Observational Study

Fluoroscopically-Guided Cervical Zygapophyseal Therapeutic Joint Injections May Reduce the Need for Radiofrequency Neurotomy

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Background: There is a paucity of literature studying therapeutic intraarticular zygapophyseal (commonly referred to as facet) joint injections in the atraumatic patient population. As a result of this, intraarticular injections have been dismissed as a possible treatment for cervical zygapophyseal joint-mediated pain. Radiofrequency neurotomy (RFN) is currently the accepted treatment for facet joint neck pain.

Objective: This prospective observational study investigated injection response in an atraumatic population to determine treatment viability and whether injections reduce the need for RFN in neck pain patients.

Study Design: Observational case series study.

Setting: This study took place in the outpatient clinic of a private practice.

Methods: The double-block paradigm (DBP) was used to determine if symptoms were zygapophyseal joint-mediated. Lidocaine and bupivacaine diagnostic injections were used. Participants passing the DBP underwent fluoroscopically-guided cervical zygapophyseal joint injections (betamethasone and 1% lidocaine) and 1 year of follow-up. Outcomes were a Verbal Numeric Scale score (VNS) > 2, 50% decrease in VNS, patient-reported improvement, and opioid use at the 1-year follow-up.

Results: One hundred and eighteen patients were enrolled; 51 passed the DBP. These 51 patients underwent injections. Forty-four patients (59 joints) were surveyed 1 year later with 7 follow-up losses. Thirty-four of 59 joints showed ≥ 2-point VNS reductions or ≥ 50% overall symptomatic improvement after 1 year. Twenty-four of 44 ceased narcotics use.

Limitations: The limitations of this research included the lack of randomization and blinding, smaller sample size, and reliance on subjective reporting from the participants both immediately after the procedures and at follow-up. As this was a prospective observational study, there is the possibility of unintended bias by both patients as well as the authors.

Conclusion: Cervical zygapophyseal joint injections may reduce the need for RFN; additional studies are required.

Key words: Neck pain, facet joint, cervical zygapophyseal joint injections, radiofrequency neurotomy

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The cervical zygapophyseal joints (commonly referred to as facet joints) are known as a common source of chronic neck pain (1). Although determining the etiology of neck pain can be guided by physical examinations and imaging, cervical medial branch blocks are the only reliable method of diagnosis (2-4). Recent publications have reviewed various methods of diagnosing cervical

facet joint pain. Boswell et al reported level I evidence for lumbar facet joint nerve blocks with dual diagnostic blocks, with at least 75% pain relief with an average prevalence of 16% to 41% and false-positive rates of 25% to 44% (5) . Similarly, Manchikanti et al reported level II evidence based on 11 controlled diagnostic accuracy studies using controlled diagnostic blocks for diagnosing cervical facet joint pain in patients without disc herniation or radicular pain (5). The prevalence rates ranged from 36% to 67% with at least 80% pain relief as the criterion standard and false-positive rates of 27% to 63%.

Presently, the recommended treatment for zygapophyseal joint pain is radiofrequency neurotomy (RFN) (5). RFN is an interventional procedure that uses electrical current to ablate the medial branches, which innervate the zygapophyseal joints. Historically, observational studies suggested that intraarticular zygapophyseal joint injections were efficacious for the treatment of zygapophyseal joint pain. However, this was refuted in patients with whiplash injury in the landmark study by Barnsley et al (6). As a result, intraarticular zygapophyseal joint injections have been ignored as a possible treatment option for those with atraumatic zygapophyseal joint-mediated pain.

Previous studies exploring therapeutic zygapophyseal joint injections have been hampered by poor patient selection. Most of these studies did not use a double-block paradigm to identify zygapophyseal joint pain. An observational study by Folman et al (8) is the closest to our study design, involving 30 atraumatic patients with pain duration exceeding 12 months. The mean time to relapse of 50% of the preinjection level of pain was 12.47 +1.89 weeks. However, the diagnostic criteria were lacking in that the patients were identified by a single fluoroscopically-guided intraarticular zygapophyseal joint injection with anesthetic, and not medial branch blocks. Additionally, the follow-up period for the study was less than 6 months.

