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# Management of recurrent lumbar disc herniation: a comparative analysis of posterior lumbar interbody fusion and repeat discectomy

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**Background:** For recurrent lumbar disc herniation, many experts suggest a repeat discectomy without stabilization due to its minimal tissue manipulation, lower blood loss, shorter hospital stay, and lower cost, recent research on the role of instability in disc herniation has made fusion techniques popular among spinal surgeons. The authors compare the postoperative outcomes of posterior lumbar interbody fusion (PLIF) and repeat discectomy for same-level recurrent disc herniation.

**Methods:** The patients included had previously undergone discectomy and presented with a same-level recurrent lumbar disc herniation. The patients were placed into two groups: 1) discectomy only, 2) PLIF based on the absence or presence of segmental instability. Preoperative and postoperative Oswestry disability index scores, duration of surgery, blood loss, duration of hospitalization, and complications were analyzed.

**Results:** The repeat discectomy and fusion groups had 40 and 34 patients, respectively. The patients were followed up for 2.68 (1–4) years. There was no difference in the duration of hospitalization (3.73 vs. 3.29 days $P = 0.581$) and operative time (101.25 vs. 108.82 mins, $P = 0.48$). Repeat discectomy had lower intraoperative blood loss, 88.75 ml (50–150) versus 111.47 ml (30–250) in PLIF ($P = 0.289$). PLIF had better ODI pain score 4.21 (0–10) versus 9.27 (0–20) ($P$-value of 0.018). Recurrence was 22.5% in repeat discectomy versus 0 in PLIF.

**Conclusion:** PLIF and repeat discectomy for recurrent lumbar disc herniation have comparable intraoperative blood loss, duration of surgery, and hospital stay. PLIF is associated with lower durotomy rates and better long-term pain control than discectomy. This is due to recurrence and progression of degenerative process in discectomy patients, which are eliminated and slowed, respectively, by PLIF.

**Keywords:** discectomy, fusion, oswestry disability index, posterior lumbar interbody fusion, recurrent lumbar disc herniation

## Introduction

In the elderly population, degenerative disc disease and facet joint disease affecting the lumbar spine are common and a major cause of disability[1]. While it is most prevalent in those over the age of 40, it can occur in younger individuals as well[2]. Typical symptoms include mechanical back pain, radicular and claudication symptoms, reduced mobility, and a poor quality of life.

Disc herniation is a common manifestation of degenerative spine disease and is typically managed through various

### HIGHLIGHTS

- For recurrent lumbar disc herniation, many experts suggest a repeat discectomy without stabilization due to its minimal tissue manipulation, lower blood loss, shorter hospital stay, and lower cost.
- Recent research on the role of instability in disc herniation has made fusion techniques popular among spinal surgeons.
- We compare the postoperative outcomes of posterior lumbar interbody fusion (PLIF) and repeat discectomy for same-level recurrent disc herniation.
- PLIF and repeat discectomy for recurrent lumbar disc herniation have comparable intraoperative blood loss, duration of surgery, and hospital stay. PLIF is associated with lower durotomy rates and better long-term pain control than discectomy.

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discectomy techniques, such as open surgery, microdiscectomy, and endoscopic discectomy[3–5]. However, the recurrence rate following discectomy can be as high as 30%, and instability progression rates are around 25%[6,7]. Risk factors for recurrence include smoking, young age, being overweight, and increased disc height[8,9]. Although repeat discectomy is a commonly recommended approach due to its minimal invasiveness, shorter hospital stays, and cost-effectivenes[10,11], it still carries the risk of reherniation and progression to instability. Fusion techniques, although more expensive and associated with longer hospital stays, eliminate the risk of same-level recurrence, and segment instability[12,13].

Yao *et al*. studied 105 patients with recurrent disc herniation and concluded that discectomy had advantages in terms of shorter operation time, hospital stay, less blood loss, and lower total cost, but had a higher recurrence rate than fusion. However, neither approach gave a clear advantage in long-term pain or function scores, suggesting that personalized treatment should be considered[12]. Similarly, a meta-analysis by Tanavalee *et al*. showed no statistically significant difference in reoperative rates between the two treatments. Improvement rates and complications were also found to be equal. Recurrent disc herniation was the primary cause of reoperation in the discectomy group, while adjacent segmental degeneration and implant removal were two causes in the fusion group. The operative time and postoperative stay were shorter in the discectomy group[14].

