Causes of False-Positive Medial Branch (Facet Joint) Blocks in Soldiers and Retirees, The

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Objective: The purpose of this study was to determine the factors associated with false-positive medial branch blocks (MBB), the nerve blocks used to diagnose facet arthropathy, in soldiers and retirees. Methods: The study subjects were 78 patients with chronic low back pain who underwent diagnostic MBB to determine whether or not the facet joints were pain generators. Radiofrequency denervation of these nerves was performed in all patients with positive responses. Patients who failed to obtain pain relief after the blocks (negative blocks) and those who obtained temporary pain relief after MBB but failed radiofrequency denervation (false-positive blocks) then proceeded to undergo discography. Based on patients' responses to diagnostic blocks, discography results, the presence of radicular pain, and previous back surgery, the data were analyzed to determine whether any of these variables correlated with false-positive MBB. Results: The presence of discogenic or radicular pain was not associated with a higher false-positive response rate to MBB. Conversely, the absence of discogenic pain was associated with a higher percentage of false-positive blocks. There was also a trend for patients with previous back surgery to have a higher falsepositive rate than those who had not undergone previous surgery. Conclusions: Although a high incidence of epidural and foraminal spread occurs during the performance of MBB, this is unlikely to be a significant cause of false-positive blocks.

Introduction

Facet arthropathy is a common cause of chronic low back pain (LBP), with its prevalence estimated at between 15% and 40%.1,2 Because there exists no pathognomonic radiologic, historical, or physical examination findings that allow one to definitively identify the lumbar zygapophyseal (L-z) joints as the pain generator in patients with LBP, the most accepted method of making the diagnosis of facet joint pain is with diagnostic blocks, either of the medial branches of the primary posterior rami innervating the L-z joints, or of the joints themselves.3 When diagnostic blocks indicate the facet joints to be the primary source of LBP, radiofrequency (RF) denervation of the medial branches has been demonstrated to be an effective longterm treatment.4,5 However, the specificity of diagnostic medial branch blocks (MBB) is not high, with false-positive rates ranging from 25% to 38%.5-7 The reasons for this vary according to the actual underlying diagnosis and probably include the spread of local anesthetic into the epidural space8 and the treatment of myofascial pain by the superficial injection of local anesthetic.9 Yet no study to date has attempted to correlate the specificity of MBB to the patients' underlying conditions.

To identify some of the causes of false-positive MBB, we sought to determine whether or not the presence of discogenic pain as evidenced by provocative discography, the presence of radicular pain, or previous back surgery was associated with false-positive MBB.

Methods

Our LBP treatment algorithm dictates that patients undergoing diagnostic discography whose symptoms are consistent with other possible causes be treated with nerve blocks first, owing to the lower risk involved. For those whose history and physical examination are consistent with L-z joint pain, these patients undergo MBB. Patients who do not respond to diagnostic MBB (negative diagnostic blocks) or those who respond and fail RF lesioning (RFL) of these nerves (hereafter defined as false-positive blocks) may then proceed to discography depending on their magnetic resonance imaging (MRI) findings and symptoms. To determine the association between discogenic pain, radicular pain, previous back surgery, and false-positive MBB, we conducted a retrospective study analyzing the medical records of patients who underwent both procedures.

After obtaining permission for this study from the Internal Review Board at Walter Reed Army Medical Center (WRAMC), the charts of 191 consecutive soldiers and military retirees who underwent diagnostic discography at WRAMC between August 1999 and July 2002 were retrospectively reviewed. Among these patients, 85 had undergone diagnostic MBB and were eligible for inclusion. Six patients with ambiguous medical records and one patient with a positive response to two diagnostic blocks who subsequently refused RF denervation were excluded, leaving 78 study patients (see Fig. 1 for study flow chart).

In addition to demographic data, the other variables recorded for analysis were response to MBB, and, if positive, RF denervation, the number of medial branches blocked, the presence or absence of discogenic pain, the presence or absence of radiculopathy, and previous back surgery.

