

Spontaneous regression of lumbar disc herniation: four cases report and review of the literature

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ABSTRACT

Spontaneous regression of lumbar disc herniation refers to shrinkage or disappearance of herniated nucleus pulposus without invasive surgical treatments. This phenomenon has been reported and is supported by improved clinical symptoms and radiographic after conservative treatment, but the underlying mechanism remains unclear. This article reports 4 cases of disc reabsorption and reviews the distribution of several clinical and radiographic factors of disc herniation reabsorption of total 46 patients, including the four from our study, gathered from 28 recent publications. Some of these factors are present with anomalous distributions. But some factors have similar deviations in patients with lumbar disc herniation. Therefore, more research is needed to explore the correlation between those factors and disc reabsorption.

Keywords: lumbar disc herniation, spontaneous regression, reabsorption, clinical factor, radiographic factor

Abbreviations:

LDH: lumbar disc herniation

MRI: magnetic resonance imaging

MC: Modic change

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INTRODUCTION

Lumbar disc herniation (LDH) is a common cause of low back pain and radicular leg pain, with a reported incidence of approximately 1%–5%. About 20% to 50% of patients who received conservative treatment require surgical treatment later, and it is increasing as the aging population, and it also tends to become younger.^{1,2} Spontaneous regression of LDH refers to the shrinkage or disappearance of the herniated nucleus pulposus without surgical intervention treatment such as discectomy or percutaneous puncture. This is a rare phenomenon, and the underlying mechanism is still unclear.² The hypothesis of lumbar disc reabsorption has been proposed by

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some scholars, suggesting that factors such as gender, age and protrusion size may impact the occurrence of reabsorption, but most of these speculations have yet to be confirmed.³ Despite the prevalence of minimally invasive surgery for LDH, many patients still opt for non-surgical treatment. Therefore, predicting and inducing the lumbar disc reabsorption is a focus in the field of conservative treatment of LDH.

In this article, we report 4 patients with spontaneous regression of LDH. In addition, we review clinical and radiographic features of 46 patients (including 4 patients in this paper) from 28 recent publications and correlate these studies to characterize factors which are favorable for disc regression.

CASE REPORTS

Case 1

A 34-year-old female suffered from chronic low back pain for 2 year and experienced exacerbated lower back pain and left leg radiating pain after exercising for 1 week. Neurological examination showed no neurological deficit, but the left straight-leg-raising test was positive. Magnetic resonance imaging (MRI) revealed a large L4-L5 disc herniation with L5 left nerve root compression (Fig. 1A, B). The patient insisted that physical therapy and acupuncture had significant relief for her previous low back pain, so she opted for conservative treatment, including oral analgesics, functional exercise, acupuncture and physical therapy. After 8 weeks of treatment, radiating pain in lower limb disappeared completely, only slight lower back pain remained. Her latest MRI was taken after 12 months showed the herniated disc almost disappeared completely (Fig. 1C, D).

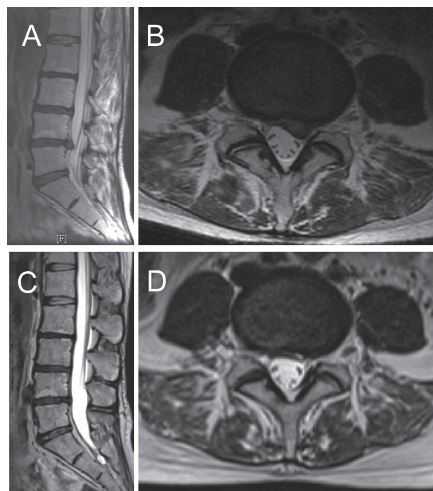


Fig. 1 Case 1

Fig. 1A: MRI sagittal view revealed L4-L5 intervertebral disc herniation.

Fig. 1B: MRI transverse view showed that the herniated disc was compressing the nerve root on the left side.

