

Focus Article

# The efficacy of conventional radiofrequency denervation in patients with chronic low back pain originating from the facet joints: a meta-analysis of randomized controlled trials

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## Abstract

**BACKGROUND CONTEXT:** Radiofrequency denervation is commonly used for the treatment of chronic facet joint pain that has been refractory to more conservative treatments, although the evidence supporting this treatment has been controversial.

**PURPOSE:** We aimed to elucidate the precise effects of radiofrequency denervation in patients with low back pain originating from the facet joints relative to those obtained using control treatments, with particular attention to consistency in the denervation protocol.

**STUDY DESIGN/SETTING:** A meta-analysis of randomized controlled trials was carried out.

**PATIENT SAMPLE:** Adult patients undergoing radiofrequency denervation or control treatments (sham or epidural block) for facet joint disease of the lumbar spine comprised the patient sample.

**OUTCOME MEASURES:** Visual analog scale (VAS) pain scores were measured and stratified by response of diagnostic block procedures.

**METHOD:** We searched PubMed, Embase, Web of Science, and the Cochrane Database for randomized controlled trials regarding radiofrequency denervation and control treatments for back pain. Changes in VAS pain scores of the radiofrequency group were compared with those of the control group as well as the minimal clinically important difference (MCID) for back pain VAS. Meta-regression model was developed to evaluate the effect of radiofrequency treatment according to responses of diagnostic block while controlling for other variables. We then calculated mean differences and 95% confidence intervals (CIs) using random-effects models.

**RESULTS:** We included data from seven trials involving 454 patients who had undergone radiofrequency denervation (231 patients) and control treatments such as sham or epidural block procedures (223 patients). The radiofrequency group exhibited significantly greater improvements in back pain score when compared with the control group for 1-year follow-up. Although the average improvement in VAS scores exceeded the MCID, the lower limit of the 95% CI encompassed the MCID. A subgroup of patients who responded very well to diagnostic block procedures demonstrated significant improvements in back

FDA device/drug status. Not applicable.

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pain relative to the control group at all times. When placed into our meta-regression model, the response to diagnostic block procedure was responsible for a statistically significant portion of treatment effect. Studies published over the last two decades revealed that radiofrequency denervation reduced back pain significantly in patients with facet joint disease compared with the MCID and control treatments. **CONCLUSIONS:** Conventional radiofrequency denervation resulted in significant reductions in low back pain originating from the facet joints in patients showing the best response to diagnostic block over the first 12 months when compared with sham procedures or epidural nerve blocks. © 2017 Elsevier Inc. All rights reserved.

*Keywords:*

Back pain; Denervation; Facet joint; Medial branch; Radiofrequency; Rhizotomy; Zygapophyseal joint

## Introduction

Low back pain can originate from the lumbar facet joints, the sacroiliac joint, the intervertebral discs, and the coccyx [1]. Lumbar zygapophyseal (facet) joint arthropathy is a known source of spine pain, with prevalence rates between 15% and 45% in patients who experience low back pain [2–4]. Each facet joint is innervated by two medial branches of the primary dorsal rami of the spinal nerves [5]. Standard treatment modalities for lumbar zygapophyseal joint pain include intra-articular steroid injections and radiofrequency denervation of the medial branches innervating the joints [3].

Radiofrequency procedures, first introduced in 1975 [6], involve the application of current from an active electrode to a dispersive ground plate. The body's tissue completes the circuit, creating an electrical field. This electrical field and the resulting ionic motion lead to the dissipation of frictional heat in the local tissue [7]. Radiofrequency denervation (“rhizotomy”) is commonly used for the treatment of chronic facet joint pain that has been refractory to other conservative treatments, and may be performed for more sustained relief, but the evidence supporting both of these uses is conflicting [3,5,8].

Some investigators have contended that there is strong evidence for long-term pain relief following radiofrequency denervation [9]. Two systematic review and meta-analyses concluded that facet joint radiofrequency denervation may be more effective for pain control than corticosteroid injections [10,11]. However, other investigators have objected to the conclusion of this meta-analysis, arguing that only one of the included studies actually showed the superiority of radiofrequency denervation, and this superiority was based on a non-validated outcome assessment instrument [12]. Other investigators have addressed that their study results have been widely referenced and often used to substantiate the claim that lumbar radiofrequency facet denervation procedures are ineffective [13]. Moreover, in one study, the authors failed to establish the facet joint as the generator of low back pain, which may have been responsible for the low success rates observed [14]. Because of such contradictory results, the efficacy of radiofrequency denervation of facet joint nerves in managing chronic low back pain remains controversial.

There are three prerequisites to determining whether radiofrequency denervation is effective in the treatment of

lumbar facet joint pain. First, the structure responsible for the generation of the pain at or near the articular facets joints must be identified [15]. Second, the electrode tip must be located at the precise location and section of the nerve supplying the joint [15]. Third, the denervation protocol must be well-documented and consistent, and the patients who have undergone the procedure must be carefully selected.

We therefore sought to evaluate more precisely the effects of radiofrequency denervation compared with sham procedures or epidural steroid injections on low back pain in patients with facet joint disease, placing emphasis on the use of a consistent denervation protocol.

## Materials and methods

### *Search strategy and selection criteria*

We undertook a systematic review and meta-analysis of relevant randomized controlled trials regarding radiofrequency denervation and control treatments for patients with low back pain originating from the facet joints. Analyses were stratified in accordance with important differences in trial characteristics in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. We searched PubMed, Embase, Web of Science, and the Cochrane Database for randomized controlled trials from inception to October 12, 2016, using the following search terms: “radiofrequency”, “lumbar”, together with “facet” or “zygapophyseal.” In addition, the reference lists of searched papers were screened for eligible studies. We excluded experiments and case reports and used only the largest study when there were overlapping study populations. There were no language restrictions on study eligibility.

Trials were included if they enrolled individuals with low back pain suspected to originate from the facet joints, and if such patients had been randomly assigned to treatment with either radiofrequency denervation (using conventional methods and well-documented protocols) or control treatments such as sham procedures or epidural steroid injections with or without the use of local anesthetic drugs. Trials in which specific endpoints were not reported were excluded only from the pooled analyses of the specific endpoints. For trials in which there were three or more arms, the relevant pairwise comparisons were assessed separately.

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