

Spontaneous Resorption of a Large Cervical Herniated Nucleus Pulposus

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Abstract

The majority of patients with symptomatic herniated discs can be successfully and conservatively managed and can achieve clinical improvement without surgical intervention. Resorption of the herniated nucleus pulposus (HNP) is 1 conservative mechanism for clinical improvement.

We present the case of a 76-year-old healthy man with acute cervical radicular right arm pain and positive Spurling test. Magnetic resonance imaging (MRI) showed a large disc extrusion behind the C6 vertebral body, causing severe central canal stenosis and right-greater-than-left foraminal stenosis. The patient did not want surgical intervention, and his symptoms resolved with conservative treatment. A follow-up MRI 7 months after his initial presentation showed almost complete resorption of the herniated disc. The patient returned to his normal activities and has not had recurrence of symptoms for 2 years.

This report provides an interesting example of complete resorption of a large, extruded cervical herniated disc in a symptomatic patient and a review of the literature on resorption of herniated discs. The review suggests that larger herniations with an epidural location (penetration of the posterior longitudinal ligament) have a greater chance of resorption.

Patients with cervical or lumbar radiculopathy resulting from herniated discs often have favorable clinical outcomes. The majority show clinical improvement with conservative treatment consisting of anti-inflammatory medications, physical therapy, and epidural steroid injections.^{1,2} One mechanism for clinical improvement with conservative management can be resorption of the herniated nucleus pulposus (HNP). The concept of resorption of the HNP has prompted considerable clinical and basic science interest since its first description in the 1980s.³⁻⁵ Evidence suggests that larger disc herniations, and particularly those that extend beyond the posterior longitudinal ligament (PLL), are most likely to resorb.

Resorption is thought to occur via an inflammatory response involving macrophages, pro-inflammatory cytokines, matrix metalloproteinases (MMPs), and neovascularization.⁶⁻²¹

We present a case report of a 76-year-old healthy man who presented with acute onset neck pain radiating into the right arm and magnetic resonance imaging (MRI) showing a large disc extrusion behind the C6 vertebral body, a location consistent with his radicular symptoms. The patient did not want surgical intervention given his initial improvement, and after 7 months of conservative treatment, his symptoms completely resolved and he returned to his prior physical activities. A follow-up MRI 7 months after initial presentation showed dramatic resorption of the herniated disc. This case provides a unique example of resorption of a large, symptomatic cervical herniated disc in a relatively old patient, coinciding with clinical improvement of radiculopathy. In addition to describing the case, we provide an updated review of the literature on resorption of herniated discs. The patient provided written informed consent for print and electronic publication of this case report.

Case Report

A 76-year-old healthy man presented with acute onset severe neck pain radiating into the right arm. The pain began suddenly 2 weeks prior to presentation while the patient was shoveling snow. There was no history of acute trauma, and the pain was relieved by ibuprofen. The patient reported no associated numbness, tingling, or incontinence of the bowel or bladder; medical history was notable for glaucoma and anxiety. The patient was retired, did not smoke, and used alcohol socially.

On examination, the patient appeared healthy and in no acute distress. His gait was normal, as was his cervical spine posture, with mildly decreased cervical range of motion. The patient's cervical spine was nontender. He had normal upper and lower extremity motor and sensory function bilaterally, with normal reflexes and no evidence of hyperreflexia or myelopathy on examination. The Spurling test was positive on the right and negative on the left. The patient's MRI at the time of initial presentation (**Figures 1A, 1B**) showed a large right paracentral disc extrusion at C5-C6, measuring 13 mm transversely by 7 mm anterior-posteriorly by 19 mm craniocaudally, extending down the posterior aspect of the C6 vertebral body and