In this study, we compare the operative techniques and postoperative outcomes in patients that underwent repeat discectomy with and without fusion for a same-level recurrent disc herniation.

## Methods

This is a single center retrospective study, which included 74 patients managed at our institution for same-level recurrent lumbar disc herniation between 2018 and 2023. The patients were divided into two groups, that is 1) 40 patients treated with repeat discectomy without fusion; and 2) 34 patients treated with posterior lumbar interbody fusion (PLIF). The patient selection was based on preoperative standing lateral flexion and extension *x*-rays. Patients with segmental instability, that is translation $\geq 4$ mm or sagittal angulation $\geq 10°$ were managed with PLIF whereas the patients without instability were managed with repeat discectomy.

Yuan Yao *et al*., provided a definition of recurrent intervertebral disc herniation, which includes three criteria. Firstly, the patient must have undergone a successful discectomy surgery without fusion and experienced no pain for at least a month postsurgery. Secondly, the patient must have recurrent symptoms consistent with the previously affected level. Thirdly, an MRI scan must confirm the presence of a disc herniation at the same-level as the previous surgery. Patients who experienced pain recurrence or disc herniation within 1 month of surgery were excluded from the study, as this is considered surgical failure rather than recurrence. Patients with herniation at a level other than the previously operated level were also excluded.

### *Clinical assessment*

The following data was collected; demographic data such as age and sex; radiological data such as lumbar spine level, presence of Modic changes on preoperative MRI, and fusion on control CT; clinical data such as follow-up time, preoperative and postoperative pain, Oswestry Disability Index, and adjacent segment disease, and surgical history, including the type of discectomy, number of repeat discectomies, type of fusion surgery, time between discectomy and fusion, intraoperative blood loss, operative time, complications, duration of hospitalization, and repeat surgery.

### *Surgical techniques*

#### PLIF

With the patient in prone position and using intraoperative X-ray, the affected segment was identified and marked. An incision was made along the previous scar. The paraspinal muscles were separated from the spinous processes bilaterally in the case of four screw fixation system and unilaterally on the side of the herniation for a unilateral two screw system.

The screws were inserted in standard fashion. The adhesions were carefully dissected to expose the dura matter and the affected nerve root. Once the disc herniation is exposed, discectomy is performed and a cage filled with bone fragments is inserted into the intervertebral space. The screws are connected by the rods, hemostasis is achieved and the aponeurosis closed. The skin is closed in layers. No drain is left in-situ.

#### Discectomy

To ensure the correct level, intraoperative radiography is used to mark a two-centimeter to three-centimeter longitudinal midline incision over the appropriate interspace. The muscular aponeurosis is incised off-center on the side of approach, and the multifidus is carefully released subperiosteally from the spinous process to the facet joints. The level is reconfirmed using intraoperative X-rays before positioning retractors and a microscope or loupes for visualization. Various dissectors and Kerrison rongeurs are used to release the ligamentum flavum and fibrous adhesions, allowing visualization of the exiting nerve root, which must be identified before proceeding to disc resection. Once the nerve root and dura are retracted medially, an annulotomy is performed over the bulging disc, and the sequestration is removed. A discectomy is performed using up-facing and down-facing curettes and pituitary rongeurs. The canal and cavity are inspected, and hemostasis is achieved. The skin is closed in a standard fashion.

## Results

The patient characteristics were analyzed and tabulated in Table 1. Seventy-four (74) patients were included in this study, that is 37 females and 37 males. They were divided into two groups repeat discectomy ($n = 40$) and fusion ($n = 34$). Of note is that the two groups were matched for age and sex with no significant difference. The mean age was 50.64 years (29–72). The mean follow-up period was 2.68 (1–4) years. The surgical techniques were analyzed and tabulated in Table 2. The mean blood loss was 88.75 ml (50–150) and 111.47 ml (30–250) for

