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.

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

Chronic neck pain is an under-appreciated yet disabling condition, with cross-sectional prevalence rates ranging between 10% and 24%. Among the roughly 13% of the population who go on to develop chronic neck pain, the cervical zygapophyseal joints (z-joints) have been postulated to account for between 50% to 60% of cases based on diagnostic, controlled blocks. 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, 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.

Compounding the high physical and financial toll cervical z-joint pain exacts on society is its refractoriness to treatment. In a systematic review on
the effectiveness of conservative treatment for neck pain, Hoving et al.\textsuperscript{11} found a paucity of evidence supporting any single noninterventional 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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.,\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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
electrode was then carefully redirected until it just slipped past the lateral margin of the articular pillar. For each procedure, correct positioning was confirmed using antero-posterior and lateral fluoroscopic imaging. Proper placement on or proximate to the nerve was confirmed using electrostimulation at 50 Hz, with concordant sensation achieved at 0.5 V or less. Prior to lesioning, the absence of distal muscle contractions was verified at either 2 V or 3 times the stimulation threshold, after which 0.5 mL of lidocaine 1% was injected through each cannula to reduce thermal pain. The RF probe was then reinserted and a 90 second, 80° C lesion was made using an RF generator (PMG-115-TD, V2.0A, Baylis Medical, Montreal, Canada; Electrothermal 20S Spine System, Smith and Nephew, Andover, MA; or Radionics RF Lesion Generator System, Model RFG-3C, Radionics, Valleylab, Boulder, CO). For the third occipital nerve, needles were inserted along a slightly oblique plane at a caudocranial angle until bone was contacted at or just below the C2-3 z-joint, after which they were advanced anteriorly until the tip was at or near the ventral edge of the C3 articular process. Depending on the sensory stimulation threshold and physician, either 2 (WRAMC and JHMI) or 3 (BIDMC and JHMI) lesions were made in parallel planes after needle redirection.

Outcome Measures and Statistical Analysis

The primary outcome measure was pain reduction, measured using a modified 0 to 10 visual analog scale (VAS) or numerical pain scores. For all subjects, a positive outcome was defined as at least 50% average pain reduction persisting at least 6 months postprocedure, coupled with satisfaction regarding the treatment result.

In addition to the aforementioned outcome measures, other demographic and clinical variables recorded for analysis were age, sex, duration of pain, opioid usage, percent pain relief from the diagnostic block, pain referral pattern, presence of paraspinal tenderness (pain overlying the facet joints with an estimated 4 kg of applied force), presence of pain worsened by neck extension and/or rotation, magnetic resonance image (MRI) evidence of facet joint degeneration (diagnosed by pain physician or radiology report), smoking history, trauma history, presence of diabetes, obesity (defined as body mass index >30), previous neck surgery, laterality, and number of levels treated.

Statistical analyses were performed using STATA version 9.2 (Statacorp, College Station, TX) as in previous studies. The distribution of categorical variables in each group was compared using Pearson’s χ². Continuous variables were compared with analysis of variance. Categorical data are reported both by number of patients and percentage. Continuous data are reported as mean and standard deviation unless otherwise indicated. A P value < .05 was considered statistically significant. Bonferroni correction was used for posthoc analysis. Data were combined across institutions. Regression analysis was used to quantify the association between the many possible predictive variables and clinical outcome. Because the outcome variable was binary (either positive or negative), a logistic statistical model was chosen. Un adjusted univariate analyses were performed, followed by multivariate logistic regression. Those variables with P < .05 in univariate analysis were included in multivariate logistic regression.

Results

Data were analyzed on 92 patients. Morphometric, demographic, and clinical characteristics were similar among the 3 treatment centers except that there was a lower percentage of female patients treated at BIDMC; a higher percentage of patients who had previous neck surgery and fewer levels treated at JHMI; and a higher percentage of patients with pain radiating below their elbow at WRAMC (Table 1). There was no statistically significant difference found for either univariate or multivariate analyses with regard to treatment outcome between study centers; therefore, all data were combined. Age, sex, and the institution at which patients were treated were not associated with outcome in either univariate analysis, or when all covariates were controlled for using multivariate logistic regression (Tables 2 and 3). Patients at JHMI, WRAMC, and BIDMC had success rates of 57%, 61%, and 53%, respectively. The mean age of those with a successful outcome was 54.6 years (SD 13.2, range 32-86) versus 53.9 (SD 13.1, range 28-82) in those with a negative outcome. Fifty percent of males and 62% of females had a successful outcome. The presence of obesity, diabetes, smoking, or trauma history did not influence patient outcomes.