Fig. 1C: MRI sagittal view revealed significant resorption of the L4-L5 disc herniation after 12 months.

Fig. 1D: MRI transverse view showed resorption of the disc and release of the nerve root compression after 12 months.

MRI: magnetic resonance imaging

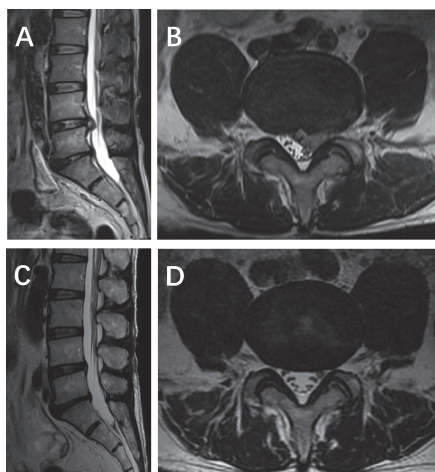


Fig. 2 Case 2

Fig. 2A: MRI sagittal view revealed L4-L5 intervertebral disc herniation.

Fig. 2B: MRI transverse view showed that the herniated disc was compressing the nerve root on the left side.

Fig. 2C: MRI sagittal view revealed almost complete resorption of the L4-L5 disc fragment after 4 months.

Fig. 2D: MRI transverse view showed almost resorption of the disc fragment and release of the nerve root compression after 4 months.

MRI: magnetic resonance imaging

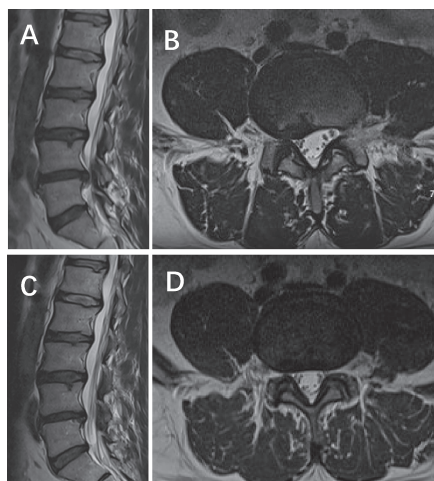


Fig. 3 Case 3

Fig. 3A: MRI sagittal view revealed L4-L5 intervertebral disc herniation.

Fig. 3B: MRI transverse view showed that the herniated disc was compressing the nerve root on the right side.

Fig. 3C: MRI sagittal view revealed almost resorption of the L4-L5 disc fragment after 9 months.

Fig. 3D: MRI transverse view showed almost resorption of the disc and significant release of the nerve root compression after 9 months.

MRI: magnetic resonance imaging

Case 2

A 68-year-old male experienced sudden lower back pain and left leg radiation pain after lifting heavy objects for 2 days. Neurological examination did not reveal sensory impairment or motor deficit, but the left straight-leg-raising test was positive. MRI revealed a large extruded disc fragment at the L4-L5 causing L5 left nerve root compression (Fig. 2A, B). Considering that the patient was experiencing this symptom for the first time, we decided to treat him conservatively with bed rest, acupuncture, physical and medical therapy. After 4-month, the symptoms disappeared completely, and MRI disclosed almost complete disappearance of the L4-L5 disc fragment (Fig. 2C, D).

Case 3

A 45-year-old male with a 3-months of history of low back pain and right lateral leg pain with numbness. Neurological examination showed no obvious neurological deficit. MRI revealed a right posterolateral herniated nucleus pulposus with compression of the L5 right root (Fig. 3A, B). A trial of conservative management failed to relieve the patient's pain, so surgery to remove the herniated disc was offered. The patient refused the surgery, however, and chose instead to proceed with physical therapy and acupuncture unless he developed a neurological deficit. The clinical symptoms subsided gradually in about 3 months. After 9 months, MRI showed that the herniated disc at L4/5 had almost completely regressed without nerve root compression (Fig. 3C, D).

