

The Value of the Provocation Response in Lumbar Zygapophyseal Joint Injections

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Abstract:

Objective: To determine the relationship between pain provocation and the analgesic response in lumbar zygapophyseal joint blocks.

Design: Consecutive patients undergoing intraarticular zygapophyseal joint blocks for the investigation of low back pain were included in this prospective study.

Setting: The referred sample was from the metropolitan areas of New Orleans and San Francisco.

Patients: Ninety patients with low back pain of >3 months' duration and no history of lumbar surgery.

Interventions: All patients underwent one or more intraarticular injections of radiographic contrast followed by lignocaine (lidocaine) 2% into zygapophyseal joints between L2-3 and L5-S1. Those with definite responses at one or more levels underwent confirmatory blocks using 0.5% bupivacaine.

Outcome measures: Provocation of familiar pain and relief of pain after the injection of local anesthetic. Patients were assessed by an independent observer.

Results: A total of 203 joints were studied. Adopting liberal criteria, either exact or similar reproduction of pain on the one hand correlated with either definite or complete relief of pain after a single, analgesic block on the other ($p < 0.0001$). However, when more stringent criteria were adopted, such as response to a confirmatory block using bupivacaine, there was no significant association.

Conclusions: This study calls into question the validity of pain provocation alone as a criterion standard in patients undergoing diagnostic lumbar zygapophyseal joint blocks.

Key Words: Zygapophyseal joint—Low back pain—Local anesthetic provocation.

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Whether or not lumbar zygapophyseal joint pain is a valid entity remains controversial. It continues to attract adherents (1-17) and detractors (18-21). Fundamental to this controversy is how lumbar zygapophyseal joint pain should be diagnosed. A number of studies have shown that clinical examination is of no value (10,16-18,22).

In some quarters, pain reproduction after the in-

traarticular administration of radiographic contrast has been advocated as a worthwhile substitute for local anesthetic blocks (4,5,8,23,24) and has been used in formal studies as a diagnostic criterion (13,25). In principle, pain provocation can be construed as an extension of physical examination. A needle substitutes for the examining finger and is used to probe otherwise inaccessible, deep spinal tissues for the source of pain. Reproducing pain by stressing a lumbar zygapophyseal joint is analogous to finding focal tenderness in the examination of a joint in the appendicular skeleton. Although this paradigm has been adopted by some, its validity has never been formally tested.

A competing paradigm is that if a given joint is a source of pain, then anesthetization of that joint should relieve that pain. The argument becomes more compelling if the pain is relieved by controlled, diagnostic blocks to eliminate placebo responses and other false-positive responses (16,26,27). Diagnostic local anesthetic blocks, therefore, provide a suitable criterion standard against which to evaluate the validity of pain provocation as a diagnostic test for lumbar zygapophyseal joint pain.

If pain provocation is a valid measure, it should correlate well with the results of diagnostic blocks. Conversely, a lack of correlation would impugn pain provocation. Our study explored this correlation. The hypothesis tested was that pain provocation provides a consistent relationship with the response to controlled local anesthetic blocks of the lumbar zygapophyseal joints.

PATIENTS AND METHODS

The study population consisted of 90 consecutive patients with low back pain of >3 months' duration who underwent intraarticular zygapophyseal joint injections. All patients were seen between April 1992 and October 1992 at either a radiology practice in New Orleans specializing in spinal pain or a specialist spine center in San Francisco. The patients were drawn from the metropolitan areas of New Orleans or San Francisco, but there were also some interurban and interstate referrals. All had been referred by neurosurgeons, orthopaedic surgeons, and physiatrists because noninvasive investigations had not been diagnostic and, in the opinion of the referring physician, the patients' pain was severe enough to warrant invasive investigations. Patients younger than 18 or older than 80 years and those who had previously undergone lumbar surgery or

who exhibited neurological signs were excluded. Patients included in the study were restricted to categories 1, 2, or 3 in the classification used by the Quebec Task Force for activity-related spinal disorders (28) as recommended by Deyo (29).

There were 59 men and 31 women, whose median age was 37 years (interquartile range, 31.6 to 44.6) and whose median duration of back pain was 15 months (interquartile range, 9.0 to 29.5). The cause of back pain was work related in 53% and followed a motor vehicle accident in 27%. Pain of other causes accounted for the remaining 20% of patients. Worker's compensation or third-party insurance coverage was present in 84%. Pain was unilateral in 59%, central in 9%, and bilateral in 32%.