**Table 1**

**Characteristics of patients who underwent discectomy with and without spinal fusion**

| | Frequency | Percentage | Cumulative percentage | | |
|---|---|---|---|---|---|
| Sex | | | | | |
| Female | 37 | 50.0 | 50.0 | | |
| Male | 37 | 50.0 | 100.0 | | |
| Surgery type Sex cross tabulation | | | | | |
| | | Sex | | | |
| | | Female | Male | Total | |
| Surgery type | Discectomy | 22 | 18 | 40 | |
| | Fusion | 15 | 19 | 34 | |
| Total | 37 | 37 | 74 | | |
| Age | | | | | |
| Surgery type | Mean | N | SD | Minimum | Maximum |
| Discectomy | 51.28 | 40 | 10.020 | 33 | 72 |
| Fusion | 49.88 | 34 | 9.380 | 29 | 69 |
| Total | 50.64 | 74 | 9.691 | 29 | 72 |
| Number of previous discectomies | | | | | |
| | Frequency | Percentage | Cumulative percentage | | |
| Single | operation 44 | 58.9 | 58.9 | | |
| Multiple | 30 | 41.1 | 100.0 | | |
| Discectomy type | | | | | |
| | Frequency | Percentage | Cumulative percentage | | |
| Microdiscectomy | 37 | 50.0 | 50.0 | | |
| Open | 31 | 41.9 | 91.9 | | |
| Endoscopic | 6 | 8.1 | 100.0 | | |

discectomy and fusion groups, respectively, *P*-value 0.289. There was no significant difference in the duration of surgery and the duration of hospitalization *P*-value 0.48 and 0.581, respectively.

The postoperative ODI were lower in the fusion group 4.21 (0–10) than the repeat discectomy group 9.27 (0–20) *P*-value 0.018 (Fig. 1 and Table 2).

**Table 2**

**Analysis of the surgical technique and the postoperative period**

| Operation Type | Average | N | SD | Minimum | Maximum |
|---|---|---|---|---|---|
| Blood loss | | | | | |
| Discectomy | 88.75 | 40 | 27.520 | 50 | 150 |
| Fusion | 111.47 | 34 | 46.524 | 30 | 250 |
| Operation duration operation Type | | | | | |
| Discectomy | 101.25 | 40 | 26.836 | 60 | 195 |
| Fusion | 108.82 | 34 | 36.141 | 60 | 195 |
| Hospital Stay type operations | | | | | |
| Discectomy | 3.73 | 40 | 1.281 | 2 | 8 |
| Fusion | 3.29 | 34 | 1.244 | 2 | 8 |
| Preoperative ODI Operation type | | | | | |
| Discectomy | 29.95 | 40 | 6.504 | 16 | 41 |
| Fusion | 31.97 | 34 | 7.230 | 19 | 43 |
| Postoperative ODI Operation type | | | | | |
| Discectomy | 9.27 | 40 | 6.055 | 0 | 20 |
| Fusion | 4.21 | 34 | 3.082 | 0 | 10 |

### *Durotomy*

Durotomy was the most common complication in both surgical techniques, that is 37.5% ($n=15$) and 11.8% ($n=4$) for discectomy group and fusion group, respectively, *P*-value 0.012 (Fig. 2 and Table 3).

### *Recurrence*

Discectomy group was associated with a recurrence of 22.5% ($n=9$). There were no recurrences observed in the fusion group *P*-value 0.003 (Fig. 3).