In another observational study of therapeutic zygapophyseal joint injections, diagnostic blocks were never performed. Kim et al (9) treated 60 patients with intraarticular cervical zygapophyseal joint injections. However, diagnoses were based on imaging. The study separated the patients into 3 groups: herniated nucleus pulposus group, myofascial pain syndrome group, and whiplash-associated disorders group. The C5-6 and C6-7 joints were injected with fluoroscopic guidance and pain relief duration was documented. All groups showed significant symptom-free time periods following the therapeutic injections. Interestingly, the whiplash-associated disorders group had the shortest symptom-free period. This finding is consistent with the authors' concerns regarding the Barnsley study, which only studied intraarticular facet joints in whiplash patients. This retrospective cohort study focuses specifically on patients with atraumatic zygapophyseal joint pain who passed the double-block paradigm.

Methods

Patients with nontraumatic chronic neck pain nonresponsive to at least one month of physical therapy were screened to participate in the study. Patients were excluded if any of the following was present: traumatic onset of neck, radicular symptoms, evidence of radiculopathy on exam, or neurologic deficit on examination. Patients provided written consent prior to their participation in the study. The patients were screened using a double-block paradigm to determine if the etiology of their symptoms involved the zygapophyseal joints. Using a lateral approach, 0.5 mL of 2% lidocaine was used to diagnostically anesthetize each medial branch under fluoroscopic guidance. The patients were blinded to the type of anesthetic used at the time of the blocks. VNS pre-block and after 15 minutes post-block VNS was obtained. Patients were provided with a pain diary. A positive response was regarded as at least an 80% reduction in pain and an appropriate duration of relief from lidocaine. In patients found to have a positive response, a second block was performed in the same way, using 0.5% bupivacaine hydrochloride.

The included cervical zygapophyseal joints were those from the C2-3 through C6-7 levels. The selection of which medial branches to block was made based on physical examination, cervical zygapophyseal joint referral patterns, and imaging (plain film, magnetic resonance imaging [MRI], and computed tomography [CT] scans) (7). Patients had one joint unilaterally and up to 2 joints bilaterally blocked depending on their pain symptoms. Patients who passed the double-block paradigm were administered therapeutic cervical zygapophyseal injections containing a mixture of 0.5 mL of lidocaine and 0.5 mL of dexamethasone per joint. Intraarticular needle placement was confirmed with iohexol.

Patients were evaluated 2 weeks after their procedure in an outpatient setting to determine the effectiveness of the therapeutic zygapophyseal joint injections. Those patients who reported ≥ 2-point Verbal Numeric Scale (VNS) reductions or ≥ 50% overall

symptomatic improvement were re-evaluated by the authors one year after their procedure to determine their post-injection outcomes: (a) VNS pain score, (b) percentage of overall improvement, and (c) opioid medication use. The opioids were being prescribed by the authors of the study. There were 11 patients who required repeat therapeutic injections during the one-year period. These 11 patients were re-evaluated in the office. The decision to repeat injections was based on patients' initial response and reported return of pain to baseline level. As with the initial therapeutic injection, patients were evaluated 2 weeks after repeat injection following the same protocol.

Results

One hundred and eighteen patients were identified and screened. Of the original 118 patients, 51 patients passed the double-block paradigm and underwent fluoroscopically-guided therapeutic cervical zygapophyseal joint injections. Eight patients were lost to follow-up at one year. Forty-four patients (59 zygapophyseal joints) were surveyed at the one-year follow-up (Table 1). Twenty-four patients (54.5%), representing 34 zygapophyseal joints (57.6%), reported at least a 2-point reduction in VNS pain level or ≥ 50% overall improvement in pain level. Eleven of the 24 patients required 2 therapeutic injections within the one-year follow-up period. As the timing for therapeutic injections was individualized, the injections were performed at differing intervals of time, ranging from 2 weeks to 52 weeks following the first intraarticular injection. The mean time period between the original and repeat therapeutic injections was approximately 6 weeks.