Case 4

A 55-year-old female was admitted with 10 days history of radiating pain in the right lower extremity. Neurological examination showed no abnormality except the right straight-leg-raising test was positive. MRI revealed a right extreme lateral herniated nucleus pulposus at L4-L5 level (Fig. 4A, B). The patient was offered surgery, but she declined it in favor of conservative

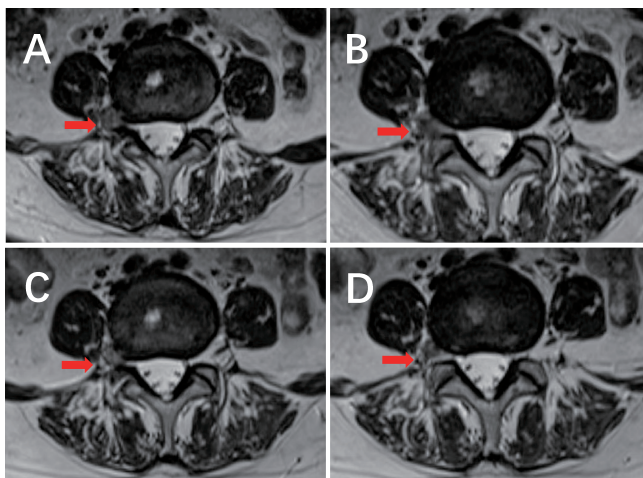


Fig. 4 Case 4

Fig. 4A, B: MRI transverse view revealed a right extreme lateral lumbar disc herniation at L4-L5 level (red arrow).

Fig. 4C, D: MRI transverse view showed partial resorption of the protruding nucleus pulposus after 2 months (red arrow).

MRI: magnetic resonance imaging

treatment, and agreed to undergo physical therapy, bed rest, acupuncture and to perform exercises, without taking medication. After 2 months conservative treatment, she said that she was nearly symptom-free except for a little residual pain in his right leg. The MRI at that time showed that the herniated nucleus pulposus had shrunk significantly (Fig. 4C, D).

METHODS

Bibliography retrieval

To identify all published case reports and case series of spontaneous reabsorption of the lumbar disc, we conducted a comprehensive search of the PubMed, Embase, and Web of Science databases using the following search terms: “intervertebral disc”, “lumbar disc”, “nucleus pulposus”, “reabsorption”, “resolution”, “absorb*”, “regress*”, “reduc*” and “decreas*”. In addition, we manually traced the reference lists of relevant literature to supplement our search. We included only studies conducted on humans that provided complete case information and radiographic images, and excluded those involving spinal infections, tumors, spondylolisthesis, spinal stenosis, or previous lumbar surgery. Two researchers independently screened the literature and extracted data, and any discrepancies were resolved by a third researcher.

Data extraction

Clinical data included the patients’ age, gender, disease duration, affected disc level, and MRI interval. Radiographic data included Modic change (MC),⁴ herniated disc size (Level 1 as filling 25% or less of the spinal canal, level 2 as filling 26%–50%, and level 3 as filling more than 50%),⁵ and classifications according to Komori⁶ (Fig. 5) and Pfirrmann⁷ (Fig. 6).

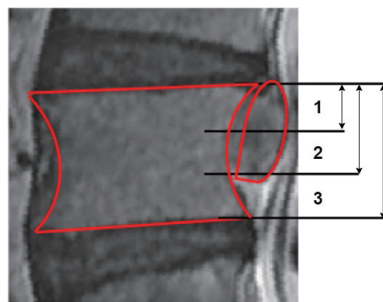


Fig. 5 Visual representation of the Komori classification

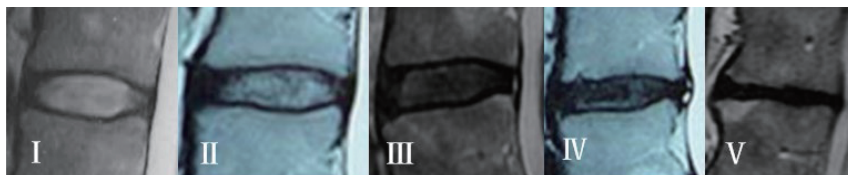


Fig. 6 Visual representation of the Pfirrmann grade

RESULTS

A total of 46 patients (including 4 patients in this paper) from 28 publications were screened out, and all cases had detail clinical and radiographic data^{2,8-34} (Table 1).