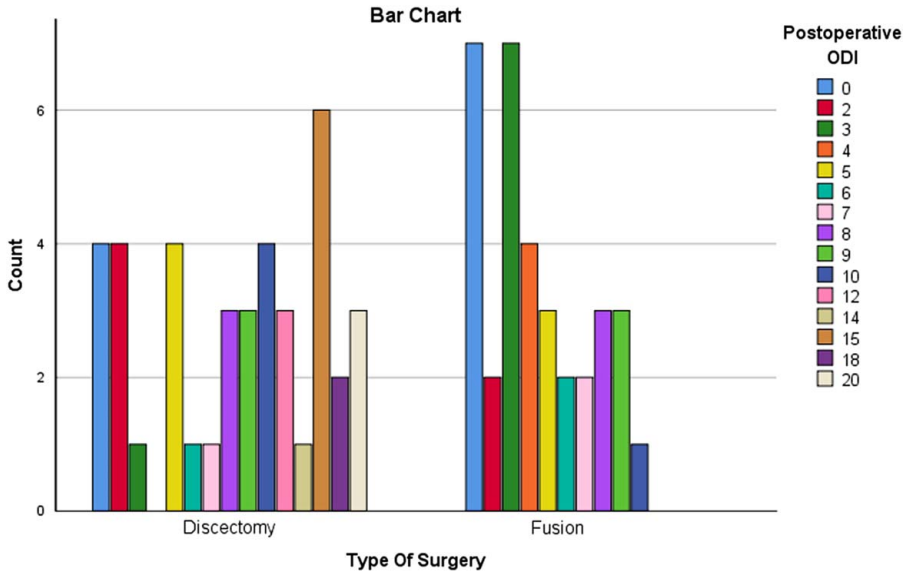


**Figure 1.** Showing the distribution of postoperative ODI scores in both patients.

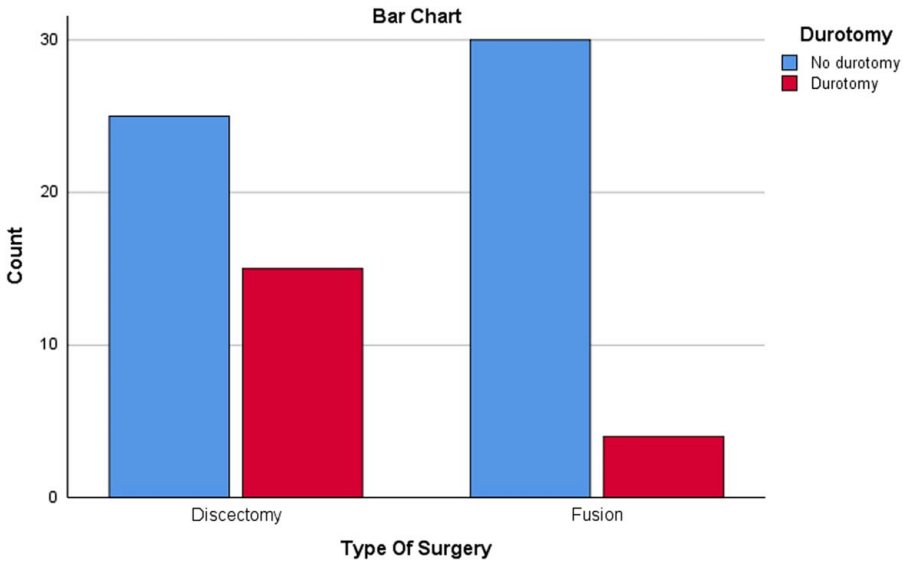


**Figure 2.** Showing the analysis of durotomy in both study groups.

**Table 3**

**Table analyzing the risk of durotomy in the discectomy and fusion groups**

| | Durotomy | | |
|---|---|---|---|
| | No durotomy | Durotomy | Total |
| Type of surgery | | | |
| Discectomy | 25 | 15 | 40 |
| Fusion | 30 | 4 | 34 |
| Total | 55 | 19 | 74 |

### *Fusion following repeat discectomy*

Of the 40 patients that underwent discectomy alone, 22.5% had fusion surgery during the follow-up period (Fig. 4). The reasons for fusion included same-level recurrent herniation, deformity, stenosis, and instability.

### *Modic-2 changes*

On analysis of preoperative MRI, Modic-2 changes were present in 77.5 and 76.2% of the patients that underwent discectomy and fusion, respectively (Fig. 5 and Table 4). Of the nine patients that had disc herniation recurrence in the discectomy group, 88.9% ($n = 8$) had Modic-2 changes on preoperative MRI (Table 5).

