Lumbar Zygapophyseal Joint Injections in Patients with Chronic Lower Back Pain

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Background: This study was designed to assess the diagnostic value and clinical benefits of lumbar zygapophyseal joint injections in patients with chronic lower back pain.

Methods: Two hundred and seventy-seven patients (136 males and 141 females, aged 15–82 years) with chronic lower back pain were enrolled in the trial and met the following criteria: pain for more than 1 year; no root signs; and no history of back surgery. Under fluoroscope, a 0.8–1.5 mL mixture of lidocaine, betamethasone dipropionate and iopamidol (1:1:0.5) was injected into each joint after intra-articular localization of the needle tip was confirmed. A questionnaire with a pain scale was administered immediately or the day after injection, and then after 1, 3, 6 and 12 weeks. Partial arthrograms were reviewed by a radiologist.

Results: Four hundred and forty-nine joint injections were performed in 277 patients (L3–4, *n* = 76; L4–5, *n* = 272; L5–S1, *n* = 101). Bilateral injections were performed in 117 patients (42.2%). The study group comprised 204 patients (73.6%) with an excellent or good response, whereas the control group comprised the remaining 73 patients (26.4%). The rates of good response in the study group were 72.1% (147/204) after 3 weeks, 40.7% (83/204) after 6 weeks, and 31.4% (64/204) after 12 weeks. Partial arthrograms revealed 25 patients (9.0%) with synovial cysts (L3–4, *n* = 3; L4–5, *n* = 14; L5–S1, *n* = 8); 23 of these patients (92.0%) had a good response to the injections. Five of the 6 patients with spondylolysis (83.3%), having abnormal communication between the injected and contiguous joint, had a good response to the injections. The abovementioned, abnormal partial-arthrogram findings correlated significantly with the rate of good response to the injections. Although 3 patients had contrast medium extravasated into the epidural space during injection, none of the 277 patients had deteriorating lower back pain after the injections.

Conclusion: Lumbar zygapophyseal joint injections, as a useful diagnostic tool for facet joint syndrome, could also have useful palliative effects in the management of chronic lower back pain. [*J Chin Med Assoc* 2005;68(2):59–64]

Key Words: arthrography, lower back pain, zygapophyseal joint

Introduction

The lumbar zygapophyseal joints, conveniently called lumbar facet joints, are some of the areas potentially affected in lower back pain.[1–3] Indeed, lower back pain originating from zygapophyseal joints is a kind of somatic pain and can radiate to the lower extremities. It may easily be confused with radicular pain, which results primarily from disk problems, and cannot be differentiated from other kinds of somatic pain of discogenic or other origin.[3] There are no noninvasive radiographic or clinical examinations to identify the zygapophyseal joints as sources of lower back pain. Analgesia from injection of anesthetics into the zygapophyseal joints or their nerve supplies has been accepted as the standard for diagnosing zygapophyseal joint pain,[4–9] and has also been accepted as providing partial or complete therapeutic relief of lower back pain. Here, we present a study of lumbar zygapophyseal joint injections, combined with partial arthrography,

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to assess the diagnostic value and clinical benefits in patients with chronic lower back pain.

Methods

Study participants

Study participants were selected consecutively from patients in our outpatient department with the principal complaint of chronic lower back pain. Commonly, the patients had focal pain, soreness or tenderness of the lower back, sometimes with referred pain to the lower extremities. Symptoms occurred intermittently and were often associated with trigger points or postures. The duration of lower back pain varied from 1 year to more than 20 years. Because of the long duration and complexity of symptoms, clinical histories were hard to trace precisely, and the triggering time or cause of lower back pain was difficult to define in most patients. However, all patients had a clinician-assessed history of lower back pain for more than 1 year. Patients were excluded for the following reasons: root signs, neural compression problems evident from previous imaging studies, if available, previous back surgery, or a history of inflammatory arthritides or spondyloarthropathies.

