

Correlation of clinical presentation with intraoperative level diagnosis in lower lumbar disc herniation

Hamed Reihani-Kermani

Background: Little evidence exists on the diagnostic values of concomitant symptoms and signs in the level diagnosis of patients with lower lumbar disc herniation. We assessed the diagnostic value of the clinical presentation of fifth lumbar and first sacral root dysfunction due to disc herniation.

Methods: We examined 139 consecutive candidates for lower lumbar discectomy. A number of clinical symptom and signs referred to fifth lumbar and first sacral root dysfunction were collected for each patient by an independent observer. Intraoperatively, all patients were assessed for the level of disc herniation (gold standard).

Results: Among the 83 men and 56 women (mean age, 41.6 years, range, 18-75 years), 72 had L4-L5 and 67 had L5-S1 disc herniation. The sensitivity and specificity for concomitant presentation of monoradicular pain, toe weakness (dorsiflexion), normal ankle reflex and straight leg rising (SLR) positive test for the level of fourth lumbar disc herniation were 41.5% and 95.5%, respectively. Positive and negative predictive values for these symptom and signs in the fourth level were 90% and 62.7%, respectively ($P < 0.0001$, relative risk=2.41, odds ratio=15.16). Sensitivity, specificity, positive and negative predictive values for concomitant presentation of monoradicular pain, toe weakness (plantarflexion), impaired ankle reflex and SLR positive test for the level of the first sacral disc herniation were 60.5%, 98.7%, 95.8% and 83.1%, respectively ($P < 0.0001$, relative risk=5.68, odds ratio=113.4).

Conclusion: The diagnostic value of clinical features of herniated fifth lumbar disc herniation is more reliable than fourth lumbar disc herniation. The value of clinical presentation in the level diagnosis of lower lumbar disc herniation is highly specific, but rather insensitive.

Key words: Lumbar disc disease, lumbar discectomy, level diagnosis, sensitivity and specificity

*From the Neurosurgery Department,
Bahonar Hospital, Kerman, Iran*

*Correspondence to:
Dr. Hamad Reihani-Kermani
Bahonar Hospital
Kerman
Iran
h_reihani@hotmail.com*

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Although approximately 70% of the adult population experiences low back pain once or more during their life, no specific pathology is defined in up to 85% of patients.¹ Approximately 1.5% of low back patients endure symptoms of sciatica, and only 2% undergo surgery.^{2,3} Despite modern neuroimaging techniques, herniated discs are found by imaging diagnostic tests in 36% to 50% of symptom-free persons;^{4,5} thus the clinical appearance of the patient is important to avoid unnecessary surgical intervention.^{6,7} While many studies have been published on the diagnostic potential of neuroimaging methods in the recent years, this is not the case for clinical examination. The clinical diagnosis of the level of a lumbar disc herniation is primarily based upon the history and objective neurological examination.⁴ The purpose of this study was to determine the diagnostic value of concomitant presentation of monoradicular pain and motor and reflex abnormalities as a clinical feature of the level of a lower lumbar intervertebral disc herniation. In a prospec-

tive study, we compared the preoperative clinical and MRI findings of the patients with sciatica in relationship to the localization of the herniated lower lumbar intervertebral disc, as verified at operation.

Methods

One hundred and thirty-nine patients selected for lower lumbar discectomy were studied prospectively. All patients were examined by an independent evaluator who was not informed of any likely correlation between clinical pattern and operative findings. All patients had disc herniation proven by magnetic resonance imaging (MRI). Patients with radiculopathy due to foraminal stenosis, thickened ligamentum flava and osteophytic changes were not included. A number of variables (related to fifth lumbar and first sacral root dysfunction) were collected for each patient. Monoradicular pain was accepted as evidence of fifth lumbar root compression when distributed to the anterolateral aspect of the calf and dorsum of the foot and as evidence of

first sacral root compression when referred to the posterior portion of the calf extending to the heel and lateral aspect of the foot. Preoperative clinical signs were divided into findings from muscle power, reflex disturbance and straight leg rising (SLR) tests. For fifth lumbar root dysfunction these signs were a) weakness of dorsiflexion of the first toe, b) normal ankle reflex, c) and an SLR positive test. For first sacral root dysfunction, the signs were a) weakness of the plantarflexion of the first toe, b) impaired ankle reflex, c) and an SLR positive test. Muscle power was recorded as normal or reduced, and tendon reflex was recorded as normal or reduced/absent (compared with the nonsymptomatic side). The SLR test was described as positive only if radicular pain was elicited. All patients underwent conventional open discectomy by a single neurosurgeon. The level (L4-L5 and L5-S1 interspaces) according to the root syndrome and MRI proven disc herniation was always explored. The surgical findings regarding herniated disc level (L4-L5 or L5-S1) were considered the definite diagnosis (gold standard). Sensitivity, specificity, and positive and negative predictive values were calculated using 2x2 tables.

Results

Of the 83 men and 56 women (mean age 41.6 years, range 18-75 years), 72 (51.8%) had level L4-L5 and 67 (48.2%) had level L5-S1 disc herniation alone. There was no statistically significant difference between two levels. Among all patients, 30 (21%) presented with monoradicular pain together with weakness of dorsiflexion of the first toe, normal ankle reflex and an SLR positive test (fifth lumbar root syndrome). Of these patients, 27 (90%) had L4-L5 and 3 (10%) had L5-S1 disc herniation. The sensitivity and specificity of these four symptom and signs for detecting L4-L5 disc herniation was 41.5% and 95.5%, respectively. The positive and negative predictive values of these symptom and signs for L4-L5 disc herniation were 90% and 62.7% ($P < 0.0001$, relative risk=2.41, odds ratio=15.16). Thirty-three patients had weakness of toe dorsiflexion and normal ankle reflex only (signs of L5 root dysfunction). Of those, 30 (90.9%) had an L4-L5 and 3 (9.1%) had an L5-S1 disc herniation ($P < 0.0001$, sensitivity=47.6%, specificity=95.5%, positive predictive value=90.0%, negative predictive value=65.6%, and accuracy=72%). Having all first sacral root symptoms (monoradicular pain) and signs (weakness of the plantarflexion of the toe, impaired ankle reflex and an SLR positive test) ($n=24$) gave a sensitivity of 60.5%, a specificity of 98.7%, a positive predictive value of 95.8% and a negative predictive value of 83.1% for L5-S1 disc herniation ($P=0.0001$, relative risk=5.68, odds ratio=113.4).

Discussion

When the clinician evaluates a patient he relies not on a

single parameter alone, but all elements of the medical history and physical examination in determining whether that patient will benefit from surgery. To assist this evaluation, several rating scales have been developed, with a more or less arbitrary weighting of the parameters.⁷⁻⁹ Yet, the scientific foundation of most parameters is deficient.¹⁰⁻¹⁷ In the present study, we assessed the value of the physical examination and monoradicular pain for diagnosing the most common levels of lower lumbar disc herniation. Our results showed that if a patient presented with fifth lumbar root syndrome it was possible to predict a correct level in 41.5% of patients with a disc herniation at L4-L5. Having all three first sacral signs concomitant with monoradicular pain gave a 60.5% probability of L5-S1 disc herniation. This difference in level diagnostic sensitivity is in agreement with results reported by Knutsson and Lansch et al and in disagreement with those reported by Korteleainen.^{12,18,19} Fourth disc herniations compress the first sacral root more often than fifth disc lesions compress the fourth lumbar root.¹² The difference in level diagnostic reliability is either due to more frequent double-root compression in fourth disc herniation,^{12,20-23} or is a consequence of the smaller cross-sectional area of the spinal canal at the fourth compared with the fifth intervertebral space.²⁴ Another explanation for this difference is anatomic variation in innervations.¹² If the four signs and symptom of fifth lumbar root were not concomitant, 95% of patients were affected at a site other than L4-L5. At the level of L5-S1, if all four signs and the monoradicular symptom were not present together, 98.7% of patients harbor a disc herniation other than L5-S1. The high specificity of the symptom and signs indicate that the clinical presentation is also suitable for excluding the level diagnosis. According to our results, if L4-L5 disc herniation was proved, then 90% of patients present with the four signs and monoradicular symptom of L5 root dysfunction (predictive value of positive tests) and if a disc other than L4-L5 was herniated, 62.7% of patients had no concomitant clinical symptom and signs (predictive value of negative tests) ($P < 0.0001$). Patients with L4-L5 disc herniation were 15.16 times more likely to exhibit the related clinical presentation. Several authors have also noted that the most common neurologic sign in L4-L5 disc herniation is weakness of dorsiflexion of the toe.^{12,18,20} This sign is specific for L4-L5 disc herniation,²⁰ while abnormality of the ankle reflex is of value in the diagnosis L5-S1 disc herniation.¹² In our study, we selected all patients ($n=33$) that presented with toe weakness (as a sign of involved L5 root) concomitant with a normal ankle reflex (as a sign of spared S1 root, to rule out double-root compression) for evaluation of muscle weakness as a sign of L4-L5 disc herniation. Of these patients, 90.9% showed hernia in the L4-L5 interspace, and only 34.4% who presented without concomitant signs had a L4-L5 disc herniation ($P < 0.0001$).

Weakness of dorsiflexion of the toe was found to be a specific (95.5%) but rather insensitive (47.6%) sign of L4-L5 disc herniation, confirming the view of Jensen.²⁰ According to our results, L4-L5 herniated disc patients have a 90.9% probability of toe weakness and if a disc other than L4-L5 was herniated, there was a 65.6% probability of toe weakness. These predictive values are parallel (but greater than) those reported in other studies.^{20,25} The current study showed that if a patient has proved L4-L5 disc herniation he is 19 times more likely present with weakness of the toe associated with normal ankle reflex.

Twenty-four patients had monoradicular pain concomitant with signs of first sacral root dysfunction (weakness of plantarflexion of the toe, impaired ankle reflex and SLR positive test) alone. Twenty-three (95.8%) patients had L5-S1 disc herniation and only one (4.2%) patient had an L4-L5 disc herniation. If these four signs and symptom did not present simultaneously, then 16.9% of patients had L5-S1 disc herniation ($P < 0.0001$). Kortelainen et al. noted that if pain and impaired ankle reflex and SLR positive test result were considered, the level diagnosis was reliable in 36% of cases.¹² In the current study, having all four first

sacral clinical aspects gave a 60.5% probability of L5-S1 disc herniation. These clinical features were highly specific (98.7%) for the level diagnosis of L5-S1.

Given a positive result, how likely is it to be a true positive finding? The results of this study showed if a patient had proved L5-S1 disc herniation, there is a 95.8% probability of presenting with all clinical aspects of first sacral root involvement. The predictive value of a negative test was 83.1%. Fifth lumbar herniated disc patients were 113.4 times more likely to exhibit these four clinical features of S1 root dysfunction. Previous reports have not stressed the importance of the diagnostic value of all clinical features of first sacral root involvement occurring concomitantly.^{12, 20, 25, 26}

We conclude that the sensitivity and specificity values for various clinical presentations are useful in clinical practice. The diagnostic value of the clinical features of herniated L5-S1 disc are more reliable than L4-L5 interspace herniation, perhaps due to more frequent double-root compression in fourth lumbar disc herniation. Clinical signs and symptoms of lower lumbar disc herniation are highly specific, but rather insensitive.

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