Introduction

Sciatica caused by lumbar disk herniation (LDH) is a common and extremely painful disorder. While 70–80% of patients with sciatica resolve spontaneously or without surgical treatment, 30% of the patients continue to have significant symptoms after 1 year. Persistent sciatica despite treatment leads to physical and emotional suffering, socioeconomic problems, and impaired work ability.

Therefore, while treating patients with sciatica caused by LDH, the objective is to relieve their pain and improve their quality of life (QOL) as soon as possible by conservative treatment. As a part of this treatment, patients are initially treated with medications and physical therapies; however, if pain continues to compromise their QOL even after 2 weeks of nonsteroidal anti-inflammatory drugs (NSAIDs), epidural injections are recommended. The epidural injections deliver steroids with strong anti-inflammatory activity as well as topical anesthetics directly to the inflamed nerve roots to suppress pain and inflammation.

Responses to epidural injections vary widely between individuals. However, little data are available on what factors, including anatomical differ-
ences on MRI, neurological findings, magnitude of pain, or the degree of disability and distress in daily life, are responsible for such uncertainty in treatment outcomes\textsuperscript{10-12}.

Given the overall effectiveness of epidural injections, it will be particularly helpful if one may pre-screen patients to find those who are more responsive to block treatments. This prospective study aimed to determine what factors are associated with poor outcomes in subacute to acute sciatica patients caused by LDH.

**Materials and Methods**

**Source Population and Selection of Participants**

This study was conducted at Juntendo University in Japan from February 2007 to July 2008, and the protocol was approved by the institutional review board. Informed consent was obtained from all patients who were accepted for the study.

Consecutive patients aged 20-60 years with acute to subacute sciatica (<12-week duration) caused by LDH, and clinical signs such as radicular pain, sensory deficits, and motor weakness consistent with the magnetic resonance imaging (MRI) and lack of response to at least 2 weeks of NSAIDs were enrolled in our prospective study. The exclusion criteria were a previous surgery to a lumbar spine, associated spinal canal stenosis with MRI confirmation, cauda equina syndrome, infection, anticoagulant treatment, bleeding history, diabetes, obesity (body mass index $>$ 30kg/m$^2$), pregnancy, epidural steroid injection during the preceding 3 months, and allergies to steroids or adjunct medications.

A total of 48 patients were enrolled in the study. Demographic variables, such as age, gender, duration of symptoms before receiving the injection, and employment status were gathered at the initial interviews before treatment. Employment status was classified into three categories as employed, absent from work, and others including unemployed, homemaker, and student.

The 40 patients who were enrolled in the study completed both the treatment and the follow-up assessments. There were 4 patients who underwent nerve root steroid infiltration because of failed treatment 4 weeks after the first epidural injection. Of these, 2 patients were subsequently referred for surgical treatment. There were 4 patients who refused subsequent evaluations for various personal reasons. The results of these 4 patients were withdrawn from the study.

**Treatments**

All the epidural injection procedures were conducted by a pain medicine-certified anesthesiologist using a translaminar approach without fluoroscopic guidance. All the injections used a 20-gauge epidural needle. The needle was cautiously advanced using a loss of resistance technique at one level cephalad to the LDH. Each patient received 8ml mepivacaine hydrochloride 0.5% twice a week repeatedly within the first 1 month. The injections included three times of epidural steroid injections with a combination of 4mg of dexamethasone and 8ml of mepivacaine hydrochloride 0.5% every 2 weeks.

We continued to perform epidural injections with mepivacaine hydrochloride 0.5% until 3-month treatment period as needed. During the observation period, all patients were allowed to continue taking the same dose of NSAIDs, but they were not allowed to undergo new treatments, including new medications, nerve root injection, and surgery. The results for patients who underwent any new treatments were defined as a poor outcome of epidural injections through the observation period.

