Retrospective Evaluation

Age-Related Prevalence of Facet-Joint Involvement in Chronic Neck and Low Back Pain

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Disclaimer: Partial funding was provided by the Laurance S. Rockefeller Trust, the Samueli Institute, and a CIRCLE grant from Georgetown University Medical Center (JG).
Conflict of interest: None.

Manuscript received: 11/19/2007
Accepted for publication: 12/19/2007

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Background: Spinal pain is common in all age groups. While the research has focused primarily on incidence and prevalence in younger working adults, there is evidence that spinal pain is one of the most frequent complaints in older persons and is responsible for functional limitations. While facet arthrosis is a common radiographic finding, which has been suggested to be a potential cause of spinal pain, nearly 10% of all adults show signs of degeneration by the time they reach age 30. Radiographic changes of osteoarthritis have been shown to be equally common in patients with and without low back or neck pain. The studies of low back pain have shown the prevalence of facet joint involvement to be approximately 15% to 45%. However, age related prevalence of facet joint neck pain has not been studied.

Objective: To assess age-related prevalence and false-positive rates of facet-joint involvement in chronic spinal pain using controlled comparative local anesthetic blocks.

Design: Retrospective analysis of 424 patients, divided into 6 groups based upon age (Group I: aged 18 – 30 years, Group II: aged 31 – 40 years, Group III: aged 41 – 50 years, Group IV: aged 51 – 60, Group V: 61 – 70 years, and Group VI: greater than 70 years of age).

Results: The prevalence of cervical facet joint-related pain was the lowest (33%) in Group VI and highest (42%) in Group I. False-positive rates for cervical facet joint blocks ranged from 39% (Group III) to 58% (Group V) with an overall false-positive rate of 45%. The prevalence of facet joint involvement in lumbar spinal pain ranged from 18% (in Group II) to 44% (in Group IV), with significant differences noted when Group II and Group III were compared to other groups and with higher rates in Group V.

Conclusion: This study demonstrated a variable age-related prevalence of facet joint pain in chronic low back pain, whereas in the cervical spine it was similar among all the age groups.

Key Words: Prevalence, facet arthrosis, facet joint pain, cervical spine, lumbar spine, controlled comparative local anesthetic blocks, false-positive rate.

Pain Physician 2008; 11:1:67-75

The lifetime prevalence of spinal pain has been reported to be between 54% and 80% (1). Although research has primarily focused on incidence and prevalence in younger, working adults, there is evidence that back pain 1) is one of the most frequent complaints in older persons (2-4); 2) is responsible for functional limitations (3,5); 3) causes difficulty in performing daily life activities (6); and 4) is also a risk factor for future disability. The published literature commonly states that 80% to 90% of low back pain resolves in about 6 weeks, irrespective of the administration or type of treatment, with only 5% to 10% of patients developing persistent back pain. Contrary to this assumption, actual analysis of research evidence shows that chronic low back and neck pain persist 1 year or longer in 25% to 60% of adult and/or elderly patients (7-13).

For any anatomical structure to be deemed a cause of back pain, it must be isolable as a provocative pain generator. Characteristically this is achieved using diagnostic techniques of known reliability and validity (14). Diagnostic blockade of the innervation of an anatomical structure that is suspected to generate pain can be performed to evaluate and verify whether the target structure is specifically provocative for pain. Such diagnostic techniques include facet joint blocks, discography, and sacroiliac joint injections. Based on evaluations utilizing controlled diagnostic blocks, the prevalence of zygapophysial or facet joint involvement has been estimated to be between 15% to 45% in heterogeneous groups of patients with chronic low back pain (15-20) and 36% to 67% in patients with chronic neck pain (15,16,21-23). However, false-positive rates varying from 27% to 63% in the cervical spine and 17% to 50% in the lumbar spine have also been described (1,15-17,20,23,24).