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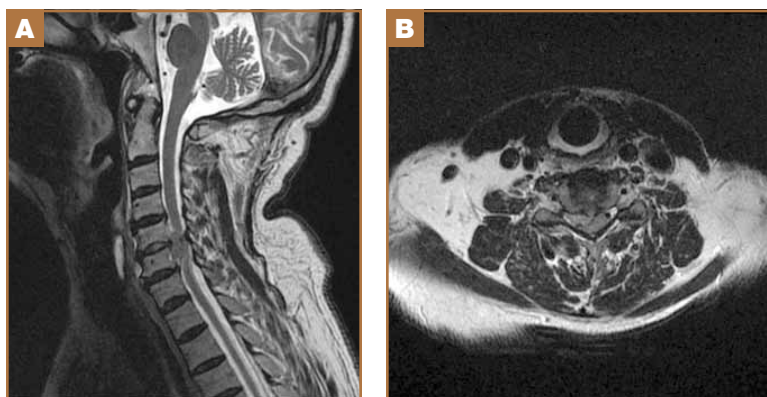


Figure 1. Representative (A) T2-weighted sagittal and (B) T2-weighted axial magnetic resonance images from initial presentation. These show a right paracentral C5-C6 disc extrusion, extending down the posterior aspect of the C6 vertebral body and causing central stenosis and bilateral neural foraminal stenosis, right greater than left. The extruded disc measures 13 mm transversely by 7 mm anterior-posteriorly by 19 mm craniocaudally.

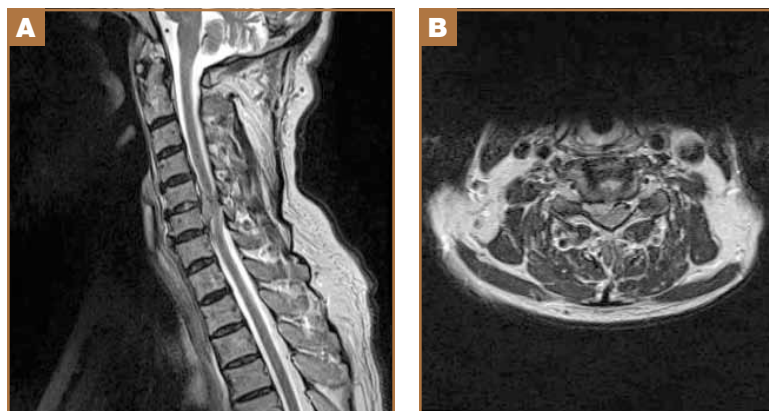


Figure 2. Representative (A) T2-weighted sagittal and (B) T2-weighted axial magnetic resonance images at 5-week follow-up. Extruded disc is stable in appearance and size compared with initial presentation, measuring 12 mm transversely by 7 mm anterior-posteriorly by 23 mm craniocaudally.

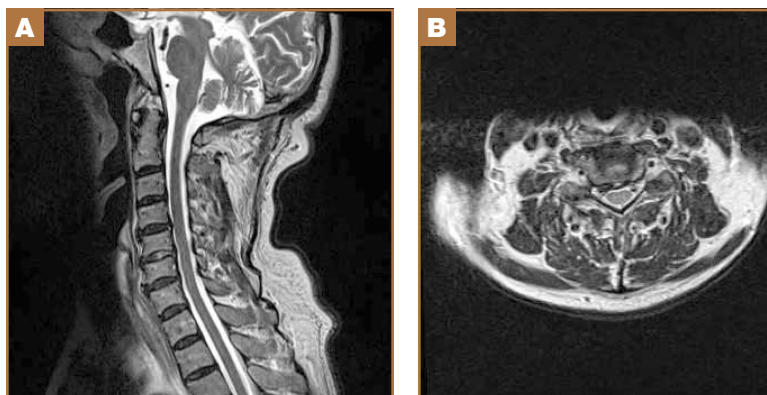


Figure 3. Representative (A) T2-weighted sagittal and (B) T2-weighted axial magnetic resonance images at 7-month follow-up. Near complete resorption of the extruded disc has occurred, along with dramatic improvement of central and foraminal stenosis.

causing central stenosis and right-greater-than-left bilateral neural foraminal stenosis.

