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Nerve Root Blocks in the Treatment of Lumbar Radicular Pain
A Minimum Five-Year Follow-Up

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Background: In a previous prospective, randomized, controlled, double-blinded study on the effect of nerve root blocks on the need for operative treatment of lumbar radicular pain, we found that injections of corticosteroids were more effective than bupivacaine for up to thirteen to twenty-eight months. We performed a minimum five-year follow-up of those patients who had avoided surgery.

Methods: All of the patients were considered to be operative candidates by the treating surgeon, and all had initially requested operative intervention. They had then been randomized to be treated with a selective nerve-root block with either bupivacaine or bupivacaine and betamethasone. Both the treating physician and the patient were blinded to the type of medication. Of fifty-five randomized patients, twenty-nine avoided an operation in the original study. Twenty-one of those twenty-nine patients were reevaluated with a follow-up questionnaire at a minimum of five years after the initial block.

Results: Seventeen of the twenty-one patients still had not had operative intervention. There was no difference between the group treated with bupivacaine alone and the group treated with bupivacaine and betamethasone with regard to the avoidance of surgery for five years. At the five-year follow-up evaluation, all of the patients who had avoided operative treatment had significant decreases in neurological symptoms and back pain compared with the baseline values.

Conclusions: The majority of patients with lumbar radicular pain who avoid an operation for at least one year after receiving a nerve root injection with bupivacaine alone or in combination with betamethasone will continue to avoid operative intervention for a minimum of five years.

Level of Evidence: Therapeutic Level IV. See Instructions to Authors for a complete description of levels of evidence.

Twenty-nine years after Macnab first described the use of selective nerve-root blocks in the lumbar spine, we reported what we believe to be the first prospective, randomized, double-blinded study showing the efficacy of these blocks in helping patients with lumbar radiculopathy to avoid operative intervention. Of fifty-five patients included in that study, twenty-nine patients avoided surgery after the use of selective nerve-root blocks. One issue that remained at the time of the completion of the original study was the long-term implications of our results. We believed that it would be important to determine whether the nerve root blocks act merely as a temporizing measure or have a more permanent effect. The purpose of our current study was to review the effect of selective nerve-root blocks at a minimum of five years after the initial treatment. To our knowledge, this is the only prospective, randomized, double-blinded study in which the efficacy of nerve root blocks for the treatment of lumbar radiculopathy was assessed at a minimum of five years.

Materials and Methods

Inclusion Criteria

This study was a follow-up analysis of patients included in our previously published study. The initial group of fifty-five patients was enrolled by four spine surgeons. We received institutional review board approval, and the patients provided informed consent for the study. All patients who met the inclusion and exclusion criteria and who consented to be enrolled in the prospective study were enrolled. The pathologic
process (a herniated nucleus pulposus or spinal stenosis) was defined either by magnetic resonance imaging or by computed tomography-myelography. All patients were considered to be operative candidates because of symptoms and the failure of nonoperative treatment. Twenty-seven patients were randomized to be treated with bupivacaine, and twenty-eight were randomized to be treated with a mixture of bupivacaine and betamethasone (the experimental group). Both the patient and the examining physician were blinded with regard to the type of block.

Of twenty-nine patients who had avoided operative treatment, twenty-one responded to requests to participate in our follow-up study. All twenty-one patients were contacted at a minimum of five years after the initial treatment. Seven patients had had an initial diagnosis of a herniated nucleus pulposus, and fourteen had had an initial diagnosis of spinal stenosis. Nine patients had received a bupivacaine block alone, and the remaining twelve had received a mixture of bupivacaine and corticosteroid blocks. All eight patients lost to follow-up had received the bupivacaine and corticosteroid blocks.

Blocks
The technique for selective nerve-root blocks has been described previously, and no substantial modifications have been made to the technique since that original publication. Patients requiring multiple blocks were given the same medication as they had received at the initial block, also in a double-blinded manner. Both the patient and the treating surgeon remained blinded with regard to the initial block medication at the five-year follow-up evaluation.

Outcomes
All patients were initially examined by one of four spine surgeons and completed a North American Spine Society low-back-pain outcome questionnaire. The initial outcome instrument includes questions regarding medical history, expectations, and outcome. All twenty-one patients in the current study returned for clinical examination by one of the four spine surgeons. The follow-up questionnaires, including questions on whether the patient's baseline expectations had been met following treatment, were completed. Two patients—one in the experimental group (treated with bupivacaine and betamethasone) and the other in the bupivacaine-only group—had received acupuncture. Five patients, including one of those who had received acupuncture, had received chiropractic care. Initial baseline values were compared with those obtained from the questionnaires at a minimum of five years after the initial treatment.

Follow-up
The final follow-up evaluation was performed at a mean of sixty-seven months (range, sixty to seventy-three months) after the initial block. The duration of follow-up averaged sixty-seven months (range, sixty to seventy-three months) for the patients with spinal stenosis and sixty-eight months (range, sixty-four to seventy-one months) for the patients with a herniated nucleus pulposus.

Statistical Methods
The chi-square test was used to compare the bupivacaine and experimental groups, and the paired t test was used to compare the outcome measures at baseline and those at a minimum of five years after the initial block. P < 0.05 was considered to be significant.

Results
Comparison of Baseline Data Between Experimental and Bupivacaine Groups
With the numbers available, no differences between the experimental and bupivacaine groups were detected with regard to any of the measured variables, including age, gender, number of levels involved by disease, diagnosis (herniated nucleus pulposus), and number of previous operations. Two patients with spinal stenosis had had decompressive surgery, and two patients with a herniated disc had had a discectomy. All four of these operations had been done prior to the patient's enrollment in the original study. None of these patients were considered to be individuals for whom back surgery had been a failure (i.e., patients who had had one or more operations and were no longer thought to be surgical candidates on the basis of a lack of nerve root compression or instability but had persistent symptoms for which they sought medical attention). In addition, with the numbers available, no significant differences between the experimental and bupivacaine groups were found with respect to baseline North American Spine Society outcome measurements.

Operative Treatment (Failure of Block Treatment)
Four of the twenty-one patients who returned for follow-up had opted to proceed with an operation and seventeen had avoided operative intervention. Of the four patients who had surgery, three had a decompression and one had a decompression with fusion and instrumentation. Of the nine patients in the bupivacaine group, one had proceeded with operative treatment. Of the twelve patients in the experimental group, three had had operative treatment. With the small numbers available, there was no significant difference with regard to the rate of surgery between the bupivacaine and experimental groups (p = 0.422). In each treatment group, there was no significant difference in the percentage of failures of the block treatment between the patients with a herniated nucleus pulposis and those with spinal stenosis (p = 0.248 for the bupivacaine group and p = 0.236 for the experimental group).

Of the fourteen patients with spinal stenosis, three opted for operative intervention and eleven did not. Of the seven patients with a herniated nucleus pulposus, one proceeded with an operation and six did not. With the small numbers available, the difference in these rates of surgery was not significant (p = 0.694). For each diagnosis, there was no significant difference in the percentage of failures of the block treatment between the experimental and bupivacaine groups.
(p = 0.145 for the patients with spinal stenosis and p = 0.350 for the patients with a herniated nucleus pulposus), although the numbers were small.

**Comparison of Baseline Findings and Responses to Five-Year Follow-up Questionnaire**

There were significant decreases in both the neurological symptoms (p = 0.019) and back pain (p = 0.009) from baseline to the five-year follow-up evaluation in all seventeen patients who had avoided operative treatment. Patients with spinal stenosis had a significant decrease in neurological symptoms (p = 0.036) and patients with a herniated nucleus pulposus had a significant decrease in back pain (p = 0.030) from baseline to the five-year follow-up evaluation. With the small numbers available, the score for treatment expectations was not significantly improved at the time of final follow-up in either the stenosis group (p = 0.350) or the group with a herniated nucleus pulposus (p = 0.593). The job exertion and job stress measurements were also unchanged.

Overall, there was a notable, although not significant, trend for resolution of neurological symptoms in the experimental group (p = 0.052). When analyzed as a subgroup, the experimental group patients with a diagnosis of herniated nucleus pulposus were found to have had significant relief of back pain (p = 0.024). The bupivacaine group patients with spinal stenosis only had a notable trend with regard to relief of back pain between the baseline and follow-up evaluations (p = 0.068).

**Multiple Blocks**

Nine patients received more than one block: five had two blocks, two had three blocks, and two had four blocks. The minimum interval between the blocks was six days; the maximum was 10.5 months. All of these blocks were at the same level as the initial block. None of these patients received operative treatment.

**Discussion**

Lumbar nerve-root blocks have become a popular means of treating patients with radiculopathy. However, few investigators have examined the efficacy of such blocks in helping patients to avoid an operation. More importantly, to our knowledge there have been no long-term follow-up studies of nerve root blocks. We therefore undertook this study to determine the efficacy of selective nerve-root blocks in helping patients to avoid surgical intervention.

Of the original twenty-nine patients who had avoided operative treatment, twenty-one were contacted and returned for follow-up. Seventeen (81%) of the twenty-one patients still had not had any operative intervention. If we assume that all eight of the patients who were lost to follow-up had operative treatment, seventeen (59%) of twenty-nine patients would not have had operative intervention. The initial study had demonstrated a significant difference in operative rates between the group that had received steroids as well as a local anesthetic and the group that had received a local anesthetic alone. The current study showed no difference between these two groups.

It is possible that this discrepancy was due to the small number of patients in the current study and that a larger study size would have elucidated a difference. One might also presume that the lack of difference between the treatment groups was due to the fact that eight of the experimental group patients could not be located. However, even if all eight patients had returned for follow-up and had avoided surgery, the difference between the experimental and bupivacaine groups would still not have been significant. It is therefore likely that many patients treated with injections of bupivacaine, with or without corticosteroids, who are able to avoid surgery at more than one year after the block will continue to be able to avoid surgery for up to five years.

In order to ascertain if these patients had not undergone surgery for reasons other than those related to symptoms, baseline and five-year questionnaires were reviewed. There was a significant diminution in back pain and neurological symptoms from baseline to five years after the block (p = 0.019 and p = 0.009, respectively). This suggests that the patients avoided surgery because of a notable decrease in symptoms.

As a direct result of our study, we are now more confident about recommending lumbar nerve-root blocks as a first step prior to operative intervention in patients with lumbar radiculopathy due to a herniated nucleus pulposus or spinal stenosis. We believe that the injections were effective in relieving symptoms for long enough that patients in whom the pain would have resolved naturally were able to avoid surgery in the meantime. Surgical intervention is not without substantial risks. An operation that had achieved similar results at five years postoperatively, such that the patient thought that no additional treatment was needed, would have been considered successful. Given that many of our patients achieved this goal without surgical intervention, we believe that this study demonstrated the efficacy of injections to help otherwise excellent operative candidates to avoid surgery.

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