Facet arthrosis, a common radiographic finding, has long been suggested to be a potential cause of low back pain (25). The exact pain generator within the facet joint remains poorly defined (25). Studies have shown that facet arthrosis frequently appears early in the third decade, and is often related to the amount of heavy work done before the age of 20 (25). Eubanks et al (25) found evidence that nearly 60% of all adults show some signs of degenerative changes by the time they reach age 30. As well, it was shown that following the initiation of arthritic changes, subsequent degeneration appears to steadily increase until the seventh decade, by which time evidence of arthrosis becomes ubiquitous. This study shows that men have both a greater prevalence and degree of facet arthrosis than women at all levels of the lumbar spine. The L4-5 level shows the highest prevalence and degree of arthrosis. Most aspects of facet arthrosis are based on the pathogenesis of degenerative cascade in the context of a 3-joint complex. This complex involves the articulations between 2 vertebrae consisting of the intervertebral disc and adjacent facet joints (26,27). Changes within each member of this joint complex will result in changes in the others in the lumbar and cervical spine (26,27). It also has been shown that the prevalence of disc degeneration, spondylosis, and facet joint osteoarthritis increases with increasing age (28). Others have shown simultaneous disc degeneration in the cervical and lumbar spine (29). Similarly, spondylosis is also common in the cervical and lumbar spine. Spondylosis is often used to describe vertebral osteophytosis secondary to degenerative disc disease or osteophytosis of the facet joints. However, spondylosis only accurately describes vertebral osteophytosis secondary to degenerative disc disease. Consequently, osteophytes occurring at the facet joints are different from osteophytes occurring on the vertebral margins adjacent to the disc.

Radiographic changes of osteoarthritis have been shown to be equally common in patients with and without low back or neck pain and degenerative joints seen on computed tomography (CT) are not always painful, even though some studies report severely degenerated joints as being more likely to be symptomatic. As per the descriptions of degenerative cascade in the context of a 3-joint complex, it is viewed with involvement of changes in the disc structure and composition paralleling changes in the articular cartilage and ligaments of joints. Thus, it is reasonable to assume that in a patient suffering with either neck pain or low back pain, the causative structures of that pain may be the same in both regions, either discs or facet joints, and these degenerative changes increase with age. In fact, increasing age has been associated with an increase in musculoskeletal symptoms, specifically low back pain. The prevalence of back pain based on age has been estimated to be 15% in children, adolescents, and adults, and 27% in the elderly (1). It is also stated that there has been an under-representation of the older population in the back pain literature, suggesting that the prevalence of low back pain in this population is not known with certainty and is not compatible with that in the younger age population.

Early studies of low back pain by Schwarzer et al

(18,19) showed the prevalence of facet joint involvement to be approximately 15% in the younger population (18) and 45% in the middle aged population (18). In contrast, facet joint-related chronic low back pain has been shown to have a prevalence of 52% in the elderly (30). To date, however, the age-related prevalence of facet joint involvement has not been studied for chronic neck pain.

Methods

This study involved a retrospective evaluation of 424 patients (251 presenting with chronic persistent cervical pain and 303 patients with chronic lumbar pain, with 294 patients with single region involvement and 130 patients showing involvement of both cervical and lumbar regions) (16). All patients were managed in a non-university, private practice setting in the United States, with procedures performed in a sterile setting in an interventional pain management ambulatory surgery center. All patients were provided complete disclosure of all potential uses of the data and valid informed consent (16). Appropriate precautions were undertaken to maintain the privacy of the patients in accordance with current HIPAA regulations.

Assignment

Patients were sorted into 6 age-related groups, Group I: aged 18 – 30 years, Group II: aged 31 – 40 years, Group III: aged 41 – 50 years, Group IV: aged 51 – 60, Group V: 61 – 70 years, and Group VI: greater than 70 years of age.

