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Prevalence of facet joint pain in chronic spinal pain of cervical, thoracic, and lumbar regions

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Abstract

Background: Facet joints are a clinically important source of chronic cervical, thoracic, and lumbar spine pain. The purpose of this study was to systematically evaluate the prevalence of facet joint pain by spinal region in patients with chronic spine pain referred to an interventional pain management practice.

Methods: Five hundred consecutive patients with chronic, non-specific spine pain were evaluated. The prevalence of facet joint pain was determined using controlled comparative local anesthetic blocks (1% lidocaine or 1% lidocaine followed by 0.25% bupivacaine), in accordance with the criteria established by the International Association for the Study of Pain (IASP). The study was performed in the United States in a non-university based ambulatory interventional pain management setting.

Results: The prevalence of facet joint pain in patients with chronic cervical spine pain was 55% 5(95% CI, 49% – 61%), with thoracic spine pain was 42% (95% CI, 30% – 53%), and in with lumbar spine pain was 31% (95% CI, 27% – 36%). The false-positive rate with single blocks with lidocaine was 63% (95% CI, 54% – 72%) in the cervical spine, 55% (95% CI, 39% – 78%) in the thoracic spine, and 27% (95% CI, 22% – 32%) in the lumbar spine.

Conclusion: This study demonstrated that in an interventional pain management setting, facet joints are clinically important spinal pain generators in a significant proportion of patients with chronic spinal pain. Because these patients typically have failed conservative management, including physical therapy, chiropractic treatment and analgesics, they may benefit from specific interventions designed to manage facet joint pain.

Background

Pain emanating from various structures of the spine is a major cause of chronic pain problems [1,2]. Linton et al [3] estimated the prevalence of spinal pain in the general population as 66%, with 44% of patients reporting pain in the cervical region, 56% in the lumbar region, and 15% in the thoracic region. Manchikanti et al [4] reported similar results. Despite the high prevalence of spinal pain, it has been suggested that a specific etiology of back pain

can be diagnosed in only about 15% of patients with certainty based on clinical examination alone [5-9].

Bogduk [9] noted that a reductionist approach to chronic low back pain requires an anatomical diagnosis. Bogduk [10] identified four factors necessary for any structure to be deemed a cause of back pain: a nerve supply to the structure; the ability of the structure to cause pain similar to that seen clinically in normal volunteers; the structure's susceptibility to painful diseases or injuries; and demonstration that the structure can be a source of pain in patients using diagnostic techniques of known reliability and validity.

The facet or zygapophysial joints of the spine are well innervated by the medial branches of the dorsal rami [11-15]. Facet joints have been shown capable of causing pain in the neck, upper and mid back, and low back with pain referred to the head or upper extremity, chest wall, and lower extremity in normal volunteers [16-26]. They also have been shown to be a source of pain in patients with chronic spinal pain using diagnostic techniques of known reliability and validity [2,27-44]. Conversely, the reliability of physical examination in diagnosing the specific cause of back pain has been questioned [45]. Further, it has been shown that medical imaging provides little additional useful in identifying a precise anatomical diagnosis.

In the 1990s precision diagnostic blocks were developed, including facet joint blocks, provocative discography, and sacroiliac joint blocks [2]. Facet joints have been implicated as a cause of chronic spinal pain in 15% to 45% of patients with chronic low back pain [32-39], 48% of patients with thoracic pain [43], and 54% to 67% of patients with chronic neck pain [39-42]. These figures were based on responses to controlled diagnostic facet joint blocks performed in accordance with the criteria established by the International Association for the Study of Pain (IASP) [46].

