diagnosis of facet joint syndrome and are used in most studies, even if they are questioned because of their sensitivity and specifity *(26, 27)*. A resolution or improvement of pain after image guided injection of local anesthetics around the joint capsule corresponding to the presumed time of action of the used local anesthetic makes the involvement of the facet joint probably (Figure 1).

In patients with unspecific chronic low back pain and unsuccessful conservative therapy (non steroidal anti-inflammatory drugs, physiotherapy) involvement of the facet joint should be considered and confirmed or ruled out with diagnostic blocks (Figure 2). Controlled diagnostic blocks imply having a patient undergo 2 separate injections, at different times, using anesthetic agents of different durations of action.

A positive response occurs when a threshold of pain relief (usually between 50–80%) is experienced and the duration of relief is consistent with the known duration of the anesthetic. Single diagnostic blocks use only a single injection and anesthetic agent.The only tool to identify facet joint alterations as the cause of pain is the verification of an analgesic response to anesthetic injections into the zygapophyseal joints or at their nerve supplies and medial dorsal branch blocks are easier to perform *(28–30)*. The diagnostic power of the blockade is based on the assumption that anesthetizing the facet joint or the capsule containing the innervations would result in pain relief. A positive result (i.e., pain relief) would mean that the facet joint is the site from which the pain originates. The technique of medial dorsal branch block consists of blocking each of the medial branches that innervate a facet above and a facet below their corresponding roots and also blocking the multifidus and interspinous muscles in the region of the corresponding dermatome *(27, 28)*.

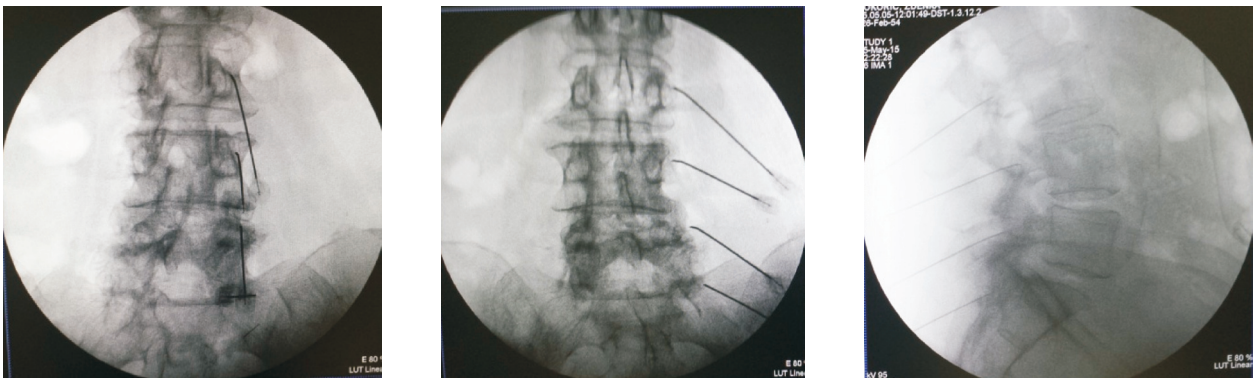
DISCUSSION

Radiofrequency ablation to induce thermal necrosis of the facet neural fibers has been reported to provide significant pain reduction in patients for 6–12 months *(28, 29)*. Radiofrequency facet joint denervation procedures have been common practice for 2 decades in treatment of chronic low back pain. A radiofrequency neurotomy is a type of injection procedure used to treat facet joint pain caused by arthritis or other degenerative changes, or from an injury. In this procedure, a heat lesion is created on certain nerves with the goal of interrupting the pain sig-



A B

Figure 2. **A.** *Oblique radiograph of the lumbar spine during lumbar medial branch block;* **B.** *Anterior-Posterior radiograph of the lumbar spine during lumbar medial branch block.*



A B C

Figure 3. A. *Oblique view demonstrating placement of radiofrequency cannulae after contact with "eye" of Scotty dog and slipped off the superior margin of the transferse processes;* **B.** *Anterior-Posterior radiograph of the lumbar spine during lumbar radiofrequency treatment of the lumbar facet jointsview of placet radiofrequency canulae,* **C.** *Lateral view of placement RF cannulae along the lumbar superior articular processes.*

nals to the brain, thus eliminating pain. The terms radiofrequency ablation and radiofrequency neurotomy are used interchangeably (Figure 3).