Pain referral pattern was unrelated to procedure success in univariate analysis. Neck pain radiating to the shoulder or upper arm was the most commonly observed presentation, with outcomes being proportionately distributed between success (n = 28; 53.8%) and failure (n = 25; 62.5%). However, pain extending to the occiput was found to predict treatment outcome. In both univariate and multivariate analysis, the presence of headache was associated with RF treatment failure (Tables 2 and 3). Only 21% (n = 11) of patients who had symptoms...
extending to their head experienced a positive outcome compared with 52.5% (n/H11005/21) who reported poor pain relief following RF denervation. No significant association was found between duration of pain and treatment outcome. The mean duration of those who failed treatment was 81.5 months (SD 65, range 12-300) versus 75.3 (SD 68.7, range 12-324) in patients reporting a positive outcome (P/H11005/.66).

A substantial number of patients underwent previous treatments including opioid therapy and surgery. Opioid usage was found to predict outcome failure with univariate analysis, but when confounding variables were controlled for by multivariate regression analysis, this association was no longer statistically significant (P/H11005/.13). Forty-two percent of patients who were using opioids had a positive treatment outcome versus 58% who reported negative results. Additionally, previous surgery did not predict outcome. Those patients who underwent prior neck surgery were no more likely to fail treatment than patients without previous surgery (P/H11005/.78).

Significant correlations with treatment outcome were found for 1 of 4 physical exams and diagnostic findings. Although pain worsened by neck extension and rotation (i.e., “facet loading”) was found to predict failure using univariate analysis, when other variables were controlled for the association only approached significance (P/H11005/.09). Fifty-three percent of patients with pain aggravated by extension and/or rotation experienced a positive outcome versus 47% without this physical sign. However, another common physical sign, paraspinal tenderness, was highly predictive of a successful outcome. Sixty-seven percent of patients with paraspinal tenderness experienced a successful outcome, whereas 69% of those without tenderness failed RF denervation.

The presence of facet pathology was noted on cervical MRI in 48% of the patients, but was not predictive of treatment outcome. Sixty-one percent of those with and 53% without MRI evidence of facet pathology had a successful outcome. The degree of relief obtained after diagnostic local anesthetic blocks also failed to predict cervical facet RF denervation outcomes. Fifty-five percent of those who had at least 50% but less than 80% relief from MBB. For the only treatment variable investigated, no relationship was found between the number of levels treated and procedure outcome.

Discussion

Cervical z-joint pain is one of the most common sources of chronic neck pain, affecting upwards of
50% of patients.\textsuperscript{5-7,30} Once considered the “gold standard” for treating facet joint pathology, RF denervation has recently come under question in the guise of a series of controlled studies regarding its efficacy.\textsuperscript{16-18} Whereas this has caused some skeptics to question the concept of RF denervation, given the high success rates reported in scrupulously conducted prospective studies,\textsuperscript{14,29,31,32} an alternative explanation is that improved patient selection criteria are needed.

The cardinal finding in this retrospective study is the strong correlation between paraspinal tenderness and RF treatment success, which supports previous research evaluating predictors of treatment success for lumbar facet denervation.\textsuperscript{20} Whereas numerous investigators have used paraspinal tenderness (n = 53) 28 (53.8%) 28 (52.5%) 50% (n = 54) 30 (58.8%) 24 (61.5%) 80% (n = 36) 21 (41.2%) 15 (38.5%) Obesity (n = 16) 9 (17.3%) 7 (17.5%) .98 Opioid treatment (n = 38) 16 (30.8%) 22 (55%) .02 Trauma (n = 21) 14 (26.9%) 7 (17.5%) .29 Duration of symptoms, mean (SD) 75.3 (68.7) 81.5 (65.0) .66 Facet pathology seen on MRI (n = 44) 27 (51.9%) 17 (43.5%) .43 Facet loading (n = 55) 26 (53.1%) 29 (74.4%) .04 Paraspinal tenderness (n = 66) 44 (84.6%) 22 (55%) .002 Number of levels treated, mean (SD) 3.5 (0.9) 3.4 (0.8) .75 

