

Impact of Clinical Information on Lumbar Spine MRI Evaluation of Patients Suspected of Lumbar Disk Herniation

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Abstract. To assess the impact of clinical information on Magnetic Resonance Imaging evaluation of lumbar spine in patients suspected of lumbar disk herniation. Lumbar spine MRI of 50 consecutive patients with back pain and 50 normal volunteers were assessed for the presence or absence of a disk bulge or herniation. The assessment included four disk levels in each MR study (L2-3, L3-4, L4-5 & L5-S1). All images were assessed before and after disclosure of clinical information. Without clinical information: 148 normal levels, 48 disk bulges and 4 disk herniations were detected in the volunteer group as compared to 20 normal levels, 108 disk bulges and 72 disk herniations in the patient group. With clinical information: 132 normal levels, 64 disk bulges and 4 disk herniations were reported in the volunteer group as compared to 12 normal levels, 112 disk bulges and 76 disk herniation in the patient group. Clinical information disclosure resulted in 33% increase in the reported number of bulging disks in volunteers, and 5.5% increase in the reported number of herniation in patients. Clinical information disclosure does not influence the detection of herniations, but lowers the threshold for reporting bulging disks.

Keywords: Low back pain, Lumbar disk herniation, MRI, Degenerative disk disease.

Introduction

The main reason for Magnetic Resonance Imaging (MRI) referral of patients with low back pain (LBP) without a history of neoplasm,

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infections, or other abnormalities is to distinguish between patients with and without degenerative disk disease. This distinction requires accurate imaging since small herniations can be difficult to detect. The literature documents that the accuracy of MRI for predicting the presence of disk herniations at surgery is high (up to 96%); hence, it is the investigation of choice for patients suspected of lumbar disk herniations^[1-4].

There are two sources of possible discrepancies in lumbar spine MRI reporting. The first is the lack of clarity on the definition of bulging disk as compared to disk herniation^[5,6]. The second is the influence of availability of clinical information on image assessment.

Recent publications recommend obscuring clinical information from observers when reporting medical tests to reduce bias^[7,8]. In practice, most radiologists consider clinical information useful, especially in patients suspected of lumbar disk herniation. Little evidence is available on the impact of clinical information on lumbar spine MRI evaluation.

In this study, variation in MRI evaluation for patients suspected of lumbar disk herniation is investigated by evaluating the impact of availability of clinical information on radiologist decision.

Material and Methods

Fifty consecutive patients (36 men, 14 women; age range, 31-68 years; mean 53 years) with LBP were referred for MRI of the lumbar spine from the neuroscience outpatient clinics with suspected disk herniation at levels L2-3, L3-4, L4-5, or L5-S1, for which conservative treatment was unsuccessful. Fifty other normal volunteers were recruited (35 men, 15 women; age range 25 – 63; mean 48 years) as a comparative group.

Low back pain (LBP) was defined on the basis of continuous mono- or multiradicular pain below the knee with a primary suspicion of disk herniation^[9,10]. Patients are considered potential candidates for surgery if conservative treatment for at least 4 weeks deemed unsuccessful.

Excluded were patients younger than 18 years or older than 70 years, pregnant women, and patients with known history of lumbosacral herniation, known spine infections or neoplasia or lumbosacral surgery and patients with contraindications for MRI.

Magnetic resonance imaging (MRI) was performed within 1 week of the clinician request date, and no treatment was given within this period.

All MRI examinations were performed with a 1.5-T Signa HD Scanner (GE Healthcare) using a dedicated lumbar spine surface coil. The protocol included sagittal T1-weighted (TR/TE, 500/14) and T2-weighted (TR 3,500/TE 120 = 20) fast spin-echo images with 4-mm slice thickness, 0.5-mm intersection gap, 200 x 512 matrix, and 29 x 29 cm field of view. In addition, axial T1-weighted (520/12) and T2-weighted fast spin-echo (4,500/120) images were obtained between L2 and S1 with 4-mm slice thickness, 0.5-mm intersection gap, 200 x 256 matrix, and 15 x 15 cm field of view. Axial images were obtained parallel to the disk.

All images and reports were reviewed twice by the author in one session; once alone and once with the referring clinicians after clinical information disclosure. The clinical information consisted of side, level, and severity of symptoms. The images were presented per patient in a random order. The L2–3, L3–4, L4–5, and L5–S1 levels were examined per patient. Each disk was evaluated for the presence of a disk bulge or herniation. If neither lesion was identified, the study was concluded to be normal.

Circumferential symmetric extension of the disk beyond the disk interspace was considered the definition of a bulging disk^[11]. No distinction between protrusion and extrusion was made. Both were considered a herniated disk.

Results

A total of 400 levels from 50 patients and 50 volunteers were included in the analysis. The blinded review of the images revealed 67 disk bulges (Fig. 1) and 1 herniation in the volunteer group; 108 disk bulge and 72 herniations (Fig. 2) in the patient population. Disclosure of clinical information resulted in the decrease in reported disk bulges by 16 levels (31%) among the volunteers, and an increase by 4 levels (3.7%) in the patient population. Detection of disk herniation also increased by 4 levels (5.5%) in the patient population, but not among the volunteers (Table 1).

Discussion

The study showed substantial disagreement in disk bulge reporting prior and after revealing clinical information. Assessing MR images with clinical information increased the number of reported bulging disks by



Fig. 1. Axial T2 weighted image of a volunteer obtained at the L3-4 level demonstrating an incidental diffuse disk bulge.

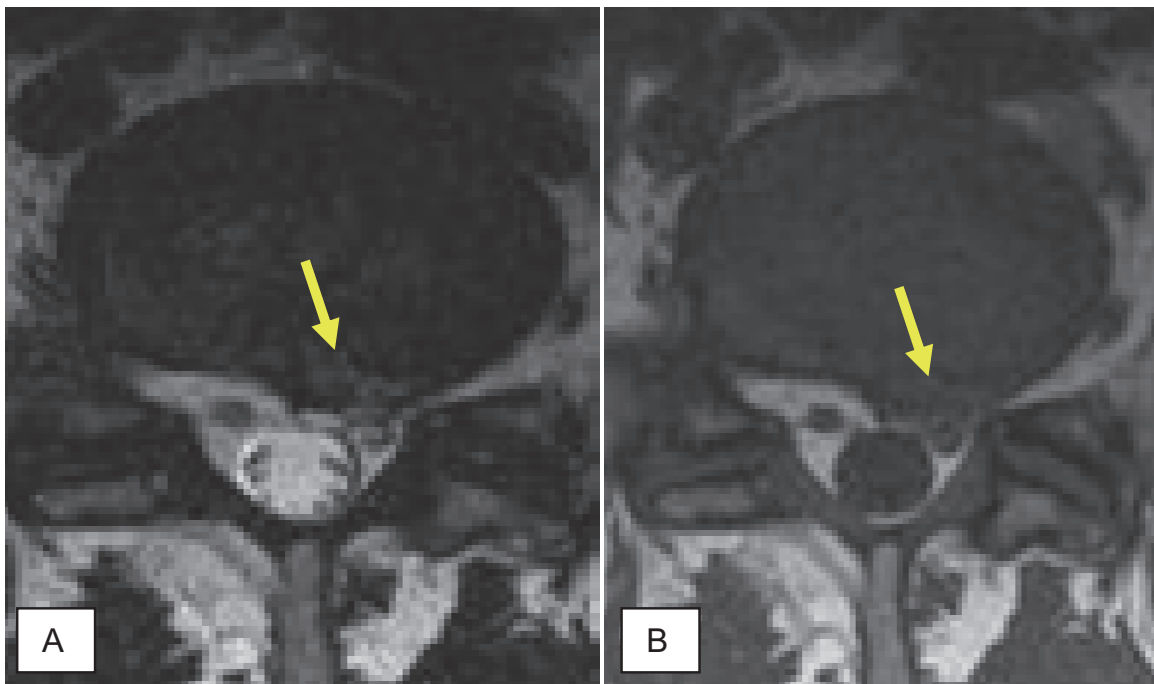


Fig. 2. Axial T2 weighted (A) and T1 weighted (B) images of a patient obtained at the L4-5 level with a left paracentral disk herniation impinging on the traversing L5 nerve.

Table 1. Tabulated results of data analysis.

	Without Clinical Information		With Clinical Information	
	Patients	Volunteers	Patients	Volunteers
Number of MR studies	50	50	50	50
Number of assessed MR levels	200	200	200	200
Number of normal levels	20	132	12	148
Number of disk bulges	108	67	112 (3.7%)	51 (- 31%)
Number of disk herniation	72	1	76 (5.5%)	1

3.7% in the patient populations and decreased it by 31% among volunteers. This is possibly caused by the uncertainty in accurate differentiation between subtle disk bulges and normal disk. This is well in-line with the reported literature^[5]. The significant decrease in the number of reported disk bulges among volunteers, after volunteer status disclosure indicates possible general radiologists low threshold in reporting disk bulges in routine lumbosacral MR imaging.

Bulging disks usually are assumed to be asymptomatic lesions as they are common in the general asymptomatic population (52% of asymptomatic people have at least one^[11-12]), one could therefore argue about their clinical relevance. A second argument against the clinical relevance of bulging disks is that the treatment is almost always conservative, and surgical treatment is usually not an option^[13].

The results also show an increase in the reporting of bulging disks after disclosure of clinical information. It seems that some small lesions are often dismissed and only considered important only when clinical symptoms are present, although a herniated disk is not evident. This again demonstrates probable radiologist's low threshold for reporting subtle abnormalities by using the bulging-disk diagnosis as an escape option. However, the exact explanation for this influence of clinical information remains unclear.

The study showed that clinical information has less influence on the detection and reporting of disk herniations. The number of reported disk herniations increased in the patient population only by 5.5% (4 cases) after clinical information disclosure. Three cases of extra-foraminal (far lateral) herniations were missed, or were not considered significant in the initial report and the clinical data was consistent with the anatomic locations of the herniation (Fig. 3 & 4). The fourth herniation was a small para-central herniation that was missed due to lower image quality

(motion artifacts). This is clinically relevant, because the decision whether to surgically intervene depends greatly on a clear MRI diagnosis.

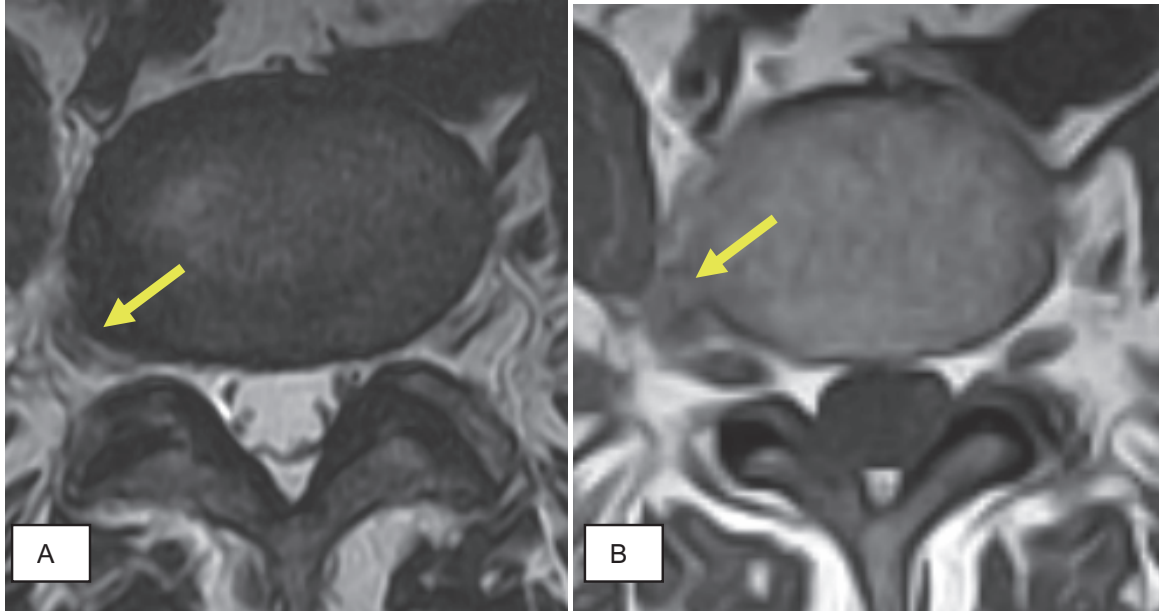


Fig. 3. Axial T2 weighted (A) and T1 weighted (B) images of a two patients obtained at the L4-5 and L3-4 levels respectively demonstrating a right extra foraminal disk-osteophyte complex impinging the exiting respective nerves. These were initially missed and were noticed after the clinical information disclosure.

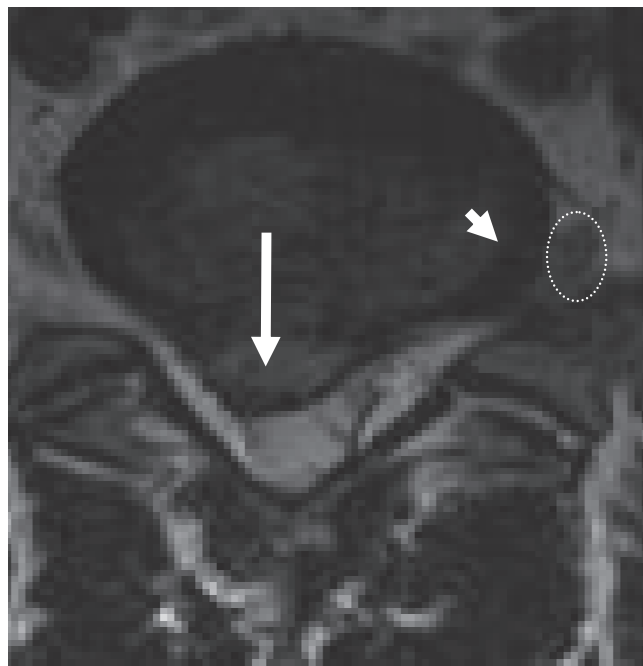


Fig. 4. Axial T2 weighted image of a patient obtained at the L4-5 level demonstrating a large right paracentral herniation (long arrow) and a left foraminal disk-osteophyte complex (short arrow) impinging the exiting respective nerves. The latter was not emphasized on the initial report and was only considered significant after disclosure of relevant clinical information.

The study has two inherent limitations. The first is the lack of a gold standard reference to verify the presence or absence of disk bulge or herniation as surgical exploration of all segments is unethical. Reliance on clinical presentation to distinguish between asymptomatic and symptomatic lesions is not a reliable reference standard. The second limitation is the single observer and limited number of patients involved. However, because most studies on this subject have had limited numbers of observers and patients, our results can be compared with those results.

In summary, although MRI is the investigation of choice for the evaluation of patients suspected of having herniated disks, substantial observer disagreement was observed in reporting the presence or absence of disk bulge and herniation before and after clinical information disclosure.

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تأثير المعلومات السريرية في تقييم الرنين المغناطيسي لدى مرضى الانزلاق الغضروفي

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المستخلص. تم دراسة فحوصات الرنين المغناطيسي لخمسين مريض يشكون من الآم أسفل الظهر وخمسين متطوع بهدف تقييم تأثير توفر المعلومات السريرية في تقييم الرنين المغناطيسي لدى مرضى الانزلاق الغضروفي. حيث تم تقييم مستويات الغضاريف بين الفقرات القطنية الثانية والفقرة العجزية الأولى قبل وبعد معرفة المعلومات السريرية. قبل كشف المعلومات السريرية تم ملاحظة وجود ٤٨ بروز غضروفي و ٤ انزلاقات غضروفية لدى المتطوعين مقابل ١٠٨ بروز غضروفي و ٧٢ انزلاق غضروفي لدى مجموعة المرضى. بعد كشف المعلومات السريرية تم ملاحظة ٦٤ بروز غضروفي و ٤ انزلاقات غضروفية لدى المتطوعين مقابل ١١٢ بروز غضروفي و ٧٦ انزلاق غضروفي لدى مجموعة المرضى. الكشف عن المعلومات السريرية أدى إلى ٣٣٪ زيادة في ملاحظة البروز الغضروفي لدى المتطوعين و ٥,٥٪ زيادة في ملاحظة الانزلاق الغضروفي لدى مجموعة المرضى مما يؤكد تأثير الكشف عن المعلومات السريرية في ملاحظة وجود الانزلاقات الغضروفية.