Schwarzer et al [32] determined that the prevalence of facet joint pain in patients with low back pain in the United States following an incident (work related, motor vehicle accident, or other causes) was 15%. The prevalence of lumbar facet joint pain in a rheumatology practice in Australia was noted to be 40% [36]. Barnsley et al [40] and Lord et al [41] evaluated potential causes of chronic neck pain following whiplash injury in Australia and reported that the prevalence of facet joint pain was 54%. Manchikanti et al [33-35,37-39,43] sought to identify the influence of age, sex, weight, occupational injury, smoking, surgery, and whether or not single or multiple regions of the spine were symptomatic. They found a lower prevalence of facet joint pain in younger patients following occupational injury, surgery or when only the low back was involved. In addition, they estimated the prevalence of cervical, thoracic, and lumbar facet pain to be 60% [42], 48% [43], and 22%–45% [33-35,37,38], respectively. However, the prevalence of facet joint pain by spinal region, in the context of the total spine has not been evaluated. Indeed, the relative involvement of the cervical, thoracic, and lumbar spine is not known.

This study was undertaken to evaluate the prevalence of facet joint pain by spinal region in patients with chronic spine pain presenting to an interventional pain management practice for diagnosis and treatment. The study protocol determined the presence of facet joint pain using responses to controlled comparative local anesthetic facet joint nerve blocks, performed in accordance with IASP criteria.

Methods

This study evaluated 500 consecutive patients presenting with chronic neck, thoracic, or low back pain, or a combination thereof. Patients were managed by one physician in a non-university, private practice setting in the United States, offering comprehensive, interventional pain management services.

Inclusion criteria were as follows: Patients were 18 to 90 years of age, had pain for at least 6 months, and pain was non-specific rather than radicular in nature. Disc related pain with radicular symptoms was excluded in all patients based on radiologic or neurologic testing, lack of a neurological deficit, and no radicular symptoms or pain that involved predominantly the upper or lower extremity. All patients had failed conservative management, which included physical therapy, chiropractic manipulation, exercises, drug therapy, bedrest, etc.

Work-up included a comprehensive history, physical examination, and evaluation of the results of prior procedures and investigations. Examinations and evaluations of patients were performed by one physician (LM). Of 585 potentially eligible patients, 500 patients agreed to participate in the study after the nature of the study and the potential hazards of the procedures were explained. Informed consent was obtained from all patients. The study period lasted from January 2001 to February 2003.

Facet joint pain was investigated in all patients starting with diagnostic blocks using 1% lidocaine. Patients with lidocaine-positive results were further studied using 0.25% bupivacaine on a separate occasion, usually 3 to 4 weeks after the first injection. The blocks were performed on the ipsilateral side in patients with unilateral pain or bilaterally in patients with bilateral or axial pain. Blocks were performed at a minimum of two levels to block a single joint. Target joints were identified by the pain pattern,

Table 1: Demographic features

		One Region (297)	Two Regions (182)	Three Regions (21)	Total (500)
Gender	Male	44% (131)	36% (66)	33% (7)	41.0% (204)
	Female	56% (166)	64% (116)	67% (14)	59.0% (296)
Age (Yrs)	Range	19 – 90	20 – 83	22 – 63	19 – 90
	Mean ± SEM	50* ± 1.0	44* ± 1.0	40 ± 2.9	47 ± 0.7
Height (inches)	Range	50 – 78	56 – 78	60 – 72	50 – 78
	Mean ± SEM	67 ± 0.2	66 ± 0.3	66 ± 0.7	67 ± 0.4
Weight (lbs)	Range	95 – 370	92 – 350	102 – 330	92 – 370
	Mean ± SEM	181 ± 2	180 ± 4	184+ 12	181 ± 3

* Indicates significant difference compared to the group with involvement of three regions ($p < .001$)

local or paramedian tenderness over the area of the facet joints, and reproduction of pain with deep pressure. Blocks were performed with intermittent fluoroscopic visualization using a 22-gauge, 2-inch spinal needle at each of the indicated medial branches in the cervical and thoracic spine, and with a 22-gauge, 3.5-inch spinal needle at each of the indicated medial branches at the L1–L4 levels and the L5 dorsal ramus at the L5 level of the lumbar spine. All blocks were performed by one physician (LM).