NOTE. Positive outcome defined as greater than or equal to 50% pain relief 6 months postprocedure. “Facet loading” is defined as pain exacerbated by cervical extension and/or rotation. Data are presented as number (percent) unless otherwise specified. Age, duration of symptoms, and number of levels treated were analyzed with ANOVA. Categorical data were compared with Pearson’s \( \chi^2 \).

Abbreviation: MRI, magnetic resonance image.

Table 2. Patient Characteristics by Outcome

<table>
<thead>
<tr>
<th></th>
<th>Positive Outcome (n = 52)</th>
<th>Negative Outcome (n = 40)</th>
<th>( P ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years, mean (SD)</td>
<td>54.6 (13.2)</td>
<td>53.9 (13.1)</td>
<td>.78</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td>.27</td>
</tr>
<tr>
<td>Male (n = 40)</td>
<td>20 (38.4%)</td>
<td>20 (50%)</td>
<td></td>
</tr>
<tr>
<td>Female (n = 52)</td>
<td>32 (61.6%)</td>
<td>20 (50%)</td>
<td></td>
</tr>
<tr>
<td>Smoking (n = 20)</td>
<td>9 (17.3%)</td>
<td>11 (28.9%)</td>
<td>.19</td>
</tr>
<tr>
<td>Diabetes (n = 9)</td>
<td>6 (11.5%)</td>
<td>3 (7.5%)</td>
<td>.52</td>
</tr>
<tr>
<td>Surgery (n = 29)</td>
<td>17 (32.7%)</td>
<td>12 (30%)</td>
<td>.78</td>
</tr>
<tr>
<td>Radiation pattern</td>
<td></td>
<td></td>
<td>.32</td>
</tr>
<tr>
<td>Neck (n = 28)</td>
<td>19 (36.5%)</td>
<td>9 (22.5%)</td>
<td></td>
</tr>
<tr>
<td>To shoulder (n = 53)</td>
<td>28 (53.8%)</td>
<td>25 (62.5%)</td>
<td></td>
</tr>
<tr>
<td>Below elbow (n = 32)</td>
<td>5 (9.5%)</td>
<td>6 (15%)</td>
<td></td>
</tr>
<tr>
<td>Radiation to occiput (n = 32)</td>
<td>11 (21.1%)</td>
<td>21 (52.5%)</td>
<td>.002</td>
</tr>
<tr>
<td>% Relief from diagnostic block</td>
<td></td>
<td></td>
<td>.79</td>
</tr>
<tr>
<td>50% (n = 54)</td>
<td>30 (58.8%)</td>
<td>24 (61.5%)</td>
<td></td>
</tr>
<tr>
<td>80% (n = 36)</td>
<td>21 (41.2%)</td>
<td>15 (38.5%)</td>
<td></td>
</tr>
<tr>
<td>Obesity (n = 16)</td>
<td>9 (17.3%)</td>
<td>7 (17.5%)</td>
<td>.98</td>
</tr>
<tr>
<td>Opioid treatment (n = 38)</td>
<td>16 (30.8%)</td>
<td>22 (55%)</td>
<td>.02</td>
</tr>
<tr>
<td>Trauma (n = 21)</td>
<td>14 (26.9%)</td>
<td>7 (17.5%)</td>
<td>.29</td>
</tr>
<tr>
<td>Duration of symptoms, mean (SD)</td>
<td>75.3 (68.7)</td>
<td>81.5 (65.0)</td>
<td>.66</td>
</tr>
<tr>
<td>Facet pathology seen on MRI (n = 44)</td>
<td>27 (51.9%)</td>
<td>17 (43.5%)</td>
<td>.43</td>
</tr>
<tr>
<td>Facet loading (n = 55)</td>
<td>26 (53.1%)</td>
<td>29 (74.4%)</td>
<td>.04</td>
</tr>
<tr>
<td>Paraspinal tenderness (n = 66)</td>
<td>44 (84.6%)</td>
<td>22 (55%)</td>
<td>.002</td>
</tr>
<tr>
<td>Number of levels treated, mean (SD)</td>
<td>3.5 (0.9)</td>
<td>3.4 (0.8)</td>
<td>.75</td>
</tr>
</tbody>
</table>

NOTE. Data are presented as odds ratio (95% confidence limits).