After discussion of treatment options, the patient elected a trial of conservative management, given his mild symptoms at initial presentation, with frequent follow-up because of the size of the herniation and the imaging findings of central and bilateral foraminal stenosis. Conservative treatment involved a soft cervical collar for comfort and nonsteroidal anti-inflammatory drugs (NSAIDs).

The patient returned for several appointments over the next 6 weeks, improving to the point of no longer requiring NSAIDs or a cervical collar. His radicular symptoms resolved, and his upper extremity motor, sensory, and reflex examination was normal without evidence of myelopathy. Spurling test was now negative. Five weeks after his initial presentation, he was symptom-free, when a repeat MRI showed no significant change in his disc herniation from his MRI at initial presentation (**Figures 2A, 2B**). In this MRI, the disc herniation measured 12 mm transversely by 7 mm anterior-posteriorly by 23 mm craniocaudally.

At several successive appointments, the patient's neck and right arm pain continued to improve, and he maintained a normal neurologic examination. He began physical therapy, which he tolerated well. Repeat MRI 7 months after initial presentation showed complete resorption of the extruded disc (**Figures 3A, 3B**). The patient returned to all his regular activities and has experienced no recurrence of symptoms at latest follow-up 2 years after resolution of his symptoms.

Discussion

This case report provides an interesting example of successful conservative treatment of a large extruded cervical herniated disc with imaging evidence of disc resorption correlating with clinical improvement. While there are many reports of imaging documentation of resorption of large lumbar HNP, there are relatively few reports of significant resorption of large cervical herniated discs, particularly in older patients. This case is unique in the patient's complete resolution of clinical and MRI findings over 7 months. The high rates of clinical improvement with conservative therapy and the review of the phenomenon of resorption of herniated discs strongly suggest that, when treating patients with clinical symptoms resulting from disc herniations, clinicians should base treatment decisions on the patients' symptoms and responses to conservative therapy. Treatment decisions should not be based on the location or size of a disc herniation on imaging.

Table. Key Studies on Resorption of Herniated Discs

Author	Year	Imaging Modality	No. of Cervical HNPs	No. of Lumbar HNPs	Time to Repeat Imaging (mo)	Findings
Teplick and Haskin ³	1985	CT	0	55	5-36	20% (11 of 55 patients) had regression of herniated disc
Saal et al. ²²	1990	CT/MRI	0	11	8-77	82% of patients showed decrease in extruded disc size by at least 50%
Maigne et al. ²³	1992	CT	0	48	1-48	81% of herniations decreased by at least 50%; largest initial herniations most likely to show greater decrease in size
Delauche-Cavallier et al. ²⁴	1992	CT	0	21	At least 6	66% of patients had decrease in size of disc herniations; larger initial herniations more likely to decrease in size
Matsubara et al. ²⁵	1995	MRI	0	32	12	34% of herniations decreased in size of herniation by at least 20% (as measured by percentage of spinal canal occupied by herniated disc)
Komori et al. ²⁶	1996	MRI	0	77	2-40	45% of patients experienced disappearance or marked decrease in herniated disc; further initial migration correlated with greater decrease in size; clinical improvement predated imaging changes
Ahn et al. ²⁷	2000	MRI	0	36	3-27	69% decrease in size of herniation, with transligamentous extension beyond the PLL found to be more important than initial size in predicting resorption
Splendiani et al. ²⁸	2004	MRI	0	64	6	35% of herniations showed regression, with increased rates of regression associated with free fragments, high initial T2 signal intensity, and initial peripheral contrast enhancement
Autio et al. ²⁹	2006	MRI	0	53	2 and 12	Significant average reduction in size, resorption correlated with age (41-50 years), baseline thickness of MRI gadolinium enhancement, and migration of disc based on methodology in Komori et al. ²⁶
Mochida et al. ³⁶	1998	MRI	38	0	2-24	40% of patients showed decrease in volume of herniated cervical disc, with extruded discs most likely to regress
Maigne and Deligne ³⁷	1994	CT	21	0	1-30	76% of herniations decreased in size by over 35%; largest initial herniations had greatest decrease in size

Abbreviations: CT, computed tomography; HNP, herniated nucleated pulposus; MRI, magnetic resonance imaging; mo, months; PLL, posterior longitudinal ligament.

