Recurrent Lumbar Disk Herniation With or Without Posterolateral Fusion

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Study Design: A prospective study assessing the outcomes of repeat surgery for recurrent lumbar disc herniation.

Objectives: To evaluate the results of repeat surgery for recurrent disc herniation, and compare the results of disc excision with and without posterolateral fusion.

Methods: The study included 39 patients who underwent disc excision with or without posterolateral fusion, with an average follow-up of 66.7 months (range, 24-116 months). Clinical symptoms were assessed based on the Japanese Orthopedic Association Back Scores. Medical and surgical data were examined and analyzed, including pain-free interval, intraoperative blood loss, length of surgery, and postoperative hospital stay.

Results: Clinical outcome was excellent or good in 84.6% of patients, including 83.3% of patients undergoing a discectomy alone, and 84.6% of patients with posterolateral fusion. The recovery rate was 84.4%, and the difference between the fusion and nonfusion groups was insignificant ($P = 0.725$). The difference in the postoperative back pain score was also insignificant ($P = 0.821$). These two groups were not different in terms of age, pain-free interval, and follow-up duration. Intraoperative blood loss, length of surgery, and length of hospitalization were significantly less in patients undergoing discectomy alone than in patients with fusion.

Conclusions: Repeat surgery for recurrent sciatica is effective in cases of true recurrent disc herniation. Disc excision alone is recommended for managing recurrent disc herniation.

Key Words: recurrent disk herniation, revision surgery, disk excision alone, posterolateral fusion

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The efficacy of the surgical excision of herniated intervertebral disks had been demonstrated in many studies. Recurrent sciatica and the problem of repeat surgery are still the difficulties of this procedure.[1–6]

Recurrent disk herniation or recurrent sciatica has been examined in many studies. There is variability in the results as most of the studies analyzed mainly mixed patient populations, including either patients with spinal stenosis (foraminal stenosis) or perineural fibrosis, or those with herniation at a new level or on a different side.[7–14]

Few studies analyzed the results of repeat operation on true recurrent disk herniation. Furthermore, repeat surgery is often followed by persistent low back pain or recurrent sciatica. There are no standardized surgical options for the treatment of recurrent lumbar disk herniation.[15] There is controversy of the superiority of repeat disk excision alone or disk excision with fusion.

This study aimed to evaluate the results of repeat surgery for recurrent disk herniation and to compare the results of repeat disk excision with and without posterolateral fusion.

PATIENTS AND METHODS

This prospective study included 39 patients treated in the Neurosurgery Department, Cairo University Hospital, between 2004 and 2009. Twenty-six were men (67%) and 13 were women (33%), with a mean age of 51.2 years. They all underwent disk excision with or without posterolateral fusion.

All patients were diagnosed with true recurrent disk herniation; no patient had lumbar instability or spinal stenosis.

All patients had a history of acute onset of recurrent radicular pain and underwent a positive straight leg raising test. Magnetic resonance imaging with gadolinium enhancement and plain x-ray were conducted for diagnosis in all cases. The levels of disk herniation were 24 at L4-L5 (13 on the right and 11 on the left) and 15 at L5-S1 (5 on the right and 10 on the left).

Patients were divided into 2 groups: the nonfusion group (those who underwent repeat laminotomy and discectomy alone) and the fusion group (those who received repeat surgery concomitant with posterolateral fusion and transpedicular screw insertion). All of the revision surgeries were performed at the same site of the recurrent disk herniation. The epidural scar was separated from the margin of the lamina. Partial removal of the lamina to the point at which the epidural scar tissue was detached and partial resection of the scar tissue enclosing the dural tube were carried out. Access to the normal anatomic planes of the epidural space was achieved. Exposure was carried out laterally to visualize the lateral

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FIGURE 1. A, Preoperative magnetic resonance image of lumbar recurrent disk. B, Preoperative magnetic resonance image of lumbar recurrent disk.

edge of the nerve root. Exposure of the disk fragment after gentle mobilization and medial retraction of the nerve root was carried out (Figs. 1, 2).

Occasionally, sharp dissection was required to separate the adherent nerve root from the extruded disk fragment or the ligamentous structures. When there was a doubt regarding the identification of the nerve root, a wide laminectomy with excision of the facet joint was required, until the pedicle was visible (Figs. 1A, B and 2).

This enabled complete decompression of the nerve structures after identification of the nerve root and disk structure. Posterolateral fusion and transpedicular screw fixation were performed simultaneously in cases that required facetectomy, as iatrogenic instability can occur following the removal of the facet joint during lumbar procedures.

Among the study group, 24 patients underwent a laminotomy and discectomy alone and 15 underwent a facetectomy and discectomy with posterolateral fusion and transpedicular screw fixation. The demographic characteristics of the 2 groups are presented in Table 1.