Abbreviation: MRI, magnetic resonance image.

*See methods for list of all variables included in multivariate analysis.

**P** values determined from adjusted multivariate logistic regression analysis.

Table 3. Factors Associated with Successful Outcome

<table>
<thead>
<tr>
<th></th>
<th>Unadjusted Univariate Analysis</th>
<th>Adjusted Multivariate Analysis*</th>
<th>( P ) Value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.00 (0.97-1.03)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institution</td>
<td>0.92 (0.6-1.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>0.63 (0.3-1.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>0.51 (0.2-1.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.61 (0.4-6.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cervical spine surgery</td>
<td>1.13 (0.5-2.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiation pattern</td>
<td>0.60 (0.3-1.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiation to occiput</td>
<td>0.24 (0.1-0.6)</td>
<td>0.33 (0.12-0.89)</td>
<td>.03</td>
</tr>
<tr>
<td>% Relief from diagnostic block</td>
<td>1.12 (0.5-2.6)</td>
<td></td>
<td>.13</td>
</tr>
<tr>
<td>Obesity</td>
<td>0.98 (0.3-2.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opioid use</td>
<td>0.36 (0.2-0.9)</td>
<td>0.47 (0.18-1.3)</td>
<td></td>
</tr>
<tr>
<td>Trauma</td>
<td>1.74 (0.6-4.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration of symptoms in months</td>
<td>0.99 (0.99-1.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facet pathology seen on MRI</td>
<td>1.4 (0.6-3.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain worsened by extension/rotation</td>
<td>0.39 (0.2-0.97)</td>
<td>0.42 (0.15-1.16)</td>
<td>.09</td>
</tr>
<tr>
<td>Paraspinal tenderness</td>
<td>4.5 (1.7-12)</td>
<td>3.81 (1.29-11.3)</td>
<td>.01</td>
</tr>
<tr>
<td>Number of levels treated</td>
<td>1.09 (0.7-1.8)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE. Data are presented as odds ratio (95% confidence limits).

Abbreviation: MRI, magnetic resonance image.

*See methods for list of all variables included in multivariate analysis.

†**P** values determined from adjusted multivariate logistic regression analysis.
derness to diagnose cervical z-joint pain, the prognostic value of this physical sign has never been validated. In addition to directly straining cervical facet joints, deep palpation overlying superficial tissues may diametrically stress them via muscular and neuronal connections between the facet joint capsule and paraspinal muscles.

In concordance with previous findings for lumbar facet RF denervation, pain exacerbated by extension and/or rotation was associated with RF treatment failure in univariate analysis, although this lost statistical significance when other variables were controlled for in multivariate analysis. The negative correlation between “facet loading” and success in the cervical region is consistent with data in the lumbar region demonstrating that pain worsened by extension and rotation is not suggestive of facetogenic pain. Thus, inappropriate selection of patients based on a fallacious premise could have contributed to the negative findings of recent studies examining RF denervation. Although the practice is not as widespread as in the lumbar region, many clinical and preclinical studies on cervical z-joint pain continue to promote the notion of cervical “facet loading” even though no study has established a connection between aggravation of neck pain by spinal extension and analgesic response to cervical facet or MBB.

The negative association between pain radiating into the occiput and treatment outcome is perplexing, considering that the levels treated were determined by pain referral studies conducted in both symptomatic patients and asymptomatic volunteers. One proposed explanation is that longstanding cervicogenic headache patients may have developed components of mixed or chronic daily headaches, which would be less amenable to facet joint denervation. However, the slim difference in average duration of pain between patients with a successful outcome (mean 72.2 months; SD 53.6, range 35-62) and those who failed treatment (mean 73.4 months; SD 70.4, range 32-78; \( P = .96 \)) seems to negate this hypothesis.