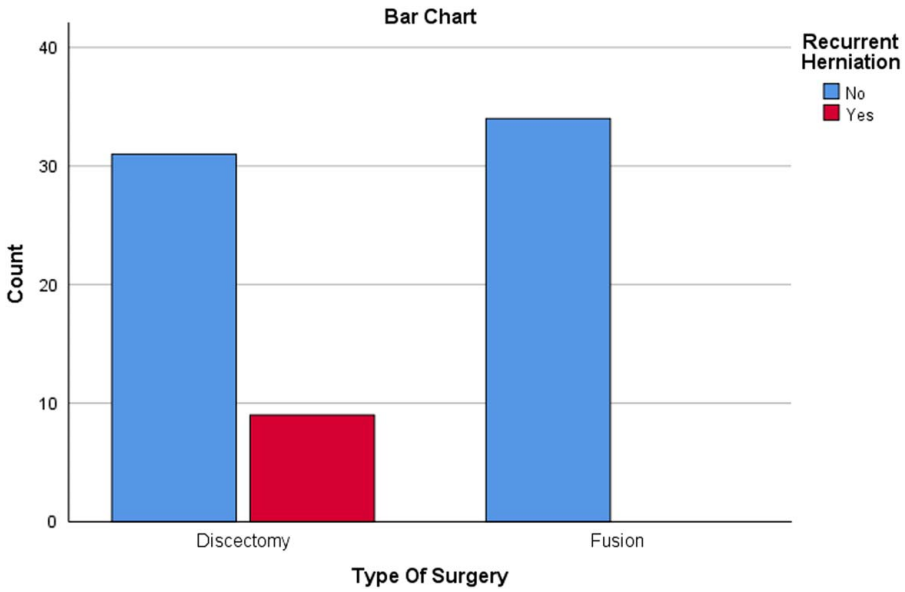


**Figure 3.** Showing the risk recurrence in both study groups.

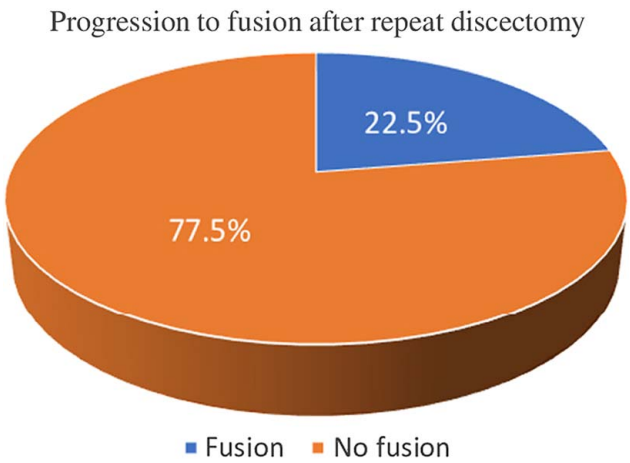


**Figure 4.** Shows that 22.5% of patients that underwent repeat discectomy eventually had fusion during the follow-up period.

## Discussion

For a long time, there has been an inconclusive debate on whether discectomy should be performed with or without fusion. There are no established guidelines to support one technique over the other[15,16]. Due to the pathophysiology of disc degeneration and herniation, there is controversy over the need for stabilization of the lumbar motion segment involved, as the resulting stenosis and instability are almost inevitable[17]. Loparev *et al.*[7] demonstrated that 83.3% of patients experience degeneration progression following microdiscectomy. Some surgeons advocate for discectomy and fusion as the primary treatment of degenerative disc disease[18], as signs of instability can be atypical and subject to interpretation. Furthermore, discectomy with fusion eliminates the risk of recurrence at the same-level, although the possibility of adjacent level herniation remains a concern[14]. However, many authors argue that the cost of surgical implants and potentially prolonged rehabilitation make fusion a less favorable option[3].

### *Recurrence and durotomy*

According to various research studies[4,12,19–25], discectomy with fusion resulted in a recurrence rate of 0% at the same-level. This can be attributed to the wider working space provided by fusion techniques, allowing for a more complete discectomy[12]. Furthermore, stabilizing and fusing the lumbar motion segment can prevent pathological micro movements that accelerate degeneration and recurrence[26]. On the other hand, repeat discectomy had a reported recurrence rate of up to 22.9%[4], which is similar to the findings of this study (22.5%). Additionally, many patients who undergo repeat discectomies may eventually require fusion within 4 years[22]. Discectomy alone is not enough to address the instability associated with disc herniation and can lead to deformity and overt instability[7]. Our study also found that 22.5% of patients required fusion within the 4-year follow-up period and 88.9% had MRI features of Modic-2 changes. Modic-2 changes have been associated with instability and back pain[27,28].