Of the 20 patients who did not receive relief from cervical therapeutic injections, 9 went on to RFN treatment. The remaining 11 patients who elected not to proceed with RFN continued on with conservative management.

Patients were questioned regarding their medica-

Table 1. *Outcome of therapeutic cervical zygapophyseal joint injections.*

Response	Pre-VNS	Post-VNS	% Relief
NEG (2)	6/10	5/10	0%
POS (1)*	5/10	2/10	75%
POS (2)*	8/10	0/10	100%
NEG (1)	8/10	8/10	0%
NEG (1)	3/10	4/10	0%
POS (1)	7/10	0/10	100%
RFN (1)	7/10	7-8/10	0%
POS (1)	8/10	0/10	100%
POS (2)*	7/10	6/10	50%
RFN (1)	6/10	6/10	0%
POS (2)*	7/10	1/10	85%
POS (1)	8/10	3/10	90%
POS (1)	9/10	1/10	80%
POS (1)*	4/10	1/10	95%
POS (2)	9/10	1/10	95%
POS (1)	7/10	3/10	50%
POS (1)	6/10	0/10	100%
POS (1)	5/10	0/10	80%
RFN (1)	5/10	5/10	0%
RFN (1)	6/10	5/10	10%
POS (4)	5/10	3/10	50%
RFN (1)	5/10	4/10	10%

Response	Pre-VNS	Post-VNS	% Relief
POS (2)*	10/10	0/10	100%
NEG (1)	6/10	5/10	30%
POS (1)*	4/10	1/10	100%
NEG (1)	5/10	4/10	25%
NEG (1)	8/10	7/10	30%
NEG (1)	7/10	7/10	0%
POS (1)	8/10	0/10	100%
POS (1)*	6/10	1/10	95%
POS (1)	8/10	0/10	100%
NEG (1)	6/10	6/10	0%
RFN (1)	7/10	7/10	30%
NEG (2)	10/10	9/10	40%
POS (1)*	5/10	1/10	80%
POS (1)*	7/10	3/10	50%
POS (1)*	4/10	0/10	100%
RFN (1)	8/10	7/10	20%
RFN (1)	6/10	5/10	20%
RFN (1)	6/10	6/10	0%
NEG (2)	5/10	5/10	20%
POS (2)	7/10	2/10	50%
POS (2)	9/10	0/10	100%
NEG (2)	8/10	8/10	0%

POS = Positive response to therapeutic facet injections; NEG = No relief with therapeutic facet blocks; RFA = No relief with therapeutic facet blocks and went to RFN. Number in parenthesis denotes number of facet joints. *denotes patients that required repeat therapeutic injection.

tion use. Twenty-four (54.5%) of the original 44 patients reported a complete cessation of opioid use (Table 2).

Discussion

RFN is a well-established treatment for facet joint pain following appropriate diagnosis with facet joint injections or medial branch blocks. This practice is largely based on the double-blind, controlled study by Barnsley et al (7), in which patients who had experienced a whiplash injury from an automobile accident showed a poor response to therapeutic cervical zygapophyseal injections. The selection criteria used in Barnsley et al (7) were strict, with patients undergoing the double-block paradigm to confirm cervical zygapophyseal-mediated pain. In over half of the patients, neither treatment provided pain relief for more than a week and fewer than 20% of the patients had any substantial relief after one month. Interestingly, there were a few patients who responded positively to intraarticular injections. This response was attributed to a placebo effect; other ongoing conservative treatments; or possible stretching of the joint capsule from the injection, independent of which injectate was used. While Barnsley et al (7) concluded correctly that injected corticosteroid and lidocaine were not beneficial for patients with traumatic pain, their results cannot be generalized to atraumatic patients. The authors themselves cautioned against the extrapolation of data from patients with whiplash injury to other causes of cervical zygapophyseal joint pain.

There have been other reports on the lack of effectiveness of zygapophyseal joint injections; however, in many of these studies, patients were simply assumed to have cervical zygapophyseal-mediated pain and did not undergo the double-block paradigm. Similar to the study by Barnsley et al (7), this study used the double-block paradigm to carefully select the patients most appropriate for therapeutic cervical zygapophyseal joint injections and excluded those with traumatic neck pain.