The regression or resorption of herniated discs with conservative treatment has been the focus of substantial basic and clinical research interest since this phenomenon was first described in the 1980s.³⁻⁵ Saal and colleagues²² reported a series of 11 patients with disc extrusion and radiculopathy who were treated nonoperatively and had initial imaging with computed tomography (CT) and follow-up MRI. At median follow-up of 25 months, 82% of patients showed imaging evidence of decrease in extruded disc size by at least 50%.²² These initial reports were case reports and small case series with CT evidence of resorption of herniated discs with conservative treatment. Subsequently, multiple studies have suggested that larger disc

herniations are the most likely to decrease in size on CT and MRI with successful conservative treatment (Table).

Maigne and colleagues²³ studied 48 patients treated conservatively for lumbar radiculopathy with CT evidence of lumbar disc herniation, which was classified as small, medium, or large on the initial CT. Repeat CT scan, at 1 to 48 months after initial presentation, showed that 9 herniations decreased 25% to 50% in size, 8 decreased 50% to 75%, and 31 decreased 75% to 100%, with the largest initial herniations more likely to show a greater decrease in size. Similarly, Delauche-Cavallier and colleagues²⁴ reported 21 patients conservatively treated for lumbar radiculopathy with CT evidence of herniated disc.

Repeat CT was obtained at least 6 months after initial presentation, showing that 14 of 21 patients had a decrease in size of the herniated disc, with larger initial herniated discs significantly more likely to decrease. Matsubara and colleagues²⁵ evaluated 32 patients conservatively treated for lumbar radiculopathy and MRI evidence of herniated lumbar discs. Serial MRIs at 6 and 12 months showed that the average percentage of the cross-sectional area of the spinal canal occupied by the disc decreased from 31.9% on presentation to 25.3% at 12-month follow-up, with the larger initial herniated discs showing a larger decrease in size. Komori and coauthors²⁶ followed 77 patients treated conservatively for lumbar radiculopathy with MRIs showing herniated discs. The initial disc herniation was graded based on MRI migration distance, and the extent of regression was evaluated on follow-up serial MRI scans obtained 2 to 40 months after initial presentation. The study found that greater initial migration was associated with greater decrease in herniation size, although clinical improvement tended to predate imaging evidence of disc resorption.

According to some study findings, resorption of herniated discs may be more closely related to factors other than size, such as extension of the disc through the PLL, presence of free fragments, or MRI parameters such as enhancement or high T2 signal.²⁷⁻²⁹ Ahn and colleagues²⁷ studied 36 patients conservatively treated for lumbar radiculopathy and MRI evidence of herniated discs. Repeat MRI at 3 to 27 months after initial presentation showed that transligamentous extension of the herniated disc through the PLL was more strongly associated with disc resorption than with herniation size. Specifically, 10 of 18 (56%) subligamentous herniations decreased in size, compared with 11 of 14 (79%) transligamentous herniations and 4 of 4 (100%) sequestered herniations. Herniations that reduced in size by at least 20% had better clinical outcomes than those that failed to decrease in size.

Splendiani and colleagues²⁸ studied 64 patients conservatively treated for lumbar radiculopathy with MRI showing herniated discs in an attempt to identify MRI predictors of disc resorption. At 6-month follow-up MRI, they found that, although only 35% of herniated discs had regressed, 100% of free fragments had regressed, as did 85% of herniations with high initial T2 signal, and 83% of herniations with initial peripheral contrast enhancement. Autio and colleagues²⁹ obtained 2- and 12-month follow-up MRI for patients with lumbar radiculopathy and herniated discs. Factors associated with greater disc resorption were age (41 to 50 years), greater baseline thickness of MRI gadolinium rim enhancement, and greater migration of the herniated disc according to the methodology used by Komori and colleagues.²⁶ The correlation of herniated disc resorption with these parameters rather than size alone appears to result from the pathogenesis of disc resorption, which is thought to involve inflammation from the HNP, recruitment of macrophages via the peridural circulation, and neovascularization.