All patients received prophylactic antibiotics preoperatively and were encouraged to ambulate the day after surgery. The use of a Taylor's brace for 3 months was suggested for patients who underwent posterolateral fusion.

The follow-up duration of both groups was 24 months at minimum, and the mean duration was 65.6 months in the nonfusion group and 68.6 months in the fusion group. All cases were examined and recorded for the pain-free interval, surgery length, intraoperative blood loss, and duration of hospital stay following operation.

Clinical symptoms were assessed using the JOA score (Japanese Orthopedic Association's evaluation system for low back pain syndrome), both before surgery and at the final follow-up. The JOA score was determined by direct questioning to assess subjective symptoms, clinical signs, and restriction of activities of daily living. The recovery rate of the JOA score was also calculated, following the description of Hirabayashi et al.[15] On the basis of the recovery rate the surgical outcome was assessed and classified using a 4-grade scale: excellent, improvement of 90%; good, 75% to 89% improvement; fair, 50% to 74% improvement; and poor, below 49% improvement (Table 2).

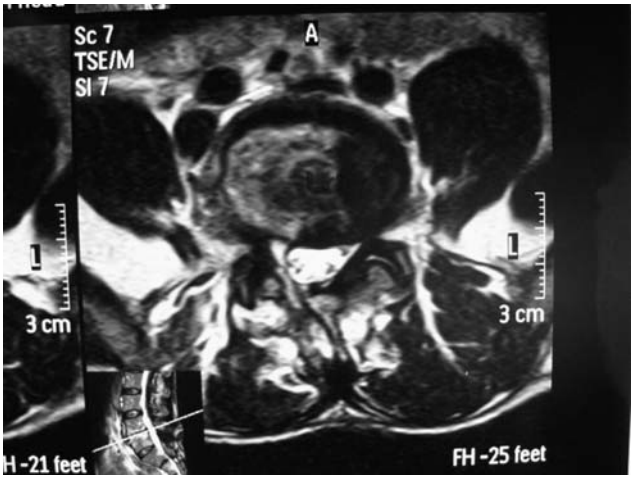

FIGURE 2. Postoperative magnetic resonance image of excised recurrent disk fragment.

The Statistical Paragraph in Material and Methods

Data were statistically described in terms of mean ± SD, or frequencies (number of cases) and percentages when appropriate. Comparison between the study groups was done using the Student *t* test for independent samples in comparing 2 groups when normally distributed and the Mann-Whitney *U* test for independent samples when not normally distributed. *P*-value < 0.05 was considered statistically significant. All statistical calculations were carried out using a computer program,

TABLE 1. Patient Demographics

	Discectomy Only (N = 24)	Discectomy With Fusion (N = 15)	*P**
Age at operation (y)	50.2 ± 12.4	52.8 ± 8.6	0.566
Duration of recurrence (mo)	57.3 ± 26.5	52.6 ± 28.6	0.674
Duration of follow-up (mo)	65.6 ± 18.2	68.6 ± 14.8	0.422

*The Student unpaired *t* test.

TABLE 2. The Japanese Orthopedic Association's Evaluation System for Lower Back Pain Syndrome (JOA Score)

Subjective Symptoms	Evaluation	Score
Lower back pain	None	3
	Occasional, mild	2
	Occasional, severe	1
	Continuous, severe	0
Leg pain and/or tingling	None	3
	Occasional, light	2
	Occasional, severe	1
	Continuous, severe	0
Gait	Normal	3
	Able to walk farther than 500 m, although it results in symptoms*	2
	Unable to walk farther than 500 m, although it results in symptoms*	1
	Unable to walk farther than 100 m	0
Clinical signs		
Straight leg raising test	Normal	2
	30–70 deg.	1
	< 30 deg.	0
Sensory disturbance	None	2
	Slight disturbance (not subjective)	1
	Marked disturbance	0
Motor disturbance	Normal	2
	Slight weakness (MMT 4)	1
	Marked weakness (MMT 3 to 0)	0

*Pain, tingling, and/or muscle weakness.
Recovery rate (%) = (postoperative score − preoperative score)/(15 − preoperative Score) × 100.
MMT indicates manual muscle testing.

that is, SPSS, version 15 (Statistical Package for the Social Science; SPSS Inc., Chicago, IL) for Microsoft Windows.

RESULTS

This study included 39 patients with true recurrent disk herniation. They all underwent disk excision with or without posterolateral fusion.

The mean JOA score of the patients improves from 9.4 before surgery to 25.7 at the final follow-up visit ($P < 0.0001$). The average recovery rate was 84.4% (range, 12% to 100%). General clinical outcome, based on the JOA score, was excellent in 19 (48.7%) patients, good in 14 (35.8%), fair in 3 (7.6%), and poor in 3 (7.6%) (Table 3).