Injection procedure

The lumbar zygapophyseal joint selected for injection was matched to the patient's subjective orientation of maximal symptoms, according to the mapping of pain-referral patterns in symptomatic patients by Mooney and Robertson.[1] Bilateral zygapophyseal joint injections were related to patient self-complaints of pain. If such complaints were ambiguous in terms of positioning, we preferred to inject the 2 contiguous joints. Before the procedure, plain X-ray films of the lumbar spine, including anteroposterior and lateral projections, were reviewed to determine the exact lumbar level of injections, and to ensure there was no vertebral bone disease. Patients were placed in the prone position with a pillow under the belly. After local aseptic and anesthetic procedures, the zygapophyseal joint was approached posteriorly with a 23-gauge spinal needle under fluoroscope.[9,10] When the needle tip was advanced to touch the bone and was beneath the inferior articular facet of the upper vertebrae, a test dose of iopamidol (Iopamiro® 370, Bracco, Italy) was injected to confirm intra-articular needle localization. A 0.8–1.5 mL mixture of lidocaine, betamethasone dipropionate (Diprospan®, Schering-Plough, Heist-op-den-Berg, Belgium) and iopamidol (1:1:0.5) was then injected into the joint. The injected volume depended on the pressure sensation of the injected joint. Posteroanterior spot films of the lumbar spine after injection were obtained as "partial arthrograms" (not a direct arthrographic purpose) to identify distribution of the injected mixture (Figure 1). These procedures and reviews of partial arthrograms were done by 1 radiologist.

Pain assessment

A questionnaire with a 10-point visual analogue scale (VAS) for pain relief was administered to patients immediately or 1 day after injection, and then at 1, 3, 6 and 12 weeks. The degree of pain relief was compared with each patient's subjective description of pain before and after treatment (Table 1). Excellent or good responses (VAS score ≤ 5) to the injections after 1 week suggested that the chronic lower back pain was of zygapophyseal joint origin, and patients were included in the study group. Conversely, patients with fair or poor responses (VAS score ≥ 6) were assumed to have pain of non-zygapophyseal joint origin and were included in the control group. Changes in VAS scores in the study group at 3-, 6-, and 12-week follow-up visits were self-reported by patients in the outpatient clinic or by telephone.

Statistical analysis

The Student's *t* test and Chi-squared test were used for statistical analysis. Differences were considered statistically significant at a *p* value of less than 0.05. Percentile values, means, standard deviations, and prevalence values were obtained using Statistical Package for the Social Sciences version 11.0 (SPSS Inc, Chicago, IL, USA).

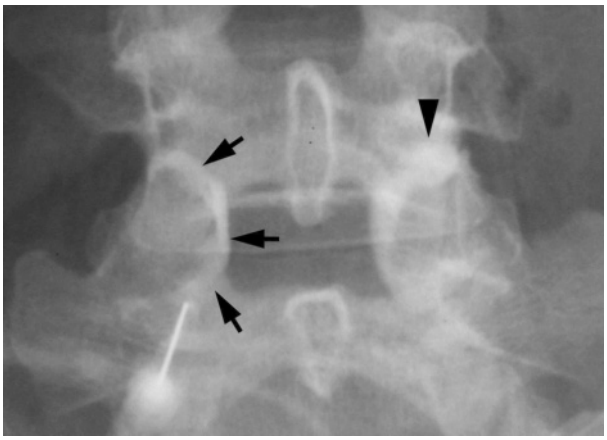

Figure 1. Spot posteroanterior film for a female patient placed in the prone position and showing the needle position and a normal arthrogram of the left L4–5 zygapophyseal joint (arrows). The arthrogram of the right L4–5 zygapophyseal joint revealed widening of the joint space and cystic accumulation of the injected mixture in the superior aspect (arrowhead).