MBBs

Inclusion criteria for performing diagnostic MBB were axial LBP with or without radiation into the legs, groin, or buttocks, and tenderness overlying the lumbar spine. Diagnostic L2-4 medial branch and L5 dorsal ramus blocks were performed with fluoroscopic guidance using 22- or 25-gauge needles by the technique described by Bogduk and Long10 (Fig. 2). Before placement of the needles, the skin at each entry point was anesthetized using 0.5 to 1 mL of 1% lidocaine with a 25-gauge needle. Patients with unilateral pain underwent unilateral blocks; those with bilateral pain received bilateral blocks. The number of blocks performed varied according to the patient's symptoms, with the majority being from L2-5. Three patients had blocks done at higher levels. After correct needle placement was confirmed, 0.5 mL of 5% buplvacaine or roplvacaine was injected at each level. After completion of all blocks, patients were instructed to engage in their normal daily activities and to maintain a written pain diary, with pain ratings on a O to 10 scale, every 30 minutes for 8 hours. In 19 patients whose response to blocks was interpreted as equivocal, diagnostic blocks were repeated with lidocaine at a later visit. To control for the presence of other spinal pathology, â‰¥50% pain relief was used as the criteria for a positive block.4,5 All patients reporting a positive response to MBB proceeded to RF denervation at their next appointment.

RF Denervation

RF denervation was performed as an ambulatory procedure using superficial local anesthesia and fluoroscopic guidance. With the C-arm intensifier positioned to confer a slightly oblique (10-15%) or anteroposterior view, 22-gauge SMK-C10 (Radionics, Burlington, MA) cannulas with 5-mm active tips were inserted until bone was contacted at the junction between the superior border of the transverse process and the superior articular process at all lumbar levels, and the junction of the ala and articular process of the sacrum for the L5 dorsal ramus. Whenever possible, the shaft of the electrode was placed so as to lie parallel to the nerve. At each level, correct placement was confirmed using electrostimulation at 50 Hz, with concordant sensation being noted at below 0.65 V in all patients, and under 0.5 V in most. Before lesioning, the absence of contractions in leg muscles was verified at three times the stimulation threshold. After electrode placement was deemed satisfactory, 0.5 mL of local anesthetic and steroid was injected through each cannula to reduce pain and prevent neuritis. The RF probe was then reinserted and a 60-second, 80Â° lesion was made using a RF generator (model RFG-3C; Radionics).

Each patient's response to RFL was recorded at his/her next appointment, 4 to 8 weeks after the procedure. A negative response was defined as less than 50% pain relief. Because only those patients without facet joint pain proceeded to discography, no study patient had a positive response to RFL. In five patients with symptoms strongly suggestive of facet disease (positive confirmatory blocks, tenderness overlying the facet joints, and pain markedly increased with lumbar extension), a second attempt at RF denervation was necessary to exclude the L-z joints as primary pain generators. Based on the response to diagnostic MBB and RF denervation, all patients were placed into one of two categories: negative diagnostic blocks or falsepositive diagnostic blocks (failed RF denervation).

Discography

The nature of our study dictated that all patients who underwent discography meet the criteria outlined for MBB. In addition, all patients had MRI evidence of a pathologic intervertebral disk on spin-echo T2 images. At least two, but up to five disks were studied in each patient, depending on the MRI findings and physical examination. Discograms were performed using a double-needle technique with an 18-gauge introducer and a 22-gauge discography needle. Fluoroscopic visualization in the anteroposterior, oblique, and lateral views confirmed needle placement in the center of the nucleus pulposus. Water-soluble contrast was injected to a pressure not to exceed 100 psi. Injection resistance, morphology of the disks, and pain response were noted by at least two different observers. A digital manometer (Merit Medical Systems, South Jordan, UT) was used to measure opening and peak intradiscal pressures. Patients graded their pain as absent (no pain or pressure only), dissimilar, similar, or exact reproduction. The latter two categories were designated as "concordant." After the procedure, 0.3 mL of cefazolin was administered into each disk for antimicrobial prophylaxis.