In the nonfusion group, one patient required further revision surgery (laminectomy and posterolateral fusion) on the same level because of recurrent back pain and sciatica 51 months after surgery. In the fusion group, 1 patient requiring further revision surgery underwent an implant removal for residual back pain 40 months after surgery.

TABLE 4. Complications

	n (%)	
	Discectomy Only (N = 24)	Discectomy With Fusion (N = 15)
Deep infection	0	0
Superficial infection	0	1 (6.6)
Dural tear	5 (20)	4 (26)
Vascular injury	0	0
Neurologic	0	0

No major vascular or neurologic complications occurred. One patient with posterolateral fusion had a superficial wound infection. Following appropriate debridement and antibiotics administration, the wound healed without sequelae. In the fusion group, one patient complained of slight residual pain during the follow-up (Table 4).

The demographic characteristics of the 2 groups are presented in (Table 1). There was no difference between the 2 groups with regard to age ($P = 0.566$) and pain-free interval ($P = 0.674$). The mean preoperative JOA score was 9.7 in the nonfusion group and 8.9 in the fusion group ($P = 0.415$). In the final follow-up, the mean JOA scores for the nonfusion and fusion groups were 25.8 and 25.6 ($P = 0.821$), respectively. Moreover, the average recovery rate was 84.8% in the nonfusion group and 83.8% in the fusion group ($P = 0.725$). Clinical outcome was excellent or good in 83.3% of patients who received discectomy alone and in 86.6% of those who underwent posterolateral fusion.

The mean preoperative low back pain score was 1.6 in the nonfusion group and 1.5 in the fusion group ($P = 0.735$). The mean postoperative low back pain score at the final follow-up was 2.3 in the nonfusion group and 2.2 in the fusion group ($P = 0.821$). In the nonfusion group, postoperative low back pain was noted in 16 (66.6%) of 24 patients at follow-up. One patient showed deterioration compared with the preoperative status, 13 patients displayed improvement despite some pain, and 10 patients were unchanged.

In the fusion group, postoperative low back pain was noted in 11 (73.3%) of 15 patients at follow-up. One

TABLE 3. Results Assessed by JOA Score

	Discectomy Only (N = 24)	Discectomy With Fusion (N = 15)	All Cases (N = 39)	*P**
Preoperative JOA score (points)	9.7 ± 3.6	8.9 ± 2.9	9.4 ± 3.3	0.415
Postoperative JOA score (points)	25.8 ± 4.5	25.6 ± 4.6	25.7 ± 4.5	0.821
Preoperative back pain score (points)	1.6 ± 1	1.5 ± 0.8	1.5 ± 0.9	0.735
Postoperative back pain score (points)	2.3 ± 0.8	2.2 ± 0.8	2.6 ± 0.8	0.821
Recovery rate (%)	84.8 ± 20.6	83.8 ± 23.1	84.4 ± 21.6	0.724

JOA indicates Japanese Orthopedic Association.

TABLE 5. Comparison of Patient Groups

	Discectomy Only (N = 24)	Discectomy With Fusion (N = 15)	*P**
Intraoperative blood loss (mL)	170.8 ± 104.8	546.7 ± 211.6	< 0.0001
Length of operation (min)	103.4 ± 24.4	187.5 ± 31.5	< 0.0001
Length of hospital stay (d)	2.3 ± 1.3	4.8 ± 1.2	< 0.0001

*The Student unpaired *t* test.

patient showed deterioration from the preoperative status. Ten patients showed improvement despite some pain, and the condition of 4 patients was unchanged.

Average intraoperative blood loss was 170.8 mL in the nonfusion group and 546.7 mL in the fusion group ($P < 0.0001$); the average length of surgery was 103.4 minutes in the nonfusion group and 187.5 minutes in the fusion group ($P < 0.0001$). The length of postoperative hospital stay was 2.3 days in the nonfusion group and 4.8 days in the fusion group ($P < 0.0001$). Intraoperative blood loss, length of surgery, and the duration of hospital stay were significantly less in patients undergoing discectomy alone (Table 5).

DISCUSSION

Repeated surgery for recurrent radicular pain has been reported to be satisfactory in 50% to 90% of patients.[7–14]

Fandino et al[11] reported 62% success rate, following reoperative lumbar disk surgery. Their study showed that epidural scarring was found in 43% (56 of 130) of the patients and half of these had poor results.

Waddle et al[16] noted that cases with a definite recurrent disk herniation had better outcomes after repeat operation. This viewpoint is confirmed by the present data, which reveal good to excellent results in 84.6% of patients.

