

Factors Predicting Success and Failure for Cervical Facet Radiofrequency Denervation: A Multi-Center Analysis

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Background and Objectives: The concept of radiofrequency denervation has recently come under question in light of several studies showing minimal to no benefit. One possibility proposed for these negative outcomes is poor selection criteria. Unlike virtually all other spine interventions, the factors associated with success and failure for cervical facet denervation have yet to be determined. The purpose of this study is to determine which demographic, clinical and treatment factors are associated with cervical facet radiofrequency denervation outcomes.

Methods: Data were garnered from 3 academic medical centers on 92 patients with chronic neck pain who underwent radiofrequency denervation after a positive response to diagnostic local anesthetic blocks. Success was defined as at least 50% pain relief lasting at least 6 months. Variables evaluated for their association with outcome included age, sex, duration of pain, opioid use, pain referral pattern, paraspinal tenderness, pain exacerbated by extension/rotation, magnetic resonance image abnormalities, diabetes, smoking, scoliosis, obesity, prior surgery, and levels treated.

Results: The only clinical variable associated with success was paraspinal tenderness. Factors associated with treatment failure included radiation to the head, opioid use, and pain exacerbated by neck extension and/or rotation.

Conclusions: Selecting patients based on key clinical variables may increase the chance of treatment success for cervical facet radiofrequency denervation. *Reg Anesth Pain Med* 2007;32:495-503.

Key Words: Cervical facet joint, Medial branch block, Neck pain, Predictive value, Radiofrequency, Zygapophyseal joint.

Chronic neck pain is an under-appreciated yet disabling condition, with cross-sectional prevalence rates ranging between 10% and 24%.¹⁻³ Among the roughly 13% of the population who go on to develop chronic neck pain,⁴ the cervical zygapophyseal joints (z-joints) have been postulated to account for between 50% to 60% of cases based on diagnostic, controlled blocks.⁵⁻⁷ Two factors that may account for the high incidence of cervical z-joint pain in chronic neck pain sufferers are the higher density of mechanoreceptors in cervical

compared with lumbar facet joints,⁸ and their susceptibility to injury during trauma. In a review by Bogduk and Yoganandan, the authors concluded that instead of the articular processes of the cervical z-joints gliding across one another, the inferior articular processes of the moving vertebrae chisel into the superior articular processes of their supporting vertebrae during whiplash-type injuries.⁹

Compounding the high physical and financial toll cervical z-joint pain exacts on society is its refractoriness to treatment.^{10,11} In a systematic review on

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the effectiveness of conservative treatment for neck pain, Hoving et al.¹¹ found a paucity of evidence supporting any single noninterventive treatment. At the turn of the millennium, the contention that radiofrequency (RF) denervation of the medial branches innervating the cervical facet joints provided intermediate to long-term pain relief went largely uncontested, supported by 1 controlled trial, several meta-analyses, and extrapolated evidence from studies evaluating lumbar facet RF lesioning.¹²⁻¹⁵ Yet in the past 6 years, the assertion that cervical facet RF denervation is an effective treatment for neck pain and cervicogenic headaches has been challenged by 3 consecutive randomized studies showing minimal to no benefit for facet joint denervation, including 1 study assessing cervical medial branch lesioning.¹⁶⁻¹⁸ There are several possible explanations for this discrepancy, with 2 of the more likely ones being methodological flaws in the earlier studies, and the failure of later studies to identify appropriate candidates for RF denervation. Facet joint interventions comprise the second most common type of procedures performed in pain clinics across the U.S.¹⁹ Considering the cost and frequency of these interventions, it is surprising that the factors that predispose patients to treatment success with cervical facet denervation have not been elucidated. In a recent study by Cohen et al.,²⁰ the authors found the only variable associated with successful lumbar facet RF denervation was paraspinal tenderness. Factors that correlated with treatment failure were “facet loading,” duration of pain, and prior back surgery. Similar analyses have been done for other frequently performed spinal interventions including epidural steroid injections, spine surgery, and intradiskal electrothermal therapy.²¹⁻²⁵ The purpose of this study is to identify which demographic and clinical variables are associated with outcome after cervical z-joint RF denervation.

Methods

After permission to conduct this retrospective study was granted from the internal review boards at Johns Hopkins Medical Institutions (JHMI), Beth Israel Deaconess Medical Center (BIDMC), and Walter Reed Army Medical Center (WRAMC), the charts of 103 patients who underwent cervical facet RF denervation between 2003 and 2006 were examined for inclusion. Eleven patients were excluded because of inadequate follow-up, inappropriate selection criteria (e.g., no diagnostic blocks), or ambiguous medical records, leaving 92 patients eligible for data analysis.

Inclusion criteria for RF denervation were age of at least 18 years, chronic neck pain of 3 months

duration or more, absence of focal neurological signs or symptoms, and at least 50% pain relief after diagnostic medial branch blocks (MBB). Excluded from the study were those patients with a specific unrelated etiology for their neck pain (e.g., symptomatic spinal stenosis, herniated disk, etc.), inflammatory arthritis, untreated coagulopathy, or a concomitant medical or psychiatric illness likely to compromise evaluation or treatment.

Diagnostic Medial Branch Blocks

All diagnostic blocks were performed using low volumes of superficial anesthesia without intravenous sedation. The facet levels targeted were chosen based on patient report and examination under fluoroscopy, and referral patterns determined from studies conducted in patients and asymptomatic volunteers.²⁶⁻²⁸ Patients with bilateral pain underwent bilateral blocks, while those with unilateral pain underwent 1-sided blocks. For each putatively symptomatic z-joint, nerves at and above the articular level were anesthetized to account for the dual innervation of each facet joint. For the C2-3 facet joint, the third occipital nerve was targeted.^{14,18,29} All MBB were conducted with 22-gauge spinal needles in accordance with standard practice. For each nerve block, proper needle placement in the center of the articular pillar was confirmed using anteroposterior and lateral fluoroscopic views. After negative aspiration and contrast injection confirmed the absence of vascular uptake, 0.5 mL of 0.5% bupivacaine was injected at each site.

In the recovery area, patients were instructed to engage in their normal daily activities and to maintain a written pain diary every 30 minutes for 6 to 8 hours. To control for the presence of other spinal pathology, at least 50% pain relief during normal activities was used as the criterion for a positive response. All patients who obtained significant pain relief after MBB proceeded to RF denervation at their next visit.

Radiofrequency Denervation

RF denervation was performed with the patient in the prone position using superficial local anesthesia and if necessary, intravenous sedation. With the C-arm positioned to confer a posterior, parasagittal coaxial plane, a 22-gauge, 10-cm electrode with a 5 mm active tip (PMC22-100-5, Baylis Medical, Montreal, Quebec, Canada; JHMI and WRAMC) or a 22-gauge, 10-cm curved electrode with a 10-mm active tip (Radionics, Burlington, MA; BIDMC) was inserted parallel to the facet joints until it contacted the articular pillar several millimeters proximal to the foraminal opening. The

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