Inclusion Criteria

Inclusion criteria were patients between the ages of 18 – 90 years undergoing controlled comparative local anesthetic blocks for chronic persistent neck or low back pain of ≥ 6 months duration that was nonspecific, rather than radicular in nature (16). Patients who were assessed by radiologic and neurologic testing to have disc-related pain with radicular symptoms were excluded. All patients included in this study had failed prior conservative management, including physical therapy, chiropractic manipulation, exercise, drug therapy, and/or bedrest.

Evaluation

All patients had a complete medical work-up which included a comprehensive history, physical examination, and evaluation of any/all prior procedures and investigations.

Diagnostic Facet Joint Nerve Blocks

Facet joint pain was initially assessed in all patients by diagnostic blocks using 1% lidocaine, followed by 0.25% bupivacaine if the responses to lidocaine were positive on 2 separate occasions, usually 3 to 4 weeks apart (16). In all cases, intravenous access and light sedation with midazolam was provided. Each facet joint nerve was infiltrated with 0.5 mL of lidocaine or bupivacaine. The blocks (with a minimum of 2 levels to block a single joint) were performed on the ipsilateral side in patients with unilateral pain or bilaterally in patients with bilateral or axial pain under fluoroscopy.

A positive response was defined as 1) at least an 80% reduction of pain; 2) the ability to perform previously painful movements (as assessed using a verbal numeric pain rating scale) (16); and 3) pain relief from a block lasting at least 2 hours when lidocaine was used and at least 3 hours (or longer than the duration of relief with lidocaine), when bupivacaine was used. Any/all other responses were considered to be negative outcome(s).

Statistical Analysis

Data were recorded on a Microsoft® Access® 2003 database. Statistical analyses were performed using the SPSS, version 9.0 Statistical Package. Prevalence and 95% confidence intervals (CI) were calculated according to methods described by Miettinen. The distribution of categorical variables in each group was compared using the Chi-squared test. Fischer's exact test was used whenever the expected value was less than 5. Continuous data were presented as mean and standard error (SE), and range. One-way analysis of variance (ANOVA) was used to compare the means, and Bonferroni tests were used to make multiple comparisons. Results were considered statistically significant at a p value < 0.05.

Results

Demographic Characteristics

Table 1 illustrates the demographic characteristics of patients evaluated for lumbar facet joint pain (depicted as 6 groups, showing differences in gender, height, weight, duration of pain, onset of pain, and history of previous surgery). There were no significant differences noted between these groups with regards to gender, height, and weight. However, duration of pain was longer in Groups III, V, and VI (i.e., middle aged and older patients) as compared to Group I (i.e.,

Table 1. *Demographic characteristics of patients evaluated for lumbar facet joint pain.*

		Age Group						P value
		Group I 18 – 30 yrs	Group II 31 – 40 yrs	Group III 41 – 50 yrs	Group IV 51 – 60 yrs	Group V 61 – 70 yrs	Group VI > 70 yrs	
Number		53	51	86	43	39	31	
Gender	Male	36% (19)	39% (20)	45% (39)	46% (20)	23% (9)	32% (10)	0.189
	Female	64% (34)	61% (31)	55% (47)	54% (23)	77% (30)	68% (21)	
Height (inches)	Range	59 – 76	59 – 76	58 – 76	57 – 72	60 – 75	58 – 75	0.433
	Mean ± SEM	66.9 ± 0.5	67.2 ± 0.5	66.9 ± 0.4	66. 5± 0.6	65.6 ± 0.6	66.2 ± 0.8	
Weight (lbs)	Range	97 – 342	115 – 427	105 – 327	115 – 308	99 – 326	106 – 390	0.433
	Mean ± SEM	184 ± 7.4	194 ± 8.1	188 ± 5.4	192 ± 6.6	191 ± 8.4	170 ± 9.3	
Duration of pain (months)	Range	6 – 203	6 – 398	6 – 430	6 – 411	6 – 417	6 – 413	0.001
	Mean ± SEM	60 ± 7.4	86 ± 10.4	120* ± 12.3	118 ± 19.4	142* ± 20.1	133* ± 22.4	
Mode of onset of pain	Gradual	51% (27)	35% (18)	50% (43)	44% (19)	77% (30)	87% (27)	0.000
	Following an incident	49% (26)	65% (33)	50% (43)	56% (24)	23% (9)	13% (4)	
Distribution of pain	Left	7% (4)	8% (4)	14% (12)	2% (1)	8% (3)	16% (5)	0.101
	Right	2% (1)	12% (6)	15% (13)	14% (6)	8% (3)	19% (6)	
	Bilateral	91% (48)	80% (41)	71% (61)	84% (36)	84% (33)	65% (20)	
Previous surgery		7% (4)	25% (13)	20% (17)	14% (6)	39% (15)	19% (6)	0.009

