

# Analysis of patient-reported outcomes and satisfaction following minimally invasive spine surgery versus traditional open surgery for lumbar disc herniation

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**Analysis of patient-reported outcomes and satisfaction following minimally invasive spine surgery versus traditional open surgery for lumbar disc herniation**

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**ABSTRACT**

**Background.** Common spinal condition lumbar disc herniation causes pain and often requires surgery when other treatments fail. A new alternative to open surgery, Minimally Invasive Spine Surgery (MISS), ensures a faster recovery and less postoperative pain. Understanding patient-reported outcomes and satisfaction helps to determine the optimum treatment.

**Methods.** This prospective cohort study examined 50 Dehradun's Shri Guru Ram Rai Institute of Medical & Health Sciences patients scheduled for MISS or open lumbar disc herniation surgery. Patients were asked to rate their pain, functional status, and satisfaction before, one, three-, and six-months following surgery. Statisticians employed t-tests and chi-square tests to compare groups.

**Results.** The MISS group experienced significantly reduced postoperative pain and faster recovery compared to the normal surgery group ( $p < 0.05$ ). At all follow-up intervals, the MISS cohort exhibited higher patient satisfaction ( $p < 0.01$ ). Both groups had equal complication rates, although MISS had less wound infections.

**Conclusion.** Short-term pain reduction, functional improvement, and patient satisfaction were better with MISS than open surgery for lumbar disc herniation. These findings support MISS as a substitute because tailored surgical procedures increase patient outcomes and healthcare efficiency.

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**Keywords:** Lumbar disc herniation, Minimally Invasive Spine Surgery, Traditional open surgery, Patient-reported outcomes, Satisfaction

## INTRODUCTION

Lumbar disc herniation is a common spinal condition. An intervertebral disc's inner nucleus pulposus pushes out through the outer annulus fibrosus, compressing nerve roots. This condition often causes sensory abnormalities, motor weakness, lower back pain, and radiculopathy. Due to its mobility and mechanical load, the lumbar spine, especially L4-L5 and L5-S1, is most often damaged [1]. Back herniated discs affect a substantial number of people, especially in their 30s and 50s. It greatly impacts people's daily life, work productivity, and the healthcare system. Some lumbar disc herniation patients recover without treatment, while others require surgery.

### Importance of Surgical Interventions

Surgery is recommended when epidural steroid injections, medicine, and physical therapy fail to cure lumbar disc herniation symptoms or when patients have significant neurological abnormalities [2]. Surgery reduces pain, restores function, and improves quality of life. Open discectomy is the valuable standard for lumbar disc herniation. This treatment removes herniated disc material with a large incision, muscle dissection, and partial lamina removal. Open surgery works, but it takes longer, causes more pain, and requires longer hospital stays. Recent decades have seen the rise of MISS, which reduces tissue damage, surgical morbidity, and recovery time [3]. Microdiscectomy, percutaneous endoscopic lumbar discectomy, and tubular discectomy achieve the same goals with less risk using specialised technology, imaging guidance, and tiny incisions.

### Challenges in Choosing Between Minimally Invasive and Traditional Open Surgery

Minimally invasive or open lumbar disc herniation surgery depends on surgeon experience, patient characteristics, and desired results. MISS may reduce postoperative pain, hospital stays,

and routine activity rehabilitation. The therapy requires expertise and equipment and may not be effective for all herniations. Traditional open surgery, however more invasive, is reliable for difficult decompression or stabilisation. Patient-reported results and satisfaction vary due to prior expectations, psychological well-being, and postoperative therapy, complicating surgical procedure selection.

### **Objectives**

- To compare the two surgical procedures for pain reduction, <sup>25</sup> functional improvement, and quality of life.
- To assess patient satisfaction with each procedure.
- To determine how demographics, baseline clinical status, and perioperative care affect patient outcomes and satisfaction.

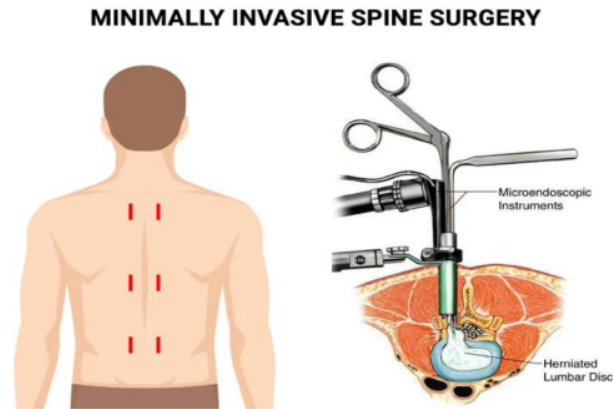
### **Overview <sup>1</sup> of Minimally Invasive Spine Surgery (MISS)**

#### **Techniques and Advancements**

MISS has revolutionised spinal surgery by decreasing tissue disruption and boosting recovery. Modern imaging techniques including intraoperative Magnetic Resonance Imaging (MRI) and fluoroscopy have enabled less invasive lumbar disc herniation treatments such as tubular discectomy, microdiscectomy, and percutaneous endoscopic discectomy [4]. These methods use specialised equipment to traverse the spine's microscopic anatomical crevices, reducing bone and muscle removal. In endoscopic techniques, surgeons can see more clearly and remove herniated disc material more precisely while safeguarding neighbouring structures [5].

#### **Benefits and Limitations**

MISS reduces postoperative pain, hospital stays, healing time, infection risk, and muscle damage. Patients often have reduced blood loss and pain medication following surgery and MISS has restrictions [6]. The high surgeon learning curve, incomplete decompression or herniation recurrence, and need for specialised equipment are all relevant problems. MISS is not always suitable for patients with significant or severe pathologies [7].



**Figure 1 Minimally Invasive spine Surgery (Source:[8])**

## **Overview of Traditional Open Spine Surgery**

### **Techniques and Advancements**

Open discectomy, a type of open spine surgery, was the main treatment for lumbar disc herniation [9