CLINICAL ASPECTS OF SCIATICA AND THEIR RELATION TO THE TYPE OF LUMBAR DISC HERNIATION

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Background: Little evidence exists on the diagnostic accuracy of clinical presentation in distinguishing the type of herniation in patients with lumbar disc disease. This study was undertaken to examine the correlation between clinical features and herniation type in lumbar disc hernia.

Methods: One hundred and fifty consecutive candidates for lumbar discectomy were examined. The initial assessments, including location and duration of pain, neurological examination, and straight leg-raising (SLR) tests were performed by an independent observer who was unaware of the final diagnosis. Intraoperatively, all patients were assessed by a single neurosurgeon for the presence of disc protrusion or extrusion.

Results: Among 90 men and 60 women (mean age: 41.4, range: 18 – 75 year), 85 patients had disc protrusion and 65 had extruded disc. Patients with radicular pain alone and those who experienced a resolution of low back pain followed by an increased severity of radicular pain were 6.5 ($P < 0.002$) and 10.2 ($P < 0.000$) times more likely to have an extruded disc, respectively. The mean preoperative duration among the group of patients with extruded disc (11 weeks) was significantly shorter than the protruded ones (18.6 weeks) ($P < 0.005$). Among all subjects, 103 patients showed neurological abnormalities. There was no association between the presence of neurological deficits and the type of herniation ($P > 0.005$). In patients with positive crossed straight leg-raising (N = 43), 33 had extruded disc and 10 had protruded disc. The positive crossed SLR test correlated significantly with the type of herniation (relative risk = 2.56, $P < 0.000$, and $\chi^2 = 27.4$).

Conclusion: In the lumbar disc disease, there were three groups of patients: a) those with radicular pain alone, b) those who experienced an increased severity of radicular pain followed by resolution of back pain, and c) patients with positive crossed SLR test who had a high probability of harboring an extruded disc. There was no significant association between the neurological abnormalities and the type of herniation.

Keywords: Low back pain • lumbar disc disease • radicular pain • sciatica

Introduction

In the evaluation of herniated lumbar disc patients, the clinical picture is of major importance. Prevalence of disc herniation, determined by magnetic resonance imaging is between 35 – 50% in asymptomatic individuals.1, 2 Thus, despite modern neuroimaging techniques, the clinical presentation of the patient still remains an important tool in patient evaluation.3 Among the patients who were selected for surgery, the preoperative classification of type of herniation has an equal importance. The degenerative change of the disc may result in various degrees of herniation (protrusion or extrusion). At surgery, a protruded disc is when the nuclear material dislocated through the major part of the annulus fibrosus and in an extruded one, the nucleus pulposus is dislocated throughout the entire part of the annulus fibrosus.4 In surgical cases, the latter is known to be associated with better results.4 – 7 The present study was undertaken to compare the clinical findings in the two different types of herniation.

Patients and Methods

An independent observer who was not informed
of the diagnosis, studied one hundred and fifty patients selected for lumbar discectomy prospectively. All patients had a disc herniation demonstrated by magnetic resonance imaging (MRI). A number of variables describing the pain characteristics were noted in each patient. The following pain-related parameters were included: low back and radicular pain (simultaneous occurrence), decreased severity of low back pain followed by increased severity of radicular pain, and radicular pain alone. Duration of pain and the presence or absence of urinary sphincter disorder was also recorded. Preoperative clinical signs included: muscle power (extensor hallucis longus, plantar flexion of foot, and proximal muscles), sensory deficit, reflex disturbance, and the straight leg-raising (SLR) test. Results from evaluation of muscle power were recorded as normal or reduced and tendon reflexes (knee and ankle) were recorded as normal or reduced/absent. The SLR or crossed positive SLR was recorded as “yes” or “no”. Patients who had pain, muscle weakness, sphincter disorder, and sensory loss were categorized as cauda equina syndrome. All patients underwent conventional open discectomy by a single neurosurgeon and the type of disc herniation was recorded from the findings at surgery. Removal of a protruded disc requires incision through the posterior longitudinal ligament, whereas removal of an extruded disc can be accomplished without incision of the disc border. The collected data were analyzed by computer, using the SPSS-10 software. The statistical methods consisted of Chi-square, one-way ANOVA, pooled Student’s t-test, binary logistic regression, and risk estimation.