* indicates significant difference with <30 age group values
Pairwise comparisons between group means was tested with the Bonferroni test.

younger patients). Mode of onset of pain also significantly differed between the groups, with gradual onset following a defined provocative incident seen in a higher proportion of the patients in Group II, whereas gradual onset (without incident) was seen in a greater proportion of the patients in Groups V and VI.

Table 2 illustrates the demographic characteristics of patients evaluated for cervical facet joint pain. There were no differences noted in any of the demographic parameters.

Prevalence of Facet Joint Pain

Tables 3 and 4 demonstrate prevalence of facet joint pain, along with false-positive rates of single local anesthetic blocks. The tables illustrate the number of patients undergoing single and double blocks with the number of patients having positive responses to double blocks, serving as the estimating factor for the prevalence rate. Tables 3 and 4 also illustrate the number of patients undergoing lidocaine blocks and the patients undergoing a second confirmatory bupivacaine block. All the patients in the study first underwent single block. The patients underwent a second block. The number of patients listed under the positive row for each age group were the patients who underwent both lidocaine and bupivacaine blocks, whereas patients in the negative row under the single block under each age group are the patients who tested negative for a single block of lidocaine. Table 3 illustrates the results of diagnostic blocks evaluating facet joint pain in the cervical spine across the multiple age groups assessed. The prevalence of facet joint pain was the lowest (33%) in Group VI and highest (42%) in Group I, yet there were no significant differences in prevalence noted between the groups.

Table 4 illustrates the results of diagnostic blocks evaluating facet joint pain in the lumbar spine across multiple age groups. The prevalence ranged from 18% (in Group II) to 44% (in Group IV). There were signifi-

Table 2. Demographic characteristics of patients evaluated for cervical facet joint pain.

		Age Group						
		Group I 18 – 30 yrs	**Group II 31 – 40 yrs**	**Group III 41 – 50 yrs**	**Group IV 51 – 60 yrs**	**Group V 61 – 70 yrs**	**Group VI > 70 yrs**	***P* value**
Number		43	48	78	42	28	12	
Gender	Male	23% (10)	27% (13)	32% (25)	45% (19)	39% (11)	8% (1)	0.100
	Female	77% (33)	73% (35)	68% (53)	55% (23)	61% (17)	92% (11)	
Height (inches)	Range	61 – 76	59 – 73	58 – 76	60 – 74	60 – 75	61 – 70	0.590
	Mean ± SEM	66.4 ± 0.7	66.6 ± 0.5	66.3 ± 0.5	66.8 ± 0.6	66.5 ± 0.7	64.4 ± 0.7	
Weight (lbs)	Range	118 – 342	120 – 427	105 – 316	115 – 308	99 – 320	108 – 200	0.278
	Mean ± SEM	186 ± 7.9	187 ± 7.7	174 ± 4.9	181 ± 5.9	186 ± 9.5	159 ± 7.5	
Duration of pain (months)	Range	6 – 240	6 – 315	6 – 335	6 – 338	6 – 333	6 – 301	0.110
	Mean ± SEM	54 ± 8.3	83 ± 10.4	89 ± 9.4	103 ± 15.2	94 ± 19.0	105 ± 29.0	
Mode of onset of pain	Gradual	49% (21)	52% (25)	50% (39)	55% (23)	75% (21)	75% (9)	0.152
	Following an incident	51% (22)	48% (23)	50% (39)	45% (19)	25% (7)	25% (3)	
Distribution of pain	Left	7% (3)	23% (11)	17% (13)	12% (5)	11% (3)	25% (3)	0.591
	Right	14% (6)	17% (8)	14% (11)	10% (4)	11% (3)	8% (1)	
	Bilateral	79% (34)	60% (29)	69% (54)	78% (33)	78% (22)	67% (8)	
Previous surgery		7% (3)	15% (7)	19% (15)	29% (12)	25% (7)	8% (1)	0.113