**Measurements**

Pain intensity was assessed before treatment and 1, 3, and 6 months from the beginning of the epidural injection, using a 100-mm visual analog scale (VAS). The scale ranged from 0 (no pain) to 100 (worst conceivable pain).\textsuperscript{10,11}

Disability was assessed before treatment and 1, 3, and 6 months from the beginning of the epidural injection, using the modified Roland Morris Disability Questionnaire (RMDQ).\textsuperscript{14-17} This 24-item questionnaire is widely utilized as an index of physical impairment for sciatica, with the questionnaire being modified by adding the phrase “my back or leg problem” at the end of all 24 questions.\textsuperscript{16,17} Roland scores range from 0 (no disability) to 24 (maximum disability).

Anxiety was assessed before treatment using the validated Japanese version of the State-Trait Anxiety Inventory, which consists of two separate,
20-item self-report rating scales for measuring state and trait anxiety\(^{(18,19)}\). The state anxiety scale measures the situation-related anxiety and the trait anxiety measures anxiety as a relatively stable personality disposition. Every item was scored 1 (not at all), 2 (somewhat), 3 (moderate), 4 (very) ranging from 20 to 80, with higher scores indicating increased anxiety. The state anxiety scores of more than 41 and 42 and trait anxiety scores of more than 44 and 45 in males and females, respectively, were defined as indicating high levels of anxiety in its Japanese version\(^{(18,19)}\).

Image analysis was performed before treatment and assessed by orthopedicians (I.Y. and D.N.) in spine surgery for the type and level of LDH. The type of LDH was classified as protrusion, extrusion, or sequestration. It is important to note that the interpretation of the extruded disc is partly subjective\(^{20}\).

Neurological findings were assessed before treatment, according to objective findings of the Japanese Orthopedic Association scoring system with sensory and motor function being measured on a 3-point scale: 1 (no neurological deficit), 2 (slight disturbance), 3 (marked disturbance)\(^{21}\). The straight leg raising (SLR), the angle at which back or leg pain prevented further leg elevation, was also measured with a goniometer, assessing on a 3-point scale: 1 (normal), 2 (more than 30° but less than 70°), 3 (less than 30°).

Outcome Assessment

Treatment outcomes were measured by the VAS and the RMDQ, which were collected at 1, 3, and 6 months from the beginning of the epidural injection. Clinically poor outcome of treatment was defined as a reduction in the VAS score of less than 50% at a point of assessment period\(^{(10,13)}\), or a reduction in the RMDQ score of less than an important change, which was dependent on the initial RMDQ scores\(^{22}\). For example, patients with high initial RMDQ score (17-24 points) need to undergo a change of 8 RMDQ points in order for the change to be deemed important, whereas patients with low RMDQ score (0-8 points) need only to undergo a change of 2 RMDQ points.

Statistical Analysis

The statistical analysis was performed in three steps. First, quantitative variables at baseline were analyzed by descriptive statistics, including median, minimum, and maximum values. Clinical and demographic characteristics were analyzed as categorical variables. For statistical analysis, ages were dichotomized as less or not less than 40, and the duration of sciatica as less or not less than 4 weeks, with the median values in both cases being used as the thresholds. Similarly, patients were divided between the recovery and non-recovery groups. Baseline variables of the recovery and non-recovery groups were compared by means of Fisher exact test.

Secondly, the relationship between the outcome (recovery and non-recovery) and the potential predictors were evaluated using multiple logistic regression analysis. Potential predictors were gathered from patient baseline variables included age, gender, duration of symptoms, employment status, SLR, sensory disturbance, motor disturbance, level of LDH, type of LDH, presence of a high trait anxiety, and presence of a high state anxiety. The results were presented as crude odds ratios with 95% confidence intervals. The Statistical significance of differences between groups without and with high trait anxiety at baseline for scores of VAS and RMDQ was analyzed by the Mann-Whitney U-test at baseline and at 1, 3, and 6 months from baseline. All statistical tests were two-tailed, and the significance level was fixed at 0.05. All the statistical analyses were performed using SPSS software, version 17.