Zygapophyseal joints were investigated with intraarticular injections using lignocaine (lidocaine). All injections were performed under fluoroscopic control. They were performed on the ipsilateral side in patients whose pain was unilateral, or bilaterally in patients with bilateral pain or central pain. Some patients with bilateral pain received unilateral injections because their pain, on the day of the procedure, was predominantly unilateral. Blocks were initiated at the segmental level of maximal pain and spinal tenderness, which was determined under fluoroscopy. If L5-S1 was the site of maximal tenderness, then the procedures were carried out at this level followed by joints at L4-5 and then L3-4. If L4-5 was the site of maximal tenderness, then L4-5 was injected first, followed by L5-S1 and then L3-4. If L3-4 was the site of maximal tenderness, then the order of injections was L3-4, L4-5, and L5-S1. If the patient's pain was experienced higher in the lumbar area, the L2-3 joints were also injected. In patients in whom there was a lumbarized sacral segment, the zygapophyseal joints at this level were injected. If the site of maximal tenderness was the posterior superior iliac spine or over the sacroiliac joint, then the L5-S1 joint was injected first, followed by L4-5 and then the sacroiliac joint.

The procedures were performed with the patient lying in an oblique, prone position on a fluoroscopy table. The skin overlying the joint was prepared using an iodine-based antiseptic solution, and the area was draped. Using standard techniques (30) under intermittent fluoroscopic guidance, a 20-, 22-, or 25-gauge 3.5-inch spinal needle was then used to gain access to the cavity of the target joint. Precise needle placement was verified with 0.3 ml of contrast medium. This was followed by the injection of 0.5 ml of 2% lignocaine. The joint was slowly injected

until a resistance was felt and imaging confirmed the absence of extracapsular leakage. There is no published evidence that extracapsular leakage of local anesthetic occurs when volumes of 0.5 ml are injected. Even in the event of leakage, only a fraction of the 0.5 ml of injected local anesthetic could reach targets such as the epidural space. There are no grounds, nor any evidence, for believing that such a small amount of local anesthetic in the epidural space can relieve low back pain.

An independent observer graded patient responses to intraarticular injection either as unfamiliar pain, no pain, similar pain, or exact pain reproduction. Exact pain reproduction constituted pain of significant intensity whose character and distribution was the same as the pain from which the patient was complaining. Ten minutes after the blocks with lignocaine, the patient was examined and was asked to walk around and perform previously painful movements. Responses to the blocks were graded as "worse," "no change," "partial," "definite," and "complete" relief. A partial response constituted a minor improvement in pain consistent with fluctuations in pain to which the patient was accustomed. A definite response was defined as a substantial and unexpected loss of pain in the symptomatic area. A complete response was defined as total relief of pain. If patients had less than a complete response, the next segmental level was investigated, and a similar assessment of response was performed, to a maximum of three levels. If patients obtained a definite or complete response at one or more segmental levels from the screening procedures with lignocaine, they were asked to return 2 weeks later to undergo a confirmatory block using 0.5% bupivacaine. This injection was performed at the level where there was the greatest relief from the block with lignocaine. A positive response from the injection of bupivacaine was defined as a >50% improvement in pain on the visual analogue scale, maintained for at least 3 h.

All data were recorded on a database using Epi Info (31). The Data Analysis component of Epi Info was used for frequencies and contingency tables. All other analyses were performed using Statistix (32). The chi-squared statistic was used to determine the relationship between discrete variables. In view of the number of tests performed, a relationship was considered significant when the *p* value was <0.01.

The response to provocation of zygapophyseal joints was evaluated as a diagnostic test by compar-

ing it to the criterion standard of response to lignocaine followed by bupivacaine. A two by two contingency table was used to derive sensitivity, specificity, positive predictive value, and negative predictive value according to accepted methods (33).

RESULTS

In all, provocation data were obtained on 229 injections at 203 levels in 90 patients. Injections were performed bilaterally at 26 segmental levels, and 177 were performed unilaterally. Intraarticular injections were performed at the following levels and at the following frequencies: four at L2-3, 40 at L3-4, 73 at L4-5, 83 at L5-S1, and three at S1-S2. Forty-six patients (51%) obtained definite relief or greater after blocks with lignocaine. Sixteen of these patients responded to subsequent, confirmatory blocks with bupivacaine, but 30 did not. For the purpose of subsequent analysis, in those patients in whom an analgesic response was obtained at one or more joints, all other joints were considered to be negative (i.e., not a source of pain).

The strength of correlations between pain provocation and analgesic response varied according to the stringency of criteria applied for positive provocation and positive analgesic response.