Table 3. *Results of single and double cervical facet joint nerve blocks (single blocks with lidocaine and double blocks with lidocaine and bupivacaine).*

	Age Group												Total (251)	
	Group I 18 – 30 yrs (43)		**Group II 31 – 40 yrs (48)**		**Group III 41 – 50 yrs (78)**		**Group IV 51 – 60 yrs (42)**		**Group V 61 – 70 yrs (28)**		**Group VI > 70 yrs (12)**			
	Double Blocks		Double Blocks		Double Blocks		Double Blocks		Double Blocks		Double Blocks		Double Blocks	
Single blocks	pos.	neg.	pos.	neg.	pos.	neg.	pos.	neg.	pos.	neg.	pos.	neg.	pos.	neg.
Positive	18	12	17	14	31	20	17	13	10	14	4	5	97	78
Negative		13		17		27		12		4		3		76
Prevalence (95% CI)	42% (27% - 57%)		35% (22% - 49%)		40% (29% - 51%)		41% (25% - 56%)		36% (18% - 54%)		33% (6% - 61%)		39% (32% - 45%)	
False positive rates (95% CI)	40% (22% - 58%)		45% (27% - 63%)		39% (26%- 53%)		43% (25% - 61%)		58% (38% - 78%)		56% (22% - 89%)		45% (37% - 52%)	

No significant difference between groups with respect to Prevalence or False Positive Rates

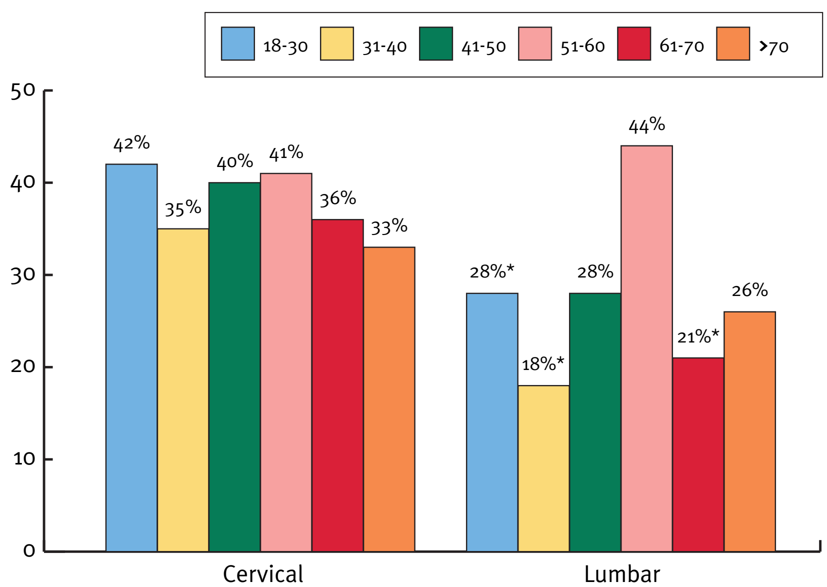
Note: * With single blocks 175 (97 + 78) patients with neck pain had positive responses. # With double blocks 97 with neck pain had positive responses.