Table 1 Clinical and imaging characteristics of 46 cases of lumbar disc herniation resorption

Author	Gender/ Age	Disease duration	MRI interval (Mo)	Disc level	MC	Komori	Pfrrmann	Size	
This article	F/34	2 years	12	L4-L5	Y	1	IV	1	
	M/68	2 days	4	L4-L5	N	1	III	2	
	M/45	3 months	9	L4-L5	N	1	IV	1	
	F/55	10 days	2	L4-L5	N	1	III	1	
Gezici ⁸	F/33	2 years	15	L4-L5	N	1	V	3	
Grasland ⁹	M/67	2 days	10	L3-L4	N	3	IV	-	
Borota ¹⁰	M/46	2 years	10	L4-L5	Y	2	V	2	
Chang ¹¹	M/46	6 months	30	L4-L5	N	1	IV	2	
	M/29	1 month	14	L5-S1	N	1	IV	2	
Naidoo ¹²	F/51	1 day	3	L4-L5	N	2	V	3	
Kim ¹³	M/53	-	24	L2-L3	N	3	V	2	
	M/58	2 years	9	L3-L4	N	3	III	2	
	F/58	-	2	L2-L3	N	2	III	3	
Yilmaz ¹⁴	F/37	4 months	2	L4-L5	N	3	V	3	
	F/65	3 weeks	3	L4-L5	N	2	IV	2	
Hu ²	M/38	1 week	-	L4-L5	N	3	V	1	
Hong ¹⁵	F/29	6 months	5	L4-L5	N	1	V	-	
Liu ¹⁶	M/48	20 days	4	L4-L5	N	3	IV	3	
Chiang ¹⁷	M/43	1 month	17	L4-L5	N	3	IV	2	
Oktay ¹⁸	M/36	-	9	L5-S1	N	1	IV	1	
	M/56	-	6	L4-L5	Y	3	IV	3	
	M/46	-	9	L1-L2	N	1	III	1	
	M/31	-	3	L5-S1	N	3	III	3	
	M/41	-	12	L5-S1	N	1	IV	3	
	Slavin ¹⁹	-/23	1 month	7	L4-L5	N	3	IV	2
	Karavelioglu ²⁰	F/44	1 month	6	L5-S1	N	3	V	1
Li ²¹	M/49	15 days	9	L4-L5	N	2	IV	2	
Tokmak ²²	F/42	3 years	17	L5-S1	N	3	IV	1	
Monument ²³	M/57	6 months	6	L4-L5	N	2	IV	2	
Macki ²⁴	M/35	1 month	5	L4-L5	Y	3	V	3	
Wang ²⁵	M/25	2 months	24	L5-S1	N	1	IV	1	
Keski ²⁶	M/44	4 months	7	L4-L5	N	3	IV	2	
	M/37	-	82	L4-L5	N	3	V	3	
	Rapan ²⁷	F/27	3 months	12	L4-L5	Y	1	IV	2
Sabuncuoğlu ²⁸	M/32	6 months	12	L5-S1	N	3	IV	2	
	F/33	7 months	10	L5-S1	N	2	IV	2	
Kim ²⁹	M/44	6 months	14	L1-L2	N	2	IV	2	
	M/64	1 week	3	L3-L4	N	1	III	2	
	M/74	1 day	3	L1-L2	N	2	V	2	
Ryu ³⁰	M/67	-	9	L4-L5	Y	2	V	1	
	F/53	6 months	6	L4-L5	Y	3	V	2	
Orief ³¹	F/33	3 weeks	6	L4-L5	N	3	IV	2	
	M/45	2 weeks	8	L5-S1	N	2	IV	2	
	Tarukado ³²	M/83	1 month	3	L2-L3	N	2	IV	2
Hakan ³³	M/41	10 days	-	L5-S1	N	3	IV	3	
Yang ³⁴	M/45	3 months	9	L3-L4	N	3	III	3	