Target points were identified as described by Bogduk [28]. Intravenous access was established and light sedation with midazolam was offered to all patients. Each facet nerve was infiltrated with 0.5 mL of 1% lidocaine or 0.25% bupivacaine. A positive response was defined as at least 80% reduction of pain with previously painful movements as assessed using a verbal analog type of pain rating scale. Following each block, the patient was examined and asked to perform previously painful movements. To be considered positive, pain relief from a block had to last at least 2 hours when lidocaine was used, and at least 3 hours, or greater than the duration of relief with lidocaine, when bupivacaine was used. Any other response was considered as a negative outcome.

All patients were discharged one hour after completion of the diagnostic blocks. They were asked to note the time of return of pain on a discharge instruction sheet. All patients were contacted within 3 to 24 hours following the block by a registered nurse and responses were recorded. All patients judged to have a positive response with lidocaine blocks underwent subsequent bupivacaine blocks. Patients who were determined not to have facet joint pain were offered other diagnostic or therapeutic interventions, including discography, epidural injections, or sacroiliac joint injections.

Data were recorded on a Microsoft® Access® 97 database. The SPSS version 9.0 Statistical Package was used to generate frequency tables. The prevalence and 95% confidence intervals (CI) were calculated. Differences in proportions were tested using the Chi-square test. Fischer's exact test was used whenever the expected value was less than five. Results were considered statistically significant if the *P* value was <0.05.

Results

Five hundred consecutive patients with chronic spine pain meeting inclusion criteria were studied. As shown in Table 1, 59% of the patients were female with an average age of 47 ± 0.7 years. Patients presenting with involvement of a single region or two regions were older than patients with involvement of three regions ($P < 0.001$).

Table 2 illustrates salient features based on regional involvement, including duration, mode of onset, and distribution of pain; proportion of patients with previous surgery; and the number of joints involved. Depending on the regions involved, most patients had two or three symptomatic facet joints.

Table 3 illustrates the results of diagnostic blocks evaluating facet joint pain in the cervical, thoracic, and lumbar spine. Lidocaine blocks were performed in each of these 500 patients in a total of 724 regions (i.e., cervical, thoracic, or lumbar). Two hundred twelve of 255 patients with pain in the cervical spine reported a definite response to initial lidocaine blocks, 53 of 72 patients with thoracic spine pain after lidocaine blocks and 198 of 397 patients with lumbar spine pain after lidocaine blocks.

Of the 212 patients in the lidocaine-positive cervical spine group, 140 patients (i.e., 55% of patients with cervical spine pain or 66% of the lidocaine-positive group) reported definite responses to bupivacaine blocks. Thirty patients in the lidocaine-positive thoracic group (i.e., 42% of patients with thoracic pain or 57% of the lidocaine-positive group) reported definite responses to bupivacaine blocks. One hundred twenty four patients of

Table 2: Salient features based on regional involvementof the spine

		Cervical (255)	Thoracic (72)	Lumbar (397)
Gender	Male	36% (92)	36% (26)	42% (166)
	Female	64% (163)	64% (46)	58% (231)
Age (Yrs)	Range	19 – 82	20 – 83	20 – 90
	Mean ± SEM	43 ± 0.9	44 ± 1.8	47 ± 0.8
Height (inches)	Range	50 ± 78	59 ± 76	56 ± 78
	Mean ± SEM	67 ± 0.25	67 ± 0.44	67 ± 0.21
Weight (lbs)	Range	92 ± 350	100 ± 330	92 ± 370
	Mean ± SEM	177 ± 3.10	173 ± 5.22	184 ± 2.51
Duration of Pain (months)	Range	6 ± 588	6 ± 495	6 ± 612
	Mean ± SEM	96 ± 6.31	83 ± 10.82	106 ± 5.79
Mode of onset of pain	Gradual	51% (130)	58% (42)	50% (198)
	Following an incident	49% (122)	42% (30)	50% (199)
Distribution of pain	Left	15% (39)	18%(13)	14%(54)
	Right	16% (40)	18%(13)	14% (57)
	Bilateral	69% (176)	64%(46)	72% (286)
Previous surgery		18% (44)	6% (4)	32% (127)
Number of joints involved	Two	26% (66)	6% (4)	79% (313)
	Three	70% (179)	69% (50)	20% (80)
	More than three	4% (10)	25% (18)	1% (4)