Table 1. Patient self-reports of 10-point visual analogue scale (VAS) scores for pain versus clinical subjective judgments of pain relief

VAS score	Clinical judgment of pain relief	Patient's subjective description of pain relief
0, 1, 2	Excellent	Total, or almost total, relief of symptoms
3, 4, 5	Good	Obvious improvement and satisfied
6, 7, 8	Fair	Slight improvement, but unsatisfied
9, 10	Poor	No, or almost no, improvement of symptoms

Results

Patient demographics

Two hundred and seventy-seven patients (136 males and 141 females, aged 15–82 years) were enrolled in the study. In total, 449 joint injections were performed (L3–4, $n = 76$; L4–5, $n = 272$; L5–S1, $n = 101$). One hundred and thirty-seven patients had 1 injection, and the remaining 140 had more than 1 injection. Bilateral injections were performed in 117 patients (42.2%). The study group comprised 204 patients (73.6%; 103 males and 101 females; mean age, 45.4 ± 11.7 years) with an excellent or good response to treatment (VAS score ≤ 5). In the study group, 338 joints were injected (L3–4, $n = 59$; L4–5, $n = 206$; L5–S1, $n = 73$). Bilateral injections were performed in 85 patients (41.7%). Seventy-three patients (26.4%; 33 males and 40 females; mean age, 48.6 ± 12.7 years; $t = -1.925$, $p = 0.055$) comprised the control group: 43 patients with fair or poor responses to the articular injections; and 30 with recurring symptoms during the first week of follow-up. Bilateral injections were performed in 32 patients (43.8%; $\chi^2 = 0.104$, $p = 0.747$). One hundred and eleven joints (L3–4, $n = 17$; L4–5, $n = 66$; L5–S1, $n = 28$) were injected in the control group. The rates of good response in the study group were 72.1% (147/204) after 3 weeks, 40.7% (83/204) after 6 weeks, and 31.4% (64/204) after 12 weeks. Fifty-nine patients (28.9%) in the study group received radiofrequency rhizotomy; the time between injections and rhizotomy was 8–313 days (mean, 57.8 ± 18.3 days).

Arthrographic findings

The findings of partial arthrograms were isolated from clinical responses to the injections. An injection was considered peri-articular when most of the injected mixture was coming out of the articular boundary; the test dose was then resumed at the correct intra-articular positioning. Peri-articular injections occurred in 37 of the 277 patients (13.4%), i.e. in 22 of 272 (8.1%) L4–5 joints, and in 15 of 101 (14.9%) L5–S1 joints. There were 26 peri-articular injections in the study group versus 11 in the control group (12.7% vs 15.1%; $\chi^2 = 0.251$, $p = 0.617$). Abnormal partial arthrograms included synovial cysts of zygapophyseal joints, abnormal opacification of another joint, and extravasation of injected mixture into the epidural space. Pouch-like accumulation of contrast medium in the superior aspect of the zygapophyseal joint was considered to be a synovial cyst (Figure 1). Twenty-five of the 277 patients (9.0%) had synovial cysts on partial arthrograms (L3–4, $n = 3$; L4–5, $n = 14$; L5–S1, $n = 8$); 23 of these patients (92.0%; $\chi^2 = 0.416$, $p < 0.001$) had a good response to the injections. Six patients had abnormal communication between the injected and contiguous joint (Figure 2). We found bony defects in the pars interarticularis in these patients, 5 of whom (83.3%; $\chi^2 = 0.416$, $p < 0.001$) had a good response to the injections. The abovementioned, abnormal partial-arthrogram findings correlated with the rate of good response to the injections. We found iatrogenic extravasation of the injection mixture into epidural space in 3 patients, 2 of whom had a good response. None of the 277 patients complained of deteriorating lower back pain after the injections.