M: male

F: female

MRI: magnetic resonance imaging

MC: Modic changes

Mo: month(s)

Y: yes

N: no

The age ranged from 23 to 83 years, with an average age of 45.87 ± 13.70 years. The age group with the largest number of patients is 41–50 years old (32.61%), followed by 31–40 years old (23.91%) and 51–60 years (17.39%), and the distribution is shown in Fig. 7A. The disease duration of LDH in the analyzed 37 cases ranged from 1 day to 3 years, with an average of 5.53 ± 8.83 months, and the distribution is shown in Fig. 7B. More specifically, 19 patients (51.35%) had symptoms for less than 1 month, and only 6 patients (16.22%) had symptoms for more than 6 months. The distribution of disc level is shown in Fig. 7C, with the most common levels are L4-5 in 25 cases (54.35%) and L5-S1 in 20 cases (23.91%). Excluding 2

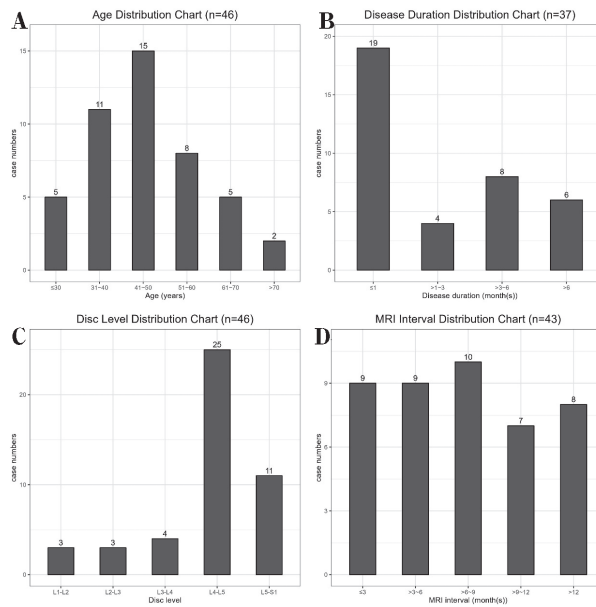


Fig. 7 Distribution of age, disease duration, affected disc level, and MRI interval time
MRI: magnetic resonance imaging

Table 2 Radiographic characteristic

Characteristic	Subtype	Number (cases)	Rate (%)
Modic changes (N=46)	No	39	84.78
	Yes	7	15.22
Komori classification (N=46)	Class 1	14	30.43
	Class 2	12	26.09
	Class 3	20	43.48
Pfirrmann classification (N=46)	Grade III	12	26.09
	Grade IV	29	63.04
	Grade V	5	10.87
Disc size (N=44)	Level 1	12	27.27
	Level 2	18	40.91
	Level 3	14	31.82

cases with missing information and 1 outlier case (7 years), a total of 43 cases of MRI interval were analyzed, ranging from 2 to 30 months, with an average of 9.07 ± 6.25 months. 18 patients (41.86%) were relieved within 6 months and 35 patients (81.40%) were relieved within 12 months, the distribution is shown in Fig. 7D. Excluding 1 cases without gender information, a total of 45 cases were analyzed, including 31 cases of male (68.89%) and 14 cases of female (31.11%). The ratio of male to female was 2.2:1.