Durotomy is a common complication associated with repeat surgery[3,5,14]. The epidural adhesions maybe be difficult to dissect of the dura and nerve root leading to iatrogenic durotomy and nerve root injury[29,30]. The risk of durotomy was higher in the discectomy group (37.5%) than the fusion group (11.8%). Fusion surgery provides a wide working space, which allows for more bone resection, more lateral extension to avoid the adhesions and easy maneuverability of instruments[12]. The defects were repaired primarily and dura glue used to avoid postoperative CSF leak. No postoperative complications were recorded in both groups.

### *Postoperative pain*

When it comes to PLIF for disc herniation, postoperative pain is a concern. Nonetheless, numerous studies have indicated that there

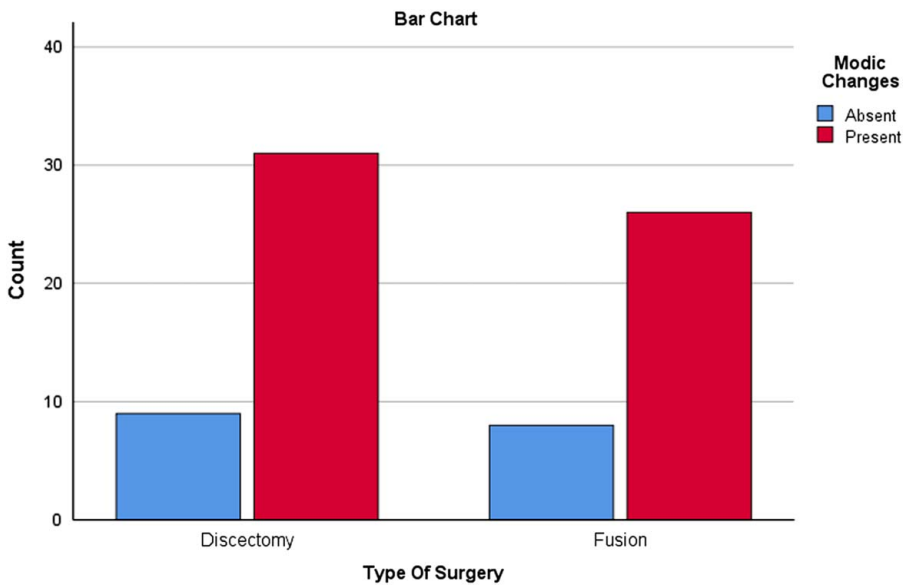


**Figure 5.** Illustrating the presence or absence of Modic-2 changes on preoperative MRI in both study groups.

**Table 4**

**Showing the analysis of the Modic-2 changes on preoperative MRI in both study groups**

| | Modic changes | | |
|---|---|---|---|
| | Absent | Present | Total |
| Type of surgery | | | |
| Discectomy | 9 | 31 | 40 |
| Fusion | 8 | 26 | 34 |
| Total | 17 | 57 | 74 |

is no discernible difference in pain outcomes between a repeat discectomy and fusion for disc herniation[4,14,28]. After degenerative disease, postoperative pain arises due to various factors like disc degeneration, intervertebral instability, osteoporosis, facets degeneration, paraspinal muscle degeneration, and endplate damage[7,31]. Though discectomy and fusion demonstrate similar satisfaction rates in the early follow-up period, discectomy patients tend to have lower satisfaction rates in the long run due to recurring back pain[4,12,28]. Discectomy procedures only offer limited relief for discogenic pain, while other pain-causing factors like instability remain unaddressed. Consequently, postoperative pain persists and may eventually require fusion procedures with the progression of degeneration[1,31]. On the other hand, fusion deals with lumbar motion segment instability, disc, and facet factors but does not adequately address muscle degeneration and osteoporosis, which can lead to persistent pain with both fusion and nonfusion management[7]. Our study yielded lower postoperative ODI and patient satisfaction rates in the fusion group compared to the repeat discectomy group.

### *Intraoperative blood loss*

According to the literature, the blood loss associated with fusion surgeries (up to $660 \pm 164.97$)[20] is higher than that of discectomy procedures (up to $300 \pm 45.4$)[24], particularly for minimally invasive discectomy techniques. Fusion surgery requires more manipulation of the highly vascular paraspinal muscles, which can result from iatrogenic injury and improper subperiosteal separation from the spinous processes, resulting in increased intraoperative blood loss[1]. It is important to note that the level of blood loss during surgery is also dependent on the surgeon's expertise. Our study found that intraoperative blood loss during fusion surgery was only slightly higher than repeat discectomy, but the difference was not statistically significant.