Discussion

Lower back pain is one of the most common complaints in clinical practice; its lifetime prevalence is estimated at 60–90%.[3,11–13] It can be classified into somatic and radicular lower back pain. Somatic pain is aching in quality, constant, and diffuse in position, but poorly localized; it results from noxious stimulation of a musculoskeletal component. Radicular pain is always shooting in quality, and band-like in position; it results from irritation of a spinal nerve or its roots. Diagnosis and identification of pain source are more difficult in somatic than radicular pain. The many sources of somatic back pain include disks *per se*, vertebrae, sacroiliac joints, zygapophyseal joints, dura mater, epidural plexuses, muscles, ligaments, and thoracolumbar fascia.[3] Pain from zygapophyseal joints is estimated to comprise 15–40% of somatic lower back pain.[3,14,15]

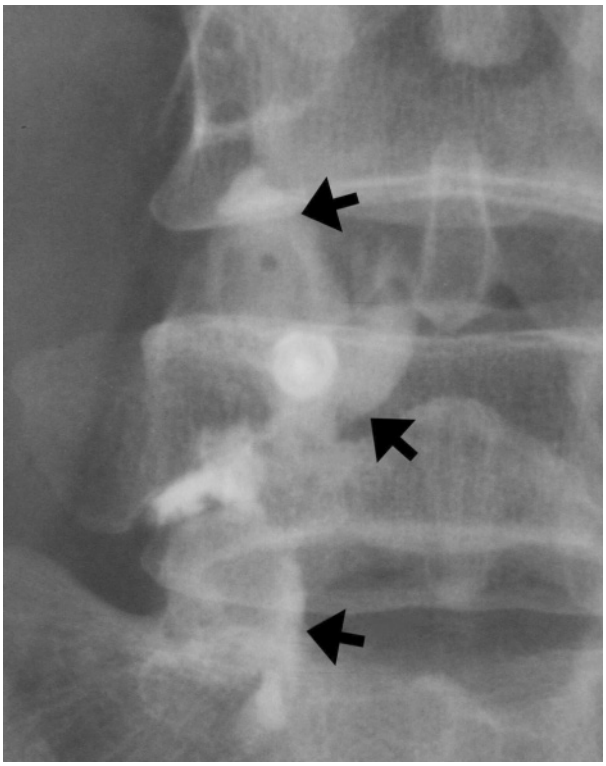

Figure 2. Spot posteroanterior film for a male patient with spondylolysis placed in the prone position and showing the needle positioned in the left L4–5 zygapophyseal joint (middle arrow), but opacification of L4–5 and L5–S1 in one injection (arrows).

There are many kinds of treatments, such as medical, herbal, physical, or chiropractic therapy, that may be helpful for somatic lower back pain. These treatments are also effective in many patients with lower back pain of unknown origin. Lumbar and sacroiliac injections can be helpful for other clinical entities, such as spondyloarthropathies or sacroilitis.[16] Since it is an invasive procedure, we reserve zygapophyseal joint injections for the late assessment of lower back pain. The present study focused on patients with chronic somatic lower back pain.

Zygapophyseal joints (apophyseal, facet or z-joints) are formed by articulation of the superior articular process of one vertebra with the inferior articular process of the one above. Pathophysiologically, zygapophyseal joints are heavily innervated areas that are subjected to high stress and strain. Resulting tissue damage or inflammation is likely to cause the release of chemicals that irritate nerve endings and result in lower back pain.[17] Possible mechanisms of zygapophyseal lower back pain include chronic synovial and/or capsular reaction to trauma, spinal instability, and degenerative osteoarthritis.