The radiographic characteristics including MC, size of the herniated disc, Komori and Pfirrmann classifications as shown in Table 2. Thirty nine cases (84.78%) had MC and only 7 cases (15.22%) did not. The most common Komori classification was Class 3 (20 cases, 43.48%). The Pfirrmann classification ranged from Grade III to V, with Grade IV being the most common (29 cases, 63.04%). The size of the disc was evaluated in 44 patients, with Level 2 being the most common (18 cases, 40.91%), followed by level 3 (14 cases, 31.82%).

DISCUSSION

Since the first clinical report of spontaneous regression of disc herniation by Guinto,³⁵ there have been increasing reports of such instances, particularly with the widespread use of MRI. However, despite the many speculations presented in the literature, the mechanism and related factors involved in this reabsorption phenomenon remain unclear. We analyzed several factors to explore their correlation with reabsorption.

Our results indicate that the male to female ratio of disc herniation reabsorption was 2.2:1. It may seem that male have a higher incidence of reabsorption than female, however, epidemiological surveys have shown that the incidence of LDH in male is also more than twice that in female.^{36,37} Robinson³⁸ found that 70% of acute disc lesions occurred in male based on 500 surgically verified lumbar disc protrusions. Due to the unequal base number, whether there is a gender difference in disc reabsorption still needs further exploration.

There is still controversy about whether the occurrence of disc herniation reabsorption is related to age. Seo³⁹ pointed out that lumbar disc reabsorption is not age-related. However, some reviews suggested that age might be a factor influencing disc reabsorption, but the underlying mechanism remains unclear.^{40,41} Hu² counted 32 patients and found the mean age of the patients was 46.4 years, which was similar to our results of 45.87 ± 13.70 years. However, it is generally agreed that LDH is more likely to occur in individuals aged 30–59 years, particularly over the age of 40,^{42,43} which is also the most common age group for disc reabsorption. It remains unclear whether the large base number of LDH patients in this age group contributes to the higher incidence of disc reabsorption, or if there are other underlying reasons that make this age group more prone to disc reabsorption.

LDH is a chronic disease, and its course typically lasts for several months, years, or even longer.⁴⁴ However, there is limited research on the relationship between the disease duration prior to treatment and the disc reabsorption. In this study, we made an interesting observation that most disc reabsorption occurs disease duration within 6 months (83.78%), particularly within 1 month (51.35%). This has important implications for the selection of treatment methods. The time of surgical intervention for LDH is a matter of ongoing debate. Some studies suggested that early surgery is better for patients with severe symptoms, as it can lead to better postoperative recovery and prognosis.^{44,45} However, other literature recommended at least 8–12 weeks of a conservative treatment to LDH patients before being considered for operation unless ongoing severe symptoms such as severe pain and disability.⁴⁶ Although surgery is effective for patients with radiculopathy in the short term, the possibility of surgical complications, repeat operations, and symptomatic

recurrent LDH remains a concern for some patients.⁴⁷ Moreover, several randomized controlled trials showed that there is no significant difference between conservative and surgical treatment for patients with radiculopathy one year after diagnosis.⁴⁸ Considering that spontaneous reabsorption of herniated discs exists in patients with short disease duration, a proportion of patients' symptoms will resolve on their own. We suggest that conservative treatment may be effective for LDH with a short disease duration, while surgical treatment may be considered for cases with a long disease duration. However, it should be noted that some patients may still have residual symptoms after disc absorption, including lower back pain, hypoesthesia, and motor deficits.

Currently, there are no reports that clarify when disc reabsorption starts, but some cases have shown marked reabsorption within 3 months.¹ A study of 64 patients found that most experienced complete resolution of their LDH after an average of 17 months, with an improvement in their symptoms and function after conservative treatment.⁴⁹ Another study reported that the time taken for spontaneous regression of the herniated mass by >50% ranged from 3 to 12 months.⁵⁰ In our study, we found that the average MRI interval time for reabsorption was 9.07 ± 6.25 months, with 41.86% of cases experiencing absorption within 6 months. Most absorption occurred within 12 months (81.40%), while reabsorption within 3 months was not rare (20.93%).