Table 4. *Results of single and double lumbar facet joint nerve blocks (single blocks with lidocaine and double blocks with lidocaine and bupivacaine).*

	Age Group												**Total (303)**	
	Group I 18 – 30 yrs (53)		**Group II 31 – 40 yrs (51)**		**Group III 41 – 50 yrs (86)**		**Group IV 51 – 60 yrs (43)**		**Group V 61 – 70 yrs (39)**		**Group VI > 70 yrs (31)**			
	Double Blocks		Double Blocks		Double Blocks		Double Blocks		Double Blocks		Double Blocks		Double Blocks	
Single blocks	pos.	neg.	pos.	neg.	pos.	neg.	pos.	neg.	pos.	neg.	pos.	neg.	pos.	neg.
Positive	15	10	9	9	24	20	19	8	8	14	8	6	83	67
Negative		28		33		42		16		17		17		153
Prevalence (95% CI)	28% (16% - 41%)		18%* (7% - 28%)		28% (18% - 38%)		44% (29% - 59%)		21%* (8% - 33%)		26% (10% - 42%)		27% (22% - 33%)	
False positive rates (95% CI)	40% (20% - 60%)		50% (26% - 74%)		45% (30% - 60%)		30% (12% - 47%)		64%* (43% - 84%)		43% (16% - 69%)		45% (36% - 53%)	

No significant difference between groups with respect to Prevalence or False Positive Rates
* - indicates significant difference with 51 – 60 age group values

Note: * With single blocks 150 (83 + 67) patients with lumbar pain had positive responses. # With double blocks 83 with lumbar pain had positive responses.



* – Indicates significant difference between < 30 and 31 – 40 year age group compared to 51 – 60 age group

Fig. 1. Illustration of prevalence of cervical and lumbar facet joint pain.

cant differences noted in prevalence when Group II and Group III were compared to other groups.

Figure 1 illustrates the prevalence of facet-joint involvement in cervical and lumbar spinal pain across the various ages assessed.

False-Positive Rates

Tables 3 and 4 illustrate false-positive results. False-positive rates were calculated by assuming that all patients who failed to respond to lidocaine were reflective of a true negative response, all patients showing a positive response to lidocaine and a negative response to bupivacaine were considered to be false-positives, and a positive response to both lidocaine and bupivacaine were classified as true positive responses.

As shown in Table 3, false-positive rates for cervical facet joint blocks with a single block were Group I: 40%, Group II: 45%, Group III: 39%, Group IV: 43%, Group V: 58%, Group VI: 56%, with an overall (mean) false-positive rate of 45%. There were no significant differences in the false-positive rates noted between the groups. Table 4 illustrates false-positive rates for lumbar facet joint blocks among various age groups. The lowest false-positive rate was seen in Group IV (30%) while highest was in Group V (64%), with Group V being significantly greater compared to other groups. Figure 2 illustrates the false-positive rates for diagnostic block responses in the cervical and lumbar spine.

Discussion

This retrospective evaluation of patients with chronic non-specific spinal pain involving the cervical and/or lumbar regions demonstrated a prevalence of facet-joint involvement of 35% to 42%, in patients with neck pain, with false-positive rates of 40% to 56%. The prevalence of facet-joint involvement was 18% to 44% in the lumbar spine, with false-positive rates ranging from 30% to 64% across age groups. These results illustrate that while minor differences exist (e.g. differences in the cervical region with Group IV), the prevalence of facet-joint involvement in neck and low back pain is relatively similar in young, middle-aged, and older patients.

These results differ from those of previous studies that showed a significantly higher prevalence of facet joint-related pain in the elderly (30). Despite this, the present study reaffirms that involvement of the facet joint(s) is a major cause of chronic spinal pain in both the cervical and lumbar regions. Moreover, this is the first study to provide age-related prevalence of facet-joint involvement in cervical spinal pain. As well, while arthrosis has been most commonly reported at L4/5 facet joints, the present study revealed that facet-joint involvement appears to frequently occur at both the L4/5 and L5/S1 levels.