Two interesting “negative” findings were the lack of correlation between treatment failure, and previous surgery and opioid use, which were found in our previous study. A negative correlation between prior surgery and successful outcome might be anticipated based on the high false positive rate for facet blocks and other diagnostic procedures in prior surgical patients, and the diminishing success rate for any type of intervention in failed back surgery syndrome. When performing lumbar pedicle screw placement, many surgeons purposefully or inadvertently perform medial branch rhizotomies. This, along with anatomical obstruction of the target points by hardware, may pose serious obstacles to neural localization in the lumbar spine. However, unlike diagnostic and therapeutic interventions performed on patients with previous lumbar spine surgery, neck surgery and cervical facet blocks are typically performed via different anatomical approaches. Opioid use was associated with treatment failure in univariate but not multivariate analysis, indicating the drugs might be more likely to be used in intractable cases. Other reasons that opioid use might predispose patients to treatment failure include the development of hyperalgesia, and their association with a higher incidence of concomitant psychopathology and secondary gain issues. Our finding that the degree of pain relief experienced with single diagnostic cervical MBB was not predictive of denervation outcome is consistent with a previous study conducted on lumbar facet RF patients.

The retrospective design of this study presents certain inherent limitations. These include patient exclusion because of failure to meet inclusion criteria and/or inadequate follow-up, missing data, less accurate measurements than data collected prospectively, and the selection of clinical variables posthoc (i.e., the estimate of the force used to denote paraspinal tenderness). This last shortcoming may serve to moderate the internal validity of this study. To illustrate, had the third occipital nerve been lesioned in 3 places in all patients as recently advocated, perhaps our outcomes in subjects with head pain would have been better. This analysis also did not enable us to classify the type of head pain from which these patients suffered. If a substantial percentage presented with features of migraine headaches, which are less likely than occipital headaches to be facetogenic in origin, it could explain the negative association between head pain and outcome. On a similar note, prospectively employing a validated radiological grading scale might have provided more insight as to whether imaging studies could be used to identify candidates for facet interventions.

Placebo-controlled or comparative local anesthetic blocks were not employed in this study as recommended by some experts, and hence our success rates were lower than those reported in some uncontrolled studies. However, subjecting patients to dual diagnostic procedures may be unjustified based on the current literature and lack of any direct comparison between treatment paradigms. To illustrate, a theoretical economic analysis revealed double-blocks to lack cost effectiveness, and a previous clinical study found that comparative blocks possess only marginal (54%) sensitivity. In 6 controlled studies evaluating the
efficacy of RF denervation for lumbar or cervical facet joint pain. Only 1 study used confirmatory blocks. In a study assessing the value of comparative local anesthetic blocks for the diagnosis of cervical z-joint pain, Lord et al. found them to be associated with a significant false negative rate. Thus, when double blocks are routinely used, an accurate diagnosis and effective treatment will be withheld from a substantial percentage of patients.

Another limitation is the nonstandardized fashion in which pain scores were tabulated. First, numerical pain scores were not noted in this study because follow-up in some patients (especially WRAMC) was conducted via telephone or e-mail, whereby pain scores were not always recorded (WRAMC uses a modified VAS pain scale). Second, VAS and numerical pain scores are not equivalent. Although a very strong correlation \( r = 0.95 \) exists between VAS and verbal numerical pain scores, patients systematically rate pain higher using verbal scores than with a true VAS scale.

Finally, the only true outcome measure evaluated in all patients was pain relief. In a recent consensus conference, a panel of experts concluded that studies assessing the effectiveness of pain treatments should consider several variables other than pain relief, including but not limited to disposition, and physical and emotional functioning. Whereas some studies have demonstrated a strong correlation between pain relief and improvement in secondary outcome measures, other studies have shown pain and functioning to be only modestly related.

In conclusion, the findings of this multicenter study suggest that a detailed history and physical exam may influence cervical facet RF denervation treatment outcomes by improving the selection process. Prospective studies are recommended to confirm our findings and ascertain what additional measures can be taken to improve the likelihood for success.

References