This study only included those patients with a verified recurrent disk herniation during operation. This may explain the satisfactory clinical outcomes of the patients under study.

The optimal surgical approach for recurrent disk herniation remains a subject of controversy (simple discectomy with or without fusion of the affected segment.[17–20]

Discectomy with fusion has several theoretical advantages. Specifically, lumbar fusion immobilizes the spine, reduces or eliminates segmental motion, reduces mechanical stresses across the degenerated disk space, and may reduce additional herniation at the affected disk space.[19,20]

In 1981, Lehmann and LaRocca[18] mentioned in their study that 36 patients with chronic back and low leg pain following previous lumbar surgery were treated by spinal canal exploration and spinal fusion. Solid fusion correlated closely with satisfactory outcomes. In contrast, several studies found that the clinical outcome was good with repeated decompression alone. Cinotti et al,[9] Jonsson and Stromqvist,[12] and Suk et al[14] mentioned that simple discectomy alone would likely have provided adequate treatment in these patients and spared them the problems associated with fusion.

This study revealed excellent or good clinical outcomes in 83.3% of patients who underwent discectomy alone and in 86.6% of patients with fusion. Although the patients in the fusion group tended to have better outcomes than those with disk excision alone, the difference in the recovery rate between these 2 groups was insignificant. Besides, in the nonfusion group, only 1 (4.2%) patient required further revision surgery (laminectomy and posterolateral fusion) for recurrent disk herniation 51 months after surgery.

Furthermore, the intraoperative blood loss and the length of operation and hospital stay were significantly less in patients undergoing discectomy alone than in patients with fusion. The disadvantages of posterolateral fusion must be weighed against the outcomes following simple repeat discectomy.

Repeated spinal surgery is more challenging and technically demanding than primary surgery because of the unclear anatomic plane and perineural scarring. The nerve root and scarring tissue were sharply dissected to expose the disk fragment. Facetectomy was occasionally required to prevent excessive nerve root manipulation and neurologic injury and also to ensure adequate exploration and excision of the disk fragment.

In the current study, facetectomy was performed in 15 (38.4%) cases, which required simultaneous posterolateral fusion because of the iatrogenic instability during operation.

Even so, 9 (23.1%) cases still experienced dural tear during surgery. This phenomenon differs from the report by Suk et al,[14] in which a repeat conventional open discectomy alone was performed in all 28 patients.

Cinotti et al[9] reported that scar tissue quantity was not related to surgical outcomes and suggested that following the removal of the disk fragment, the epidural scar does not cause residual radicular pain.

This was confirmed by the high satisfactory rate of the current study. Intraoperatively, disk fragments and perineural fibrosis was found in all cases. The aim of the surgery was to explore the herniated disk and to remove the disk fragment. The scar tissue was not routinely excised completely.

This study showed that repeat lumbar spine operation for recurrent sciatica after a previous discectomy may prove effective in cases of true recurrent disk herniation.

Persistent backache was the most common late postoperative symptom and caused distress for many patients. The mechanism of backache is so complex that the source of pain is difficult to resolve. Harris and Macnab[19] mentioned that, although the disk itself may be a source of pain, its degeneration more commonly produces symptoms because of secondary effects on the paraspinal muscles, spinal ligaments, posterior joints, and nerve roots.

Fusion of the surgically treated segment may theoretically prevent postoperative low back pain resulting from excessive stresses on these supporting structures. Results from the current study revealed insignificant benefits from fusion. Moreover, many of the patients in the fusion group reported low back stiffness or dullness. The source of the pain might be back muscle injury induced by prolonged surgery time and the use of retractor pressure to expand the operative field beyond the facet joint during fusion.[20]

The present study has the advantage of consistency between the 2 groups. By carefully selecting the patient population, this investigation attempted to minimize confounding factors and concentrate on one variable (discectomy with or without posterolateral fusion) and only included patients with true recurrent disk herniation.

Other factors, including age, pain-free interval, preoperative pain score, and follow-up duration, were not different between these 2 groups. The 2 groups examined here appear comparable in terms of the influences on the clinical outcomes of repeat surgery, although the included patients were not randomized and the sample size was not large enough to detect the difference.

CONCLUSIONS

This study found that repeat surgery for recurrent sciatica following a previous discectomy is effective in cases of true recurrent disk herniation. The results of disk excision with posterolateral fusion were slightly better than those of disk excision alone; the difference was not significant. In addition, the intraoperative blood loss and the length of surgery and hospital stay were significantly less in patients undergoing disk excision alone. Furthermore, the difference in postoperative low back pain was insignificant between the fusion and nonfusion groups. According to the above, disk excision alone is recommended for managing recurrent disk herniation.

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