Our study found that L4-L5 and L5-S1 segments had the highest probability of reabsorption, which is consistent with previous literature.^{2,51} However, it is worth noting that these segments are also the most common levels of LDH.³⁶ It is unclear whether the segments themselves have an impact on reabsorption or if the high probability of herniation in these segments' accounts for the large number of reabsorption cases.

Some studies suggest that the patients with MC have herniated tissue that contains relatively more hyaline cartilage endplate and less nucleus pulposus. Conservative treatment was less effective in these patients because their cartilage-rich herniations showed less vascular invasion and consequently less reabsorption.⁵² We reviewed the prevalence of MC and found that it varies from 0.5 to 1.9% in adolescents and young adults, and 5.8% to 47.1% in middle-aged or older adults.^{53,54} In our study, the incidence of reabsorption in patients with MC was 15.22%, which was not significantly lower than the incidence reported in previous studies. Therefore, further research is needed to determine if MC affects the occurrence of reabsorption.

Komori observed that among 77 patients with disc herniation, 12.99% were classified as class 3, and predicted that the higher the displacement of herniated nucleus pulposus, the great likelihood of reabsorption.⁶ Lee, who studied 505 cases, found 38.6% of patients were classified as grade 2 or 3 at baseline, which decreased to 3.4% at follow-up, and suggested that Komori classification is a major predictor for herniated disc absorption.⁵⁵ There is no literature available on the relationship between Pfirrmann classification and disc reabsorption. But some studies suggested that Pfirrmann classification is closely associated with severity of LDH and can predict clinical treatment outcomes.^{3,50} In our study, all cases were classified as types III–V, with type IV being the most common (57.89%), which was significantly higher than 22.67% in disc herniation patients.⁷

In clinical practice, the decision of whether to perform surgical intervention for herniated discs often relies on the size of the herniation. Typically, a larger herniation would indicate a higher likelihood of surgery. However, recent studies have demonstrated that using the size of the disc herniation is not a reliable indicator for predicting the necessity of surgery.⁵⁶ Furthermore, many cases of large discs reabsorption have been reported. As we found that level 2 (40.91%) and 3 (31.82%) herniation had a higher likelihood of reabsorption compared to level 1 (27.27%).

CONCLUSION

Disc resorption provides imaging basis for conservative treatment. This article reports 4 cases of disc reabsorption and reviews the distribution of several clinical and radiographic factors of disc herniation reabsorption. Some of these factors are present with anomalous distributions. However, it is worth noting that some factors, such as patient age, gender, intervertebral disc level, and MC, also have similar deviations in patients with LDH. Are these biases due to the large number of patients with these factors, or other underlying reasons that make these factors more likely to induce disc reabsorption? Can these characteristics predict spontaneous resorption of herniated discs? Can these characteristics be used as factors in clinical diagnosis and treatment? How should we deal with a patient with surgical indications but prediction of resorption? How should we find a new balance between conservative and surgical treatment? These questions remain to be further studied.

There are certain limitations to this study. Firstly, it only included published papers, which may introduce publication bias and overestimate the effect size, leading to a false sense of confidence in the results. Additionally, the study may not have included all relevant papers on the topic, resulting in incomplete data and potentially inaccurate or incomplete conclusions. Finally, the lack of external validation, due to the study only including its own data, can make it difficult to assess the reliability and validity of the data and the study's conclusions. Therefore, these questions are needed to be validated in larger multicenter clinical trials.

AUTHOR CONTRIBUTION

Yang Zheng and Can Zhu contributed equally as first authors to the work.

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STATEMENTS OF DECLARATIONS

We confirm the article is original material and it has not been submitted elsewhere for publication or has been published elsewhere. All authors have read and agreed to the published version of the manuscript. There was no conflict of interest of this paper.

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