In a notable study on cervical zygapophyseal joint injections conducted by Park et al (11), patients administered intraarticular injections on one occasion had an increased cervical range of motion, a more greatly reduced mean Numeric Rating Scale pain score, and a decreased incidence of combined tension-type headache compared with a control group that underwent conservative management during the follow-up period (8). In another study, 89 patients with chronic unilateral shoulder pain were separated into 2 groups. In the experimental group, patients were administered an injection in the C4–5 zygapophyseal joint; in the control group, patients were administered an injection in the corresponding unilateral multifidus muscle (9). In patients who received the joint injection, there was both a decrease in pain intensity and an increase in the pressure-pain threshold relative to the control group. The results of the study by Park et al (11) contradicted those of the previous study by Barnsley et al (7). In our study, 57.6% of zygapophyseal joints showed at least a 2-point reduction in the VNS score or ≥ 50% overall improvement in pain symptoms one year following therapeutic joint injections. These findings suggests that therapeutic intraarticular zygapophyseal joint injections could be used successfully for the treatment of atraumatic cervical joint pain. While RFN has been proven effective in the treatment of cervical zygapophyseal joint pain, the procedure is more invasive than intraarticular injections and has increased risks. Complications of RFN include superficial numbness and paresthesia, worsened and prolonged pain at the procedural site, weakness and instability of the neck paraspinal muscles, and permanent nerve pain and damage (10-11). RFN not only ablates innervation to the zygapophyseal joint but also to the overlying multifidus muscle group, which is responsible for spinal stability. Abbott et al (14) described a complication involving irreversible right L5 sensory radiculopathy following a lumbar RFN procedure, eventually requiring placement of a permanent spinal cord stimulator. In addition to complications, the amount of fluoroscopic time and material costs involved favor therapeutic zygapophyseal injections over RFN. Intraarticular injections could be used as a less invasive treatment method compared with RFN, and hold potential for the patient to avoid neurotomy altogether.

Manchikanti et al (15-17) published a series of studies focused on therapeutic cervical medial branch

Table 2. *One year outcome of therapeutic zygapophyseal joint injections: Positive response: cessation of opioids, > 2 point drop on VNS, and > 50% drop on VNS.*

	# of patients	# zygapophyseal/ facet joints
Positive Response	24 (54.55%)	34 (57.63%)
Negative Response	20 (45.45%)	25 (42.37%)
Total #	44	59

blocks with local anesthetic with or without steroids in managing chronic neck pain of facet joint origin. While our study did not focus on the use of therapeutic cervical medial branch blocks in the treatment of neck pain, these studies are the first of their kind, highlighting another therapeutic option for the treatment of cervical zygapophyseal pain (12-14).

An important implication of this study is that therapeutic zygapophyseal injections do not preclude the use of RFN in the future. The use of RFN is not in question. In our own study, RFN was later used in patients who did not respond to therapeutic injections.

Of the original 44 patients included in the study, 24 reported the complete cessation of opioid use. The cessation of opioids is evidence in and of itself of the effectiveness of therapeutic zygapophyseal injections. The importance of the cessation of opioid use cannot be understated, particularly with statistics showing increasing tolerance and abuse in the present-day opioid crisis.

Limitations to the present study include lack of randomization and blinding, small sample size, and reliance on subjective reporting from patients both immediately after the procedures and at follow-up. There is also the possibility of unintended recall bias by patients when data was originally reported at the 2-week and 52-week evaluations. The implementation of standardized pain and function surveys would eliminate this concern. The possibility of confirmation bias must also be acknowledged, as authors interpreted data retrospectively. The sample size for this study was small because patients were pooled from one center. One hundred and eighteen patients were still identified, though the use of DBP and follow-up losses reduced this number to 44 patients. Our results confirm the effectiveness of therapeutic intraarticular cervical zygapophyseal joint injections in atraumatic patients, indicating that this intervention should be considered as an alternative treatment before RFN. At the very least, this study reveals the need for further research on the use of therapeutic zygapophyseal joint injections.

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