Inclusion criteria for a diagnosis of discogenic pain were based on the discographic categories outlined by Derby.11,12 All patients classified as having discogenic pain had at least one disk with a grossly abnormal radiographie appearance on discography, and a measurement of at least 7 of 10 concordant pain at less than 50 psi above opening pressure when dye was injected at the abnormal disk(s). In addition, there had to be at least one normal, adjacent control disk. Patients who failed to meet these criteria were classified as having negative discography.

Radiculopathy

Because our patients were drawn from a discography database, all of our patients suffered from degenerative disk disease. Based on previous published work in this same population, a large majority of these patients had annular tears.13 This, coupled with the observation that facet hypertrophy can itself cause foraminal stenosis, translated into some of our patients suffering from axial back pain and radiculopathy. When indicated, the radiculopathy in these patients was treated with epidural steroid injections, nerve root blocks, neuropathic medications, and surgical consultation. MBB and discography were used exclusively to diagnose and treat nonradicular back and leg pain. A diagnosis of radiculopathy was made based on history, physical examination, radiologie findings, and, in a few instances, elec-_ trodiagnostic studies.

Outcome Measures and Statistical Analysis

Outcome measures included the aforementioned O to 10 pain rating scales to determine the efficacy of MBB, and visual analogue scales with a range of 0 to 10 after RF denervation. Descriptive statistics, including mean and SD, are presented for all study variables. For categorical variables, Fisher's exact test was used to examine the association with false-positive MBBs. For continuous variables, two-sample t tests and Mann-Whitney U tests were used. All tests were two-sided. When indicated, p values, odds ratios, and 95% confidence intervals are reported.

Results

A total of 78 patients identified from the 191 consecutive charts reviewed who underwent diagnostic MBB and provocative discography were included in the study. Fifty-eight of these patients were active duty military and 20 were retirees. Among the entire sample, 52 (67%) had a negative response to the diagnostic facet joint nerve blocks and 26 (33%) experienced a 50% or greater reduction in pain (mean reduction of 79%) and went on to fail subsequent RFL (false-positive response). For active duty patients, these numbers were 38 (66%) and 20 (34%), respectively. The average age of patients with negative diagnostic blocks was 37.8 years (SD, 8.3; range, 21-56); those with false-positive blocks had an average age of 42.7 years (SD, 12.0; range, 21-66; p = 0.07). In active duty patients, the mean age was 35.0 years (SD, 7.0; range, 21-54). Twenty-eight percent (17 of 61) of males had false-positive diagnostic blocks versus more than one-half of the females (9 of 17; p = 0.08; odds ratio, 2.9; 95% confidence interval [CI], 0.97-8.8). The preponderance of men in our study (78%) reflects the absence of military dependents in our sample (42 soldiers and 19 retirees were men). The mean duration of LBP was 6.0 years (SD, 5.1; range, 1-20) in those patients who did not respond to diagnostic MBB, and 10.7 years (SD, 9.9; range, 1-30) in those with false-positive responses (p = 0.06). In the active duty patients, the average duration of back pain was 6.9 years (SD, 6.2; range, 1-20). The mean number of medial branches blocked was 5.8 (SD, 1.5) in the negative response group and 6.0 (SD, 1.5) in the falsepositive group. None of the above differences were significant. Because the active duty subset mirrored the total sample on all demographic and clinical variables, the data below is presented as a whole. The demographic and treatment characteristics of patients are contained in Table I.

The Presence of Discogenic Pain

Forty-eight (62%) of the 78 patients evaluated had positive discograms. Of the 52 patients with negative diagnostic facet blocks, 39 (75%) were subsequently diagnosed with discogenic pain, whereas only 9 (35%) of the 26 people with false-positive blocks had positive discographies. Based on these findings, the absence of discogenic pain was strongly associated with a falsepositive response to MBB (p = 0.001; odds ratio, 5.7; 95% CI, 0.06-.49; Tables II and III).