Facet joints have been shown to be a source of chronic spinal pain by means of diagnostic techniques of known reliability and validity (1,15-23) utilizing

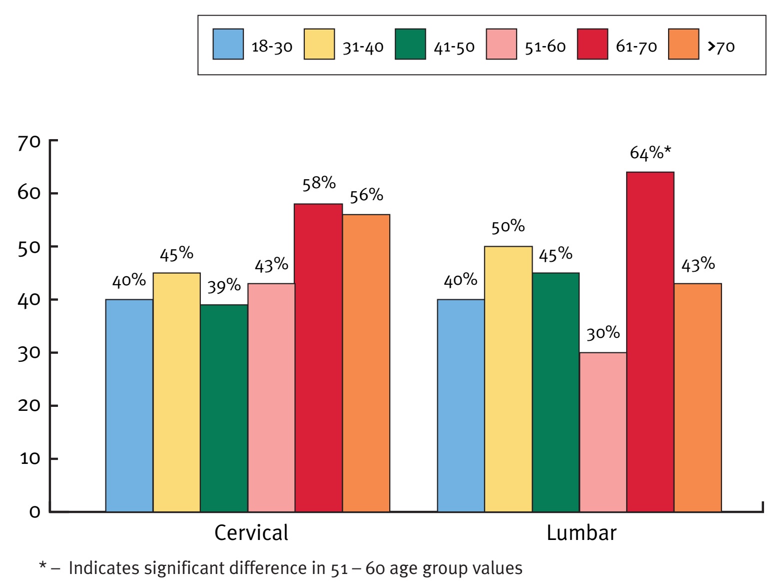


Fig. 2. Illustration of false-positive rates in cervical and lumbar spine.

criteria established by IASP (24). Blocks of facet joints are performed to test the hypothesis that the target joint is a source of the patient's pain and the joint is anesthetized generally by the facet joint blocks of the nerves that innervate the target joint. Consequently, painful joints are identified by true-positive responses by means of controlled diagnostic blocks, generally with controlled comparative local anesthetic blocks utilizing 2 local anesthetics on 2 separate occasions anesthetizing the same joint. Further, the value and validity of medial branch blocks and comparative local anesthetic blocks in the diagnosis of facet joint pain has been demonstrated. In addition, specifically in the elderly, there are no clinical features or diagnostic imaging studies that can determine whether a facet joint is painful or not, leading us to depend on controlled diagnostic blocks as the only available reliable tool in the diagnosis of chronic spinal pain.

This study may be criticized for a small number of patients in certain groups after allocating them into 6 groups. Further, rationale of allocation into 6 groups may be questioned as we do not have any specific evidence of radiologic changes or prevalence of facet joint pain based on changes in every 10 years. However, this allocation appeared to be better than simply demarcating the patient's above and below 65 years of age even though it consequently resulted in a small proportion of patients in certain age groups. Since the basic sample is large, we believe that the results are appropriate and accurate in providing information with regards to age-related prevalence of facet joint pain.

Conclusion

The present study demonstrated the prevalence of facet-joint involvement in chronic low back pain variable from 18% (Group II aged 31 – 40 years) to 44% (Group IV aged 51 – 60 years). Despite this variance, these differences were not significant, and there were no other significant differences in the prevalence of facet-joint involvement between age groups of patients. False-positive rates varied from a low of 30% to a high of 64% (Group V). The prevalence of facet-joint involvement in chronic neck pain ranged from 33% (Group VI) to 42% (Group I), and false-positive rates ranged from 39% (Group III) to 58% (Group V). Overall, despite minor variations, this study showed a lack of correlation between age and the prevalence of facet-joint involvement in either cervical or lumbar pain.

Acknowledgments

The authors wish to thank Tonie D. Hatton, Sherry Loveless, and Diane E. Neihoff for editorial assistance and Rajeev Manchukonda for technical assistance in preparation of this manuscript. We would also like to thank the editorial board and associate editors for their constructive suggestions and criticisms.

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