Results

Among the 90 men and 60 women (mean age of 41.4 years and ranging from 18 – 75 years) took part in this study, 85 (57%) had a protruded disc and 65 (43%) had an extruded disc. In patients who had a protruded disc, the mean preoperative duration of pain was 21.1 weeks and in those with an extruded disc was 11 weeks. The mean preoperative duration of pain in patients with an extruded disc was significantly shorter than patients with a protruded disc ($P < 0.005, F = 8.41$) (Figure 1). There was no age- or sex-related differences in the distribution of the different types of disc herniation. One hundred and twenty patients had unilateral and 30 had bilateral pain.

![Figure 1. Preoperative pain duration related to the type of disc herniation. Error bars are shown for comparing the duration of pain in both types of herniation, depending on the side of pain.](image-url)

There was no side-related significant difference in the distribution of types of disc herniation ($P > 0.3$, $F = 0.921$). Among the patients who had unilateral pain, 41 (30%) had low back and radicular pain, 44 (36%) experienced an increased severity of radicular pain followed by resolution of back pain, and 36 (30%) had a radicular pain alone. Patients with an extruded disc were significantly more likely to experience a resolution of low back pain at the onset of radicular pain than patients with disc protrusion ($P < 0.000, \text{relative risk} = 10.2$). Patients with a radicular pain alone, in comparison with the ones who had low back and radicular pain, were significantly more likely to have an extruded disc ($P < 0.002, \text{RR} = 6.5$) (Table 1). Among the patients with bilateral pain, 20 (69%) had low back and radicular pain, 6 (21%) experienced an increased radicular pain followed by a decreased low back pain, and 3 (10%) had a radicular pain alone. The relative risk for an extruded disc in patients with radicular pain alone and those who experienced resolution of low back pain followed by an increased severity of radicular pain was 2.1, but this correlation was not statistically significant. Among all patients, fifteen (10%) had sphincter disorder (6 had protruded and 9 had extruded disc) and 12 (8%) of the patients presented at initial examination with cauda equina syndrome (5 had protruded and 7 had extruded disc). One hundred and three (69%) patients had sensory loss and 90 (60%) experienced muscle weakness (63 [42%] extensor hallucis longus and 24 [10%] plantar flexion). Sixty-five patients had reduced/absent deep tendon reflexes. There was no significant
difference observed in the urinary sphincter disorder and/or cauda equina syndrome of patients with an extruded disc, compared to those with a disc protrusion. A similar correlation concerning sensory deficit, motor power, and reflex abnormality was noted. Therefore, the presence of neurological deficits had no correlation with the type of herniation. Among all patients, 138 (92%) had a positive SLR test on the affected side. Among the patients who suffered from a protruded disc, 56% had positive SLR and 44% of those with an extruded disc had a positive result, observed with the SLR test. This difference was not significant. The crossed SLR (CSLR) test was positive in 43 and negative in 107 patients. Among those with positive CSLR test, 33 (77%) had protruded and 10 (23%) had extruded disc. The crossed positive SLR test was significantly correlated with the type of herniation (more common in patients with extruded disc) \((P < 0.000, \text{RR} = 2.56, and \chi^2 = 27.4)\) (Table 2).