Table 3: Results of single and double facet joint nerve blocks (Single blocks with lidocaine and double blocks with lidocaine and bupivacaine)

	Cervical (255)		Thoracic (72)		Lumbar (397)	
	Double Blocks +		Double Blocks		Double Blocks	
Single Blocks*	Positive	Negative	Positive	Negative	Positive	Negative
Positive	140	72	30	23	124	74
Negative		43		19		199
Prevalence	55% (95% CI 49% – 61%)		42% (95% CI 30% – 53%)		31% (95% CI 27% – 36%)	
False positive rate	63% (95% CI 54% – 72%)		55% (95% CI 39% – 78%)		27% (95% CI 22% – 32%)	

Note: * With single blocks in the cervical spine, 212 patients (ie, 140 + 72) had positive responses with lidocaine blocks; 53 patients with thoracic pain had positive responses; and 198 patients with lumbar pain had positive responses. + With double blocks, 140 patients with neck pain, 30 with thoracic pain and 124 with lumbar pain had positive responses.

the 198 lidocaine-positive lumbar group (i.e., 31% of patients with lumbar pain or 63% of lidocaine-positive group) reported definite responses to bupivacaine blocks.

The double local anesthetic block group provided a prevalence rate of facet joint pain in patients with chronic cervical spine pain of 55% (95% CI, 49% – 61%); 42% (95% CI, 30% – 53%) with thoracic pain; and 31% (95% CI, 27% – 36%) with lumbar pain.

Table 4 illustrates the rate of facet joint involvement by specific region of the spine. Overall, facet joints were painful in at least one region of the spine in 43%, in at least two regions in 15%, and in all three regions in 2% of patients.

Table 4: Facet joint involvement by region on the basis of double nerve blocks

Double blocks	Number	% of positive
At least One region positive	500	43% (216)
At least Two regions positive	203	15% (73)
All three regions positive	21	2% (9)

In terms of the overall prevalence of facet joint pain, when considering the initial group of 500 patients with chronic neck, thoracic, or low back pain, or a combination

thereof, cervical facet joints were symptomatic in 28%, thoracic facet joints in 6%, and lumbar facet joints in 25% of patients.

For purposes of calculating false-positive rates, all patients with no response to lidocaine were assumed to be true-negatives, and all patients with a positive response to lidocaine and a negative response to bupivacaine were considered to be false-positives. The resultant false-positive rate was 63% (95% CI, 54% – 72%) for the cervical spine, 55% (95% CI, 39% – 78%) for the thoracic spine, and 27% (95% CI, 22% – 32%) for the lumbar spine.

Discussion

This prospective study of patients with chronic non-specific spinal pain involving the cervical, thoracic and lumbar regions, alone or in combination, demonstrated by spinal region that the prevalence of cervical facet (zygapophysial) joint pain in patients with neck pain was 55%, thoracic facet joint pain in patients with mid back or upper back pain was 42% and lumbar facet joint pain in patients with low back pain was 31%. The false positive rates were quite high with single blocks: 63% for the cervical spine, 53% for the thoracic spine and 27% for the lumbar spine. Out of 500 patients participating in the study, cervical facet joint pain was seen in 140 patients or 28%, thoracic facet joint pain was seen in 30 patients or 6%, and lumbar facet joint pain was seen in 124 patients or 25%. Facet joint pain occurred in at least one region of the spine in 43% of patients, in two regions in 15%, and in all three regions in 2% of patients.