The Presence of Radiculopathy

In the 78 patients studied, 24 (31%) had signs and symptoms consistent with radiculopathy. When analyzed according to their response to diagnostic MBB, 15 (63%) of the 24 patients with radicular signs and symptoms had negative MBB and 9 (37%) of 24 had false-positive blocks. These percentages were not statistically different from the 54 patients who did not have radicular complaints (69% with negative MBB versus 31% with false-positive blocks (p = 0.61; Tables II and IV).

Previous Back Surgery

Seventeen (22%) of the 78 patients underwent previous back surgery. These 17 patients were comprised of 8 patients in the negative MBB group and 9 patients in the false-positive group. In other words, 8 (15%) of 52 patients not responding to diagnostic blocks (negative MBB) and 9 (35%) of 26 patients with false-positive responses underwent previous back surgery. Despite the trend toward patients with false-positive blocks having had previous back surgery, this difference did not reach statistical significance (p = 0.08; odds ratio, 2.9; 95% CI, 0.97-8.8; Tables II and V).

Discussion

A key finding of this study is that the presence of discogenic and/or radicular pain was not associated with a higher false-positive rate in soldiers and retirees undergoing diagnostic medial branch and L5 dorsal ramus blocks for suspected facet joint pain. Based on the findings by Dreyfuss et al.8 showing that with as little as 0.5 mL of contrast, the aberrant spread of contrast medium toward neural structures such as the epidural space and intervertebral foramina occurred in 16% of cases, one might have expected patients with discogenic or radicular pain (whose symptoms would likely be relieved by the leakage of local anesthetic to those areas) to have a higher false-positive response rate to diagnostic facet joint nerve blocks than those without disk disease or radiculopathy. However, in none of the 120 nerve blocks performed in that study did the spread of dye reach as far as the ventral dura. Conversely, we found that patients without discogenic pain were more likely to have had false-positive diagnostic blocks. Because these patients presumably had etiologies other than disk disease and radiculitis causing their chronic LBP, it is possible that the high incidence of falsepositive blocks in patients with negative discographies was from the inadvertent treatment of some other underlying disorder.

In light of the high false-positive rate of diagnostic facet blocks,5-7 some authors have recommended the use of confirmatory blocks before proceeding to denervation.7,14,15 However, this is by no means universal, even in civilian teaching hospitals.4,5,16 At a tertiary care institution like WRAMC where a large percentage of soldiers are referred from overseas and many others must wait months for an appointment, it is also impractical. In fact, RF denervation is so safe that some practitioners in the United States and abroad proceed straight to RF neurotomy if L-z joint pain is suspected. One reason for using placebo or confirmatory blocks is to try to eliminate the high placebo response rate, estimated to be around 30%,17 without having to perform sham blocks. In a study by North et al.16 examining the specificity of a battery of local anesthetic blocks in patients with lumbosacral spine disease, the authors found the specificity of not only medial branch, but of all blocks, to be low. The placebo effect is highly variable and multifactorial, and would be expected to operate differently in the context of an analgesic procedure (facet blocks) with positive expectations versus a provocative procedure (discography) with negative expectations. In a study by Lord et al.,18 the authors demonstrated that patients with cervical facet joint pain can obtain complete, lasting pain relief from placebo procedures. In our study, although we used confirmatory blocks in only a small percentage of our patients, our 33% false-positive response rate was similar to that obtained in other studies.4,5,7

Another potentially confounding factor is that RFL is not 100% efficacious, and it is likely that some of the patients in the false-positive group were, in fact, false-false-positives (i.e., true positives). These patients may really have had L-z joint pain, but the small RF lesions missed the relevant nerves. Alternatively, they may have had L-z joint disease in combination with other spinal pathology so that they failed to obtain adequate relief with RFL. The relationship with disk disease and facet disease is complex. In animal studies performed by Indahl et al.,19,20 the authors demonstrated that one role of the facet joint may be modify discogenic irritation, so that the role of the facet joint as an independent pain generator may be overestimated by the use of diagnostic blocks.