### Discussion

The ability to predict the presence of an extruded disc is clinically important. As these patients have been reported to achieve a better result from discectomy, therefore case selection could be improved by a simple assessment of signs and symptoms on presentation.\(^4\) - \(^7\) Although the pain generator in disc herniation is not clear,\(^3\) the association between pain distribution and operative findings obtained from this study, perhaps, could be explained by the known innervations of the structures surrounding a herniated disc. Pain fibers are present in the outer layer of the annulus and posterior longitudinal ligament and produce a low back pain.\(^9\) - \(^13\) If the disc exerts pressure on the dural sleeve of the nerve root, radicular pain is experienced along the course of the nerve root (radicular pain).\(^14\) Patients who suffer from disc protrusion will experience more back pain and less radicular pain as a result of stretching of the posterior longitudinal ligament. In contrast, the tension in posterior longitudinal ligament is reduced by exit of disc materials through a tear associated with disc extrusion. This may explain why patients who suffer from an extruded disc often experience a decrease or resolution of back pain, when root symptoms commence or are aggravated.\(^15\) From the results of this study, it can be concluded that among all patients (candidates for lumbar discectomy), those who suffer from radicular pain alone and who experience a decreased severity of low back pain followed by an increased severity of radicular pain at the initial presentation, have a high probability of harboring an extruded disc. These findings parallel those of Pople and Griffith.\(^15\) The association between the presence of an extruded disc and radicular pain alone on presentation could be explained by findings in an experimental animal study in which nucleus pulposus per se was demonstrated to induce a disturbance of neural function.\(^16\) If this mechanism is relevant in human, concerning degenerative nucleus material, then the chemical/inflammatory effect of the nucleus might contribute to the appearance of severe radicular pain noted in patients suffering from extruded disc.\(^17\) In the present study, the preoperative duration of pain in patients with an extruded disc was significantly shorter than the duration of pain from a protruded disc. Jensson and Stromqvist found similar results.\(^5\) One of the most characteristic features of pain in patients harboring an extruded disc was progressive pain, the main indication for disc surgery,\(^18\) which, of course, is presumably why this group had a shorter duration of symptoms.\(^19\) Although neurological signs are important for distinguishing between radicular and

### Table 1. Patient's type of pain, related to the type of disc herniation.

<table>
<thead>
<tr>
<th>Type of pain</th>
<th>Herniation type</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Protrusion</td>
<td>Extraduction</td>
</tr>
<tr>
<td>Low back and radicular pain</td>
<td>35</td>
<td>6</td>
</tr>
<tr>
<td>Increased radicular pain and decreased low back pain</td>
<td>16</td>
<td>28</td>
</tr>
<tr>
<td>Radicular pain alone</td>
<td>17</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>53</td>
</tr>
</tbody>
</table>

### Table 2. Relationship between the type of disc herniation and crossed straight leg-raising test.

<table>
<thead>
<tr>
<th>Crossed straight leg-raising test</th>
<th>Herniation type</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Protrusion</td>
<td>Extraduction</td>
</tr>
<tr>
<td>Positive</td>
<td>10</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>23.3%</td>
<td>76.7%</td>
</tr>
<tr>
<td>Negative</td>
<td>75</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>70.1%</td>
<td>29.9%</td>
</tr>
<tr>
<td>Total</td>
<td>85</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>56.7%</td>
<td>43.3%</td>
</tr>
</tbody>
</table>

Odd ratio = 6.5; \(P < 0.000\), and \(\chi^2 = 27\).
referred pain, they have limited value in the diagnosis of the type of lumbar disc herniation.\(^7\),\(^20\) In the present study, like others, correlation between neurological signs (e.g. muscle weakness, sensory loss, and reflex abnormalities) and type of herniation was not found. This may indicate different mechanisms for pain and neurological signs, and that sciatica is not entirely affected by mechanical factors.\(^21\) – \(^23\) With regards to the herniation type, the only significant physical finding was the crossed positive SLR test. The CSLR test is a specific but insensitive sign of lumbar disc herniation.\(^24\),\(^25\) Raising the contralateral (painless) lower extremity, draws the dural tube cauda and anteriorly, thus forcing the involved nerve against the pathologic disc and causing radicular pain in the affected (painful) limb.\(^26\) Like previous authors, we also found that the incidence of crossed positive SLR test is correlated with the type of hernia.\(^3\),\(^7\),\(^18\),\(^26\) – \(^28\) Patients with a positive result of the CSLR test had a significantly higher incidence of extruded disc, which may indicate that root hyperalgesia is not merely a question of a simple mechanical compression. In contrast to the findings of Jansson and Stromqvist,\(^3\) the authors did not find a significant correlation between the result of the SLR test and the herniation type.

In conclusion, the clinical history of pain characteristic and its duration as well as the crossed SLR test in patients with lumbar disc herniation has a high correlation with surgical pathology. Patients with a radicular pain alone and those who experienced an increased severity of radicular pain followed by the resolution of low back pain, and patients with a positive crossed SLR test result, have a high probability of harboring an extruded disc. The results indicated that there is no correlation between the presence of neurological deficits and the type of herniation. These associations may be of interest in clinical practice as well as shedding light into the pathophysiology of lumbar disc syndromes.

**References**