Results

Twenty six of 44 patients (59.1%), thirty one of 44 patients (70.5%), and thirty three of 44 patients (75.0%) had clinically successful outcomes at the 1-, 3-, and 6-month follow-up assessment, respectively. The median frequency of epidural injections was 11 times injections (range: 2-24 injections). There were no major complications, including epidural hematoma or abscess formation.

The demographic and clinical characteristics of the study population are shown in Table-1. Most of the patients were employed at the start of the study and presented with a positive SLR test. Marked motor disturbance was diagnosed only in 4 patients. The median VAS score was 75.5 and the median RMDQ score was 17.5. The median
scores for trait anxiety and state anxiety were 44.5 and 54.0, with 81.8% of the patients showing a high state anxiety and 52% showing a high trait anxiety.

Baseline variables of the recovery and non-recovery groups were compared by means of Fisher exact test. As presented in Table 2, at the 1-, 3-, and 6 month assessments, prevalence of high trait anxiety was statistically significant (p=0.036, p=0.008, and p=0.004, respectively).

The results of the multivariate logistic regression models using forward selection with a likelihood ratio test are presented in Table 3. The presence of a high trait anxiety (OR=0.133, 95% CI : 0.027-0.651) and motor disturbance (OR=3.517, 95% CI : 1.098-11.267) were found to be significantly associated with an increasing risk of poor outcome at the 1-month assessment. At the 3-month assessment, the presence of a high trait anxiety (OR=0.115, 95% CI : 0.022-0.611) was the only prognostic factor. Then, at the 6-month assessment, the presence of a high trait anxiety (OR=0.065, 95% CI : 0.007-0.570) was the only significant prognostic factor.

Scores on the course of pain intensity (Figure 1) differed between both groups without and with high trait anxiety at the 1-, 3- and 6-month assessment and scores on the course of disability (Figure 2) differed at the 3- and 6-month assessment.

Discussion

Our objective was to identify risk factors of epidural injections administered for pain treatment in drug-resistant patients with sciatica caused by LDH. Sciatica caused by LDH is known to naturally resolve, so changes in RDQ and VAS observed in this study do not necessarily reflect the effect of treatment with epidural injections. However, we believe that this would still aid in selecting optimal treatment for our patients in future if significant factors were elucidated by this study. When multivariate analyses were conducted to control for associations among these measures, the presence of higher trait anxiety was found to be correlated with greater pain and disability at 1-, 3-, and 6-months following the treatments.

Surgeries and other conservative treatments have reported that chronicity of pain caused by LDH is largely affected by psychological factors, and the same result was observed with epidural injections used in this study. This indicates that outcomes of LDH treatments are often affected by psychological factors regardless of the type of treatment. Therefore, it is not always appropriate to consider further invasive treatments for patients with high trait anxiety when epidural injections are not immediately effective.

The mechanism of the negative impact of psychological factors on treatment outcomes could not be determined by this study. However, patients with high trait anxiety tend to have excessive fear and increased anxiety for pain. Therefore, they avoid daily behavior that could trigger pain and subsequently decrease their activities of daily living. As the result, they begin to show depressive symptoms, and because they are depressed, they tend to become even more sensitive to their physical pain. Thus, we speculate that this vicious circle beginning with anxiety causes persistent pain in patients.

Based on the results of this study, we consider it
necessary to evaluate the psychological aspects of patients with sciatica caused by LDH before treating them with epidural injections. Furthermore, treating patients with psychological high-risk factors may help improve prognosis if we are constantly supportive of such patients as well as help incorporate early-stage psychological intervention, such as cognitive-behavioral therapy, if necessary, into the treatment.

Several methodological differences between prior studies evaluating predictors of pain-related outcomes following treatment for sciatica, such as retrospective design on heterogeneous in-populations, make it difficult to draw any firm conclusion from them. Therefore, we tried to maintain a homogenous patient population to the greatest extent possible to minimize the effects of methodical variations on patient prognosis.