Both terms refer to a procedure that destroys the functionality of the nerve using radiofrequency energy. Success rates vary, but typically about 30% to 50% of patients undergoing this procedure for low back pain will experience significant pain relief for as much as two years. Of the remaining low back pain patients, about 50% will get some pain relief for a shorter period. As a general rule, if effective, the ablation will often provide pain relief lasting at least 9 to 14 months and sometimes for longer. After this period of time, however, the nerve will regenerate and the pain may return. Radiofrequency denervation showed efficacy in open as well as in placebo- controlled trials and could be a treatment option in carefully selected patients *(30).* After positive diagnostic blocks, denervation or therapeutic blocks with long acting local anesthetics and corticoids should be tried *(31).* Although medial branch neurotomy may benefit properly selected patients, the relief achieved is rarely complete or permanent. Because of this, treatment decisions are best based upon having a realistic understanding of expected outcomes in relation to a patient's current level of pain and physical function. Candidates for radiofrequency facet denervation should meet all of the following criteria:

• No prior spinal fusion surgery in the vertebral level being treated;

- Low back (lumbosacral) or neck (cervical) pain, suggestive of facet joint origin as evidenced by absence of nerve root compression as documented in the medical record on history, physical and radiographic evaluations; and the pain is not radicular;
- Pain has failed to respond to three months of conservative management which may consist of therapies such as nonsteroidal anti-inflammatory medications, acetaminophen, manipulation, physical therapy, and a home exercise program;
- A trial of controlled diagnostic medial branch blocks (2 separate positive blocks or placebo controlled series of blocks) under fluoroscopic guidance has resulted in at least a 50% reduction in pain; and
- If there has been a prior successful radiofrequency denervation, a minimum time of six months has elapsed since prior radiofrequency treatment (per side, per anatomical level of the spine).

Radiofrequency facet joint denervation is performed as a day procedure. All patients are given intravenous sedation to ensure they are as comfortable as possible throughout the procedure. The doctor performing the procedure will use local anaesthetic to numb patient skin before accurately inserting a needle using x-ray guidance next to the medial branch nerve to the facet joint. The doctor will then check that the needle is properly positioned by stimulating the nerve. This may cause muscle twitching and provoke some of pain. Once the needle is in the correct position, the area will be numbed and radiofrequency energy used to disrupt the medial branch nerve. Several nerves may need to be treated to obtain optimal pain relief. Patient will be monitored for 1–2 hours following the procedure prior to discharge. Full pain relief from the procedure may take several weeks. Most patients are able to return to work within two days following the procedure. Nerves regenerate after radiofrequency facet joint denervation. This usually takes between six months and two years. Dreyfuss et al followed 15 patients showing >80% relief on controlled diagnostic blocks. 13 had relief of >60% at one year, with 9 of these exceeding 90% pain reduction *(22).* Lakemeir et al assessed the 6-month response to medial branch neurotomy in 29 patients after showing a minimum of 50% pain relief to a single diagnostic block. Average pain scale re-

duced from 6.6 to 4.7. Oswestry Index reduced from 40.8 to 28. This study also compared facet denervation to intra-articular steroid injection, finding no statistical difference between the two procedures *(32).* The response to radiofrequency rhizotomy, after having successful comparative nerve blocks, in Goldfeld et al's study of 174 patients showed 119 having good (50%) to excellent (80%) pain relief and 55 showing no improvment. 96% of those with good-excellent responses had relief lasting between 6–24 months with 43% of that cohort showing sustained benefit for 2 years *(38).* Cohen *et al.* followed 262 patients who had a positive controlled diagnostic block with >50% pain relief. Following medial branch neurotomy, 54% had pain relief >50% lasting at least 6 months. There was no difference in response between those reporting >80% relief on confirmatory blocks as compared to those reporting relief of between 50–80% *(33).* A later study of his reinforced this finding, further concluding that the use of more stringent diagnostic criteria (higher pain relief thresholds or double as compared to single blocks) would likely result in withholding a beneficial procedure from a substantial number of patients without a corresponding improvement in success rates. Not all studies have shown favorable results for Medial Branch Neurotomy. One of the largest double blind randomized trials found no difference in pain scores, physical function, or medication use between active intervention and sham groups *(34).* As briefly discussed earlier, even when Medial Branch Neurotomy is successful, relief is rarely complete or permanent. Smuck et al reviewed 16 articles finding that the average duration of >50% pain relief for an initial procedure was 9 months. Repeat Medial Branch Neurotomy carried a success rate between 33–85% with an average duration lasting 11.6 months *(35).* These statistics were similar to an earlier study also showing a 10-month average duration of benefit for both initial and repeat procedures *(36).* In general, a reasonable number of patients with > 50% pain relief on controlled diagnostic blocks (and possibly even a single diagnostic block) could expect to experience similar relief with medial branch neurotomy for an average duration of 6–12 months. Repeat medial branch neurotomy tends to yield similar results. Complication rates with Medial Branch Neurotomy are considered to be low, minor, and in most cases, transient. As with most procedures, there is a remote risk of bleeding, infection, nerve injury or allergic reaction to the medications used. In addition, the injections may cause some temporary soreness in back. However. complications from these techniques may occur. These include discomfort around the injection site, numbness of the skin, neuritis, pain from muscle spasm at injection site, permanent nerve pain and reactions to administered medications *(36).* Kormick et al had performed 2 studies involving a total of 741 denervations. These revealed 5 cases of neuritic pain lasting longer than 2 weeks, 5 cases of muscle soreness lasting less than 2 weeks, one case of prolonged muscle spasm, and no instances of motor deficits, sensory deficits, or infections *(37–39).* In summary, Medial Branch Neurotomy could be considered an option for patients suffering persistent axial and referred non-radicular leg pain unresponsive to less invasive conservative measures.

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