With regard to discography results, our 61.5% positive discography rate is higher than that published in some studies,21 but less than in others.22 The high incidence of discogenic pain in our subjects may be in part because of the active lifestyles prevalent in the military community. Although we classified discogenic pain as being categorical, in reality, it is a continuous variable for which there are several different diagnostic categorization systems.22,23 Patients with lumbar disk disease, like those with facet arthropathy and degenerative joint disease, often have other concurrent causes of back pain.24,25 This is the rationale for classifying patients not only with "exact reproduction" of symptoms, but also those with "similar pain" during discography as having discogenic pain. Although provocative discography is generally accepted as a valid means of diagnosing discogenic back pain,26 controversy exists regarding its sensitivity and specificity. Depending on the psychometric profile of patients, the false-positive rates of lumbar discography can be extremely high in certain subjects.27,28 To some extent, these factors may partially explain the high failure rate in the treatment of disk disease.

By definition, the term "failed back surgery syndrome" (FBSS) denotes the persistence of back or leg symptoms after lumbar disk surgery. In many cases, this pain is radicular or discogenic. Because the large majority of patients with FBSS have other conditions contributing to their pain, one would not expect complete pain relief with MBB. In a study conducted by Schwarzer et al.,2 in patients with chronic LBP, only 12% of patients obtained complete pain relief after intra-articular facet joint injections. This indicates that most patients with facet arthropathy have other causes of back pain as well. This is the rationale for using 50% pain relief as the criteria for a successful block.2,4,5 Although FBSS patients may derive good pain relief with L-z joint blocks, these people are even less likely than nonsurgical patients to obtain complete pain relief from the procedure. In our study, there was a definite trend for those patients having undergone previous back surgery to have a higher rate of false-positive MBB (53% vs. 28%), although the small numbers involved did not reach statistical significance. Our results are in contrast with those of North et al. ,4 who found no difference in the response rate between those patients who had undergone previous lumbosacral spine surgery and

those who had not. They are consistent with those of Carragee et al. ,28 who found that patients who underwent previous back surgery were at high risk for false-positive discography.

One possible explanation for our findings is that in patients with negative discographies and false-positive MBB, myofascial pain accounted for a greater proportion of their symptoms. Indeed, myofascial pain is a common cause of LBP,24,29 especially in patients in whom other causes have been ruled out (i.e., negative facet blocks and discographies). In the study by Dreyfuss et al.8 on the specificity of lumbar MBB, whereas spread of contrast into adjacent neural structures occurred in 16% of blocks, in 100% of cases there was distal spread into the posterior back muscles. Because diagnostic blocks are usually performed at the levels where the pain is worst, this, as well as the superficial anesthetic injections, could have resulted in temporary relief of myofascial pain. In fact, trigger point injections are sometimes done with a small volume of botulinum toxin similar to that used to anesthetize the skin during nerve blocks.30 In a review of myofascial pain and trigger point management by Han and Harrison,31 the authors estimated that the incidence of myofascial pain varied between 30 and 85% of all patients presenting to pain clinics and that it was more prevalent in women than in men. Consistent with this hypothesis is our finding that false-positive diagnostic blocks occurred more frequently in women than in men (53 vs. 28%). To limit this confounding effect and/or test this hypothesis, one could reduce or eliminate the use of superficial anesthetic and minimize the amount of local anesthetic used to block the medial branches. In the study by Dreyfuss et al.,8 the authors found that the 0.5 mL of contrast medium injected engulfed the target nerve in all 120 MBBs. They suggested that smaller volumes might also prove sufficient. Another possible solution might be the use of a single needle insertion site for each side, which would minimize the amount of superficial anesthetic required.32

In summary, this study provides preliminary evidence that the presence of discogenic or radicular pain is not responsible for the lack of specificity of uncontrolled MBB in soldiers and retirees. Other factors, such as previous back surgery and/or the spread of local anesthetic into the musculature of the back, may be partially responsible for the high false-positive rate of MBBs. More research is necessary to identify and control for potential causes of false-positive medial branch nerve blocks in the military community.

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