This study also demonstrated bilateral involvement in 69% of patients in the cervical spine, 64% in the thoracic spine, and 72% in the lumbar spine. The majority of patients with cervical and thoracic spine had involvement of three joints, compared to the lumbar spine with involvement of two joints. A small proportion of patients had involvement of more than three joints. Mode of onset and duration of pain were similar in all regions.

Facet joints have been shown to be a source of chronic spinal pain by means of diagnostic techniques of known reliability and validity. Blocks of facet joints can be performed to test the hypothesis that the target joint is a source of the patient's pain [27]. Facet joints can be anesthetized with intraarticular injections of local anesthetic or by anesthetizing the medial branches of the dorsal rami that innervate the target joint. If pain is not relieved, the joint can not be considered the source of pain. The true source may be another facet joint or some other structure. True-positive responses are determined by performing controlled blocks, either in the form of placebo injections of normal saline or comparative local anesthetic blocks on two separate occasions, when the same joint is anesthetized using local anesthetics with different durations of action. The value and validity of medial branch blocks and comparative local anesthetic blocks in the diagnosis of facet joint pain has been demonstrated [27-44,50-60]. Further, controlled blocks are the only reliable tool in diagnosing chronic spinal pain, because there are no clinical features or diagnostic imaging studies that can determine whether a facet joint is painful or not [5,7-9,11,27,29,32,34,44,52-55,61-67].

This study may be criticized for not using placebo-controlled diagnostic blocks or intraarticular injections, and for not evaluating other potential sources of pain. First, we utilized comparative controlled diagnostic blocks based on ethical considerations, ease of enrollment, and clinical practice in the United States. Reliability of controlled comparative local anesthetic blocks has been proven by numerous controlled trials. Second, medial branch blocks are considered accurate, easily performed, and reliable. We felt it essential to evaluate the entire spine, rather than separate, isolated regions of the spine. Finally, the study was limited to evaluation of pain of facet joint origin. Evaluating other potential sources of pain in each individual patient with discography and sacroiliac joint injections is difficult and beyond the scope of the present study. Moreover, the reliability of selective nerve root blocks and trigger point injections for diagnostic purposes is not proven.

Conclusion

This study evaluated patients with chronic, non-specific spinal pain involving all three regions of the spine: cervical, thoracic and lumbar spine. Painful cervical facets were identified in 55% of patients with neck pain, 42% of patients with thoracic pain, and 31% of patients with low back pain. False-positive rates after single injections were 63%, 55%, and 27% for cervical, thoracic, and lumbar facet joint blocks, respectively. Overall, of the 500 patients with chronic spinal pain evaluated in this study, 28% had painful cervical facets, 6% painful thoracic facets, and 25% painful lumbar facets. At least one region was involved in 43% of patients; at least two regions in 15% of patients and 2% of patients had painful facets in all three regions of the spine. Depending on the regions involved, most patients had two or three symptomatic facet joints.

Although single diagnostic blocks appear unreliable, with a relatively high false-positive rate, true-positive results obtained by performing two sets of diagnostic blocks on separate occasions indicate that facet joints are a cause of chronic spinal pain in nearly half of all patients with chronic spinal pain presenting to an interventional pain management practice. Because these patients typically have failed conservative management, including physical

therapy, chiropractic treatment and analgesics, patients with chronic spinal pain may benefit from specific interventions designed to identify and eliminate facet joint pain.

Competing Interests

None declared.

Authors' Contributions

LM, MVB, and VS originally discussed the importance of this topic and agreed that it needed to be studied in a systematic fashion. LM, MVB, and VS designed the protocol. KSD and CDB participated in the study by assisting in patient recruitment and data collection. VP assisted with the protocol formation, designed data collection, and analyzed the statistics. LM drafted the manuscript, which all authors read, discussed, revised, and finally agreed upon.

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