Adopting liberal criteria, either exact or similar reproduction of pain on the one hand correlated with either definite or complete relief of pain after a single, analgesic block on the other (Table 1). However, a different association emerged if more stringent criteria were applied.

There was a strong association between exact pain reproduction and complete response to local anesthetic, but in a negative sense (Table 2) (i.e., failure to reproduce exact pain was predictive of failure to relieve pain, but not the opposite).

Still more stringent criteria provided dismal associations. There was no significant association be-

TABLE 1. A two-by-two contingency table demonstrating the association between response to provocation and response to single, uncontrolled, local anesthetic blocks

	Response to single blocks	
	Relief ^a	No relief
Exact or similar pain provocation	42	38
Dissimilar or none	27	96

^a Relief is defined as definite or complete relief ($\chi^2 = 20.16$; $p = 0.000$).

TABLE 2. A two-by-two contingency table demonstrating the association between response to provocation and response to a single, uncontrolled, local anesthetic block

	Response to single blocks	
	Complete relief	<Complete relief
Exact pain provocation	7	23
Any other response	13	160

$$\chi^2 = 7.20; p = 0.007.$$

tween either exact or similar reproduction of pain and relief of pain by controlled, double blocks of the joint (Table 3). Under these conditions, the same proportion of patients responded to provocation as did not, irrespective of whether or not they responded to analgesic blocks. Using double blocks as the criterion standard, the sensitivity and specificity of provocation as a diagnostic test were $\leq 50\%$. For the prevalence in the population studied, the positive predictive value of this test was 16% and, using the 95% confidence limits, was at best 26%.

DISCUSSION

Given the data from our study, it is easy to understand how investigators might be lulled into crediting pain provocation as a legitimate sign of lumbar zygapophyseal joint pain. A substantial number of patients who suffer some form of pain-reproduction subsequently experience some form of relief after single diagnostic blocks (Table 1); the results are quite different when more stringent criteria are applied (Table 2).

However, it must be recognized that single, uncontrolled, diagnostic blocks are unreliable as a diagnostic criterion because they carry a 32% placebo

TABLE 3. A contingency table demonstrating the association between response to provocation and response to double blocks of the zygapophyseal joints using lignocaine on one occasion and bupivacaine on another

	Response to double blocks	
	Relief	No relief
Exact or similar pain provocation	8	42
Dissimilar or none	8	32

Sensitivity, 50% (95% CI, 37-63%); specificity, 43% (95% CI, 31-55%); positive predictive value, 16% (95% CI, 6-26%); negative predictive value, 80% (95% CI, 67-93%). False positive rate, 57% (95% CI, 45-69%).

CI, confidence interval.

rate (16) and a 38% false-positive rate (27). Correlating provocation to single blocks is therefore, at best, capricious and at worst, meaningless.

When the most stringent criteria are applied for the diagnosis of lumbar zygapophyseal joint pain, the association with pain provocation disappears. Pain provocation does not identify those joints that respond to double blocks of the joint (Table 3).

The results of our study pertain only to the population studied. The patients in this study were predominantly men of median age 37 years whose back pain was work related or followed a motor vehicle accident. Such results may not apply to an older population whose back pain is not related to some traumatic event. Furthermore, the positive predictive value of a test is related to the prevalence of the condition. In our study, only in 16 of 90 patients (18%) was pain diagnosed as arising from zygapophyseal joints. In a different population, with a higher prevalence of the condition, the positive predictive value of provocation might have been more favorable. Therefore, these results may have to be treated with caution when applied to an entirely different study population, such as elderly women.

Defenders of pain provocation might argue that in our study, insufficient volumes were used to distend the joints to produce pain. Were this the case, the study would have been biased toward finding fewer positive responses, which includes false-positive as well as true-positive responses. This was not the case. False-positive responses were very common (Table 3). To have achieved a false-positive rate of 57%, the stimuli used in our study must have been adequate to produce a pain response. Stronger stimuli could not have improved the observed lack of correlation between provocation and analgesia, for any gain in true-positive rates would have been offset by an increase in the false-positive rate.

The fallibility of pain provocation lies in its propensity to false-positive responses. It seems that the back pain of a large proportion of patients is aggravated by stressing their zygapophyseal joints, even though the joints are not the actual source of their pain. Whether this sensitivity is psychological or neurophysiological is immaterial for diagnostic procedures. The imperative is that any diagnostic procedure must be controlled for false-positive responses regardless of the mechanism. Pain provocation as practiced in the context of lumbar zygapophyseal joint pain does not control for false-positive responses and, for that reason, cannot be used as a diagnostic criterion.

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