Goldthwait, in 1911, was the first to suggest lumbar zygapophyseal joints as potential sources of lower back pain.[18] Facet joint syndrome was used by Ghormley, in 1993, to depict lower back pain of zygapophyseal origin.[19] In 1963, Hirsh et al reproduced lower back pain by local injection of hypertonic saline into the zygapophyseal joints.[20] Mooney and Robertson, in 1976, documented relief of lower back pain by the injection of local anesthetic.[1] Subsequent investigations reported a wide range of relief rates, from 7.7–75.0%, based on responses to a single block, for zygapophyseal joint injections in patients with chronic lower back pain.[1,2,4–10,21–31]

The use of intra-articular corticosteroids has been suggested in several articles,[1,2,5,9,26,29] regardless of controversy. These studies reported long-term relief rates of 18–63% for intra-articular steroids in patients with back and referred leg pain. The clinical features or imaging studies available for diagnosing zygapophyseal joint pain have not yet been explored, and lumbar zygapophyseal joint injections for lower back pain still require much research. Nevertheless, injection of local anesthetics into the lumbar zygapophyseal joints, or their nerve supply, has become accepted as the standard for diagnosing zygapophyseal joint pain.[4–10,21–29]

Our study revealed that 73.6% of patients had at least 1 week's palliation of lower back pain after lumbar zygapophyseal joint injections. The subjective intensity of pain, especially that triggered by specific postures and/or motions, was much decreased after the blocks. We recommended this 1 week as the "golden period" for starting physical or other kinds of treatment. The rate of good response in our study group declined from 72.1% to 40.7% between the 3- and 6-week follow-up visits. This time was thought to be the most effective for steroid injection, but this requires further investigation. After 12 weeks' follow-up in the study group, the relief rate was 31.4%, which was consistent with a prevalence of 15–40% for somatic lower back pain of zygapophyseal joint origin.[3,14,15] There seemed to be a small percentage of patients who derived long-term benefit, and when we considered that patients had often received several unsuccessful treatments, it was encouraging to try lumbar zygapophyseal joint injections. Fifty-nine patients (28.9%) opted to receive further aggressive radiofrequency rhizotomy between 8 and 313 days (mean, 57.8 days) after injection. The 2 shortest durations between injection and rhizotomy were 8 and 14 days. These 2 patients wanted further vigorous treatment as soon as possible, because the effects of injection were beyond their expectations. We recommended radiofrequency rhizotomy for patients with 3 weeks' pain relief after zygapophyseal joint injection. We would consider radiofrequency neurotomy as the next step for pa-

tients benefiting from lumbar zygapophyseal joint injection.[32,33]

All injection procedures were performed by a radiologist. Peri-articular injections were made in none of the L3–4 joints, 8.1% of the L4–5 joints, and 14.8% of the L5–S1 joints. This revealed that, among the lumbar joints, L5–S1 was the most difficult to inject, perhaps because of the obtuse angle between the spinal needle and L5–S1 zygapophyseal joint. Fortunately, peri-articular injections did not decrease the efficacy of articular injections. Nine percent of patients had synovial cysts on partial arthrograms. This was considered an underestimate, because such arthrograms are not used for diagnosis. Most patients with synovial cysts had significantly good responses to the injections. We believe that synovial cysts developed in disordered or degenerated zygapophyseal joints. When a symptomatic zygapophyseal joint cyst is suspected, joint injection is the first and best choice for diagnosis and treatment.[34] We found abnormal opacification of a contiguous lumbar joint in 6 patients, and the injected mixture flowed into bony defects in the pars interarticularis.[35–37] It was statistically significant that 5 of these 6 patients (83.3%) had good responses to the injections, a rate that was compatible with previous reports for joint injection in spondylolysis. We found 3 patients with iatrogenic extravasation of injection mixture into the epidural space. Two of these patients had good responses, and none had worse symptoms after injection. The injection procedures were safe, and none of the 277 patients had worse lower back pain or complications after the injections.

In conclusion, our study showed lumbar zygapophyseal joint injections to be useful not only for diagnosing facet joint syndrome, but also for providing partial and temporary palliation in patients with chronic lower back pain. The injections also provided opportunities for patients to restart progressive physical rehabilitation or radiofrequency rhizotomy. As a minimally invasive, but safe, procedure, we recommend that lumbar zygapophyseal joint injections be reserved for the diagnosis and temporary palliation of chronic lower back pain.

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