**Table 5**

**Showing the presence or absence of Modic-2 changes in the patients that had disc herniation recurrence**

**Recurrent herniation Modic changes cross tabulation Count**

| | Modic changes | | |
|---|---|---|---|
| | Absent | Present | Total |
| Recurrent herniation | | | |
| No | 16 | 49 | 65 |
| Yes | 1 | 8 | 9 |
| Total | 17 | 57 | 74 |

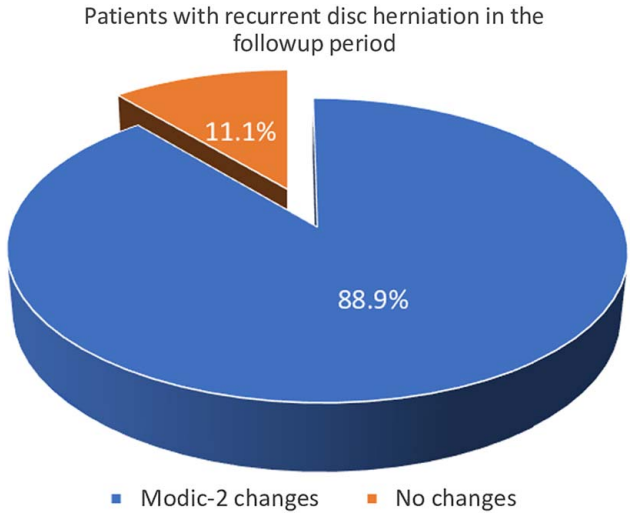


**Figure 6.** Showing the percentage of patients with Modic changes who had recurrent dice herniation.

### *Duration of hospitalization*

Regarding the postoperative hospital stay, it is essential to discuss this with patients preoperatively, as longer hospital stays lead to increased costs for both patients and hospitals and can cause psychological distress[32]. Various authors have reported that fusion surgeries have significantly longer hospital stays than discectomy procedures[12,13]. However, our study found no significant difference in hospitalization duration between the two groups. Moreover, patients who underwent fusion surgery had fewer restrictions and could return to normal activities earlier than the discectomy group[33–38]. After fusion surgery, patients were allowed to sit and walk without restrictions a few hours after the surgery, whereas after discectomy, patients were advised not to sit for about a month and wear a corset at all times.

### *Limitations*

This study has some limitations. Firstly, it is a retrospective study. Secondly, the sample size was small, that is discectomy 40 patients and PLIF 34 patients. Thirdly, the follow-up periods in this study were relatively short 2.68 (1–4). A prospective randomized controlled trial with a longer follow-up period and a much larger sample size would provide more significant information to compare PLIF and microdiscectomy.

## Conclusion

PLIF and repeat discectomy for recurrent lumbar disc herniation have comparable intraoperative blood loss, duration of surgery, and hospital stay. PLIF is associated with lower durotomy rates and better long-term pain control than discectomy. This is due to recurrence and progression of degenerative process in discectomy patients, which are eliminated and slowed, respectively, by PLIF. The economic and social costs of recurrent herniations in repeat discectomy may equal or even exceed the cost of implants used in fusion.

## Ethical approval

Ethical approval was waived in view of the retrospective nature of the study.

## Consent

Informed consent was taken prior to initiation of this Article from patients.


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No funding was received to assist with the preparation of this manuscript.


## Author contribution

G.M.: study concept or design and writing the paper; G.M., S.K. M., G.E.C., S.V.S.: data collection; A.V.K., G.I.A., O.O., D.T.K. N., C.E.G.: data analysis or interpretation; B.C.: review, editing, and final approval.

## Conflicts of interest disclosure

The authors declare that they have no competing interests.

## Research registration unique identifying number (UIN)

1. Name of the registry: not applicable.
2. Unique identifying number or registration ID: not applicable.
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): not applicable.

## Guarantor

Bipin Chaurasia.

## Data availability statement

Not applicable.

## Provenance and peer review

Exempted.

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