This study has several limitations. First, epidural injections were administered without using fluoroscopy. Table 2 presents the relationship between baseline variables and treatment outcomes.

<table>
<thead>
<tr>
<th>Baseline Variables</th>
<th>1 month</th>
<th>2 month</th>
<th>3 month</th>
<th>4 month</th>
<th>5 month</th>
<th>6 month</th>
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<tr>
<td>n=26</td>
<td>n=20</td>
<td>n=14</td>
<td>n=13</td>
<td>n=11</td>
<td>n=10</td>
<td>n=10</td>
</tr>
</tbody>
</table>

**Age**
- < 40 yr: 12/10/22
- ≥ 40 yr: 14/8/22

**Gender**
- Male: 15/10/25
- Female: 11/8/19

**Duration of Symptoms**
- < 4 weeks: 19/10/29
- ≥ 4 weeks: 7/8/15

**Employment Status**
- Employed: 15/14/29
- Absent: 5/1/6
- Others: 6/3/9

**Sensory Disturbance**
- Marked: 6/6/12
- Slight: 11/6/17
- Normal: 9/6/15

**Motor Disturbance**
- Marked: 1/3/4
- Slight: 7/6/13
- Normal: 18/9/27

**Level of LDH**
- L3-L4: 2/1/3
- L4-L5: 11/6/17
- L5-S1: 13/11/24

**Type of LDH**
- Protrusion: 5/4/9
- Extrusion: 12/9/21
- Sequestration: 9/5/14

**High State Anxiety**
- Absence: 6/2/8
- Presence: 20/16/36

**High Trait Anxiety**
- Absence: 16/5/21
- Presence: 10/13/23

Baseline variables of the recovery and non-recovery groups were compared by means of Fisher exact test. *p < 0.05
roscopy or contrast media. Epidural injections administered in this manner are known to be less accurate than those under fluoroscopic guidance with contrast enhancement. However, it should be noted that lumbar epidural injections can generally be administered with high precision in nonobese patients, and that the translaminar approach is known to be more reliable than the caudal approach. Second, repeated injection was not uniform because we continued injections as needed according to severity of symptoms. Therefore, evaluation of the results of epidural injection was limited. Third, herniated discs that appear “ring-shaped” under MRI are more likely to contract spontaneously, and LDHs sometimes contract spontaneously within 6 months. As we do not take MRI images of our patients routinely, we cannot evaluate such cases of spontaneous contraction.

### Table 3: Multivariate logistic regression analysis for prognostic factors

<table>
<thead>
<tr>
<th>Independent variable at baseline</th>
<th>Comparison</th>
<th>1 month</th>
<th>3 month</th>
<th>6 month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>OR</strong></td>
<td><strong>95% CI</strong></td>
<td><strong>p</strong></td>
</tr>
<tr>
<td>High trait anxiety</td>
<td>Presence vs Absence</td>
<td>0.133</td>
<td>0.027</td>
<td>0.651</td>
</tr>
<tr>
<td>Motor disturbance</td>
<td>Marked vs Normal</td>
<td>3.517</td>
<td>1.098</td>
<td>11.267</td>
</tr>
</tbody>
</table>

At the 1-month assessment, the presence of a high trait anxiety and motor disturbance (Marked vs Normal) were the prognostic factors. At the 3- and 6-month assessment, the presence of a high trait anxiety was the only significant prognostic factor.

OR: odds ratio, CI: confidence interval
Fourth, the followup period of 6 months could be considered relatively short. Finally the high ratio of patients showing improvement after 3 months may have affected the results. As the number of cases increase, it may be possible to obtain accuracy in results after 3 or 6 months.

Conclusion

This study revealed that high trait anxiety seen in the pretreatment stage is negatively related to prognosis in LDH patients with acute to subacute sciatica undergoing epidural injections.

References