As in the case report presented here, resorption of cervical disc herniations has been reported and correlated with size. That there is significantly less literature regarding the natural

history of cervical herniations than for lumbar herniations likely results from concerns about neurologic compromise. Multiple case reports and small case series have documented resorption of cervical herniated discs in patients with cervical radiculopathy and myelopathy, including large and extruded herniations.³⁰⁻³⁵ Mochida and colleagues³⁶ studied 38 patients with cervical disc herniations and cervical radiculopathy who underwent repeat MRI. In 15 of 38 patients (40%), the authors found decrease in size of the herniated disc, with extruded discs most likely to regress compared with nonextruded discs. Maigne and Deligne³⁷ studied 21 patients with cervical radiculopathy and CT at presentation showing herniated cervical disc and repeat CT at 1 to 30 months after conservative treatment. At follow-up CT, the authors found that 5 herniations decreased 0% to 35% in size, 6 decreased 35% to 75%, and 10 decreased 75% to 100%, with the largest herniations having the greatest tendency to decrease in size.

Basic science and translational research has aimed to elucidate the pathways of normal intervertebral disc metabolism, mechanisms of disc degeneration, and the mechanism of resorption of herniated discs.³⁸⁻⁴¹ Research suggests that the resorption process involves an immune response to the disc tissue, particularly the pro-inflammatory nucleus pulposus rather than the relatively inert peripheral annulus.⁶⁻⁸ Macrophages are recruited to the herniated disc and play a key role in mediating resorption partially through the actions of MMPs and tumor necrosis factor- α (TNF- α).^{7,9-20} Vascular endothelial growth factor and angiogenesis also play a role in the resorption process.^{6,13,16,21} This process is more robust when the herniation extends into the epidural space, penetrating the PLL, because the peridural circulation in this location facilitates the inflammatory response and recruitment of macrophages.⁶

Matsui and colleagues⁷ obtained 21 lumbar disc herniation surgical specimens that were classified as protrusion, subligamentous extrusion, transligamentous extrusion, or sequestration, as well as 4 nonherniated discs as controls. They performed histology and immunohistochemical staining, showing that transligamentous extrusions and sequestrations elicited a more pronounced inflammatory response than protrusions and subligamentous extrusions, including more granulation tissue, more macrophages, and higher levels of MMP-1 and MMP-3. Similarly, Ozaki and coauthors⁶ evaluated 64 lumbar disc herniation surgical specimens, classified as protrusion, subligamentous extrusion, transligamentous extrusion, migration, or sequestration. Histology and immunohistochemistry showed a greater degree of neovascularization when the herniating nucleus pulposus perforates the PLL.

Although the available literature suggests that larger herniated discs are more likely to show greater resorption than smaller disc herniations, there are limitations to the available evidence. Many are retrospective studies of relatively small series of patients who improved with conservative therapy. Assuming the resorption of the herniated disc is correlated with clinical improvement, this would tend to overestimate the percentage of discs that resorb, since patients who failed to improve would have undergone surgery and been excluded from

the results. In addition, the majority of the studies showed poor correlation of extent of resorption based on CT or MRI with clinical improvement, which reinforces the importance of treating according to patient symptoms rather than imaging findings. Another limitation of our literature review is that the evidence for disc herniation resorption is far less robust in the cervical spine than the lumbar spine. However, the consistency in results between studies provides support for the theory that an epidural location favors resorption.

Areas for future research include higher quality studies on natural history of conservative treatment of HNPs, particularly in the cervical spine, and attempting to harness the basic science understanding of HNP resorption into novel nonoperative treatments for patients with symptomatic HNPs.

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This paper will be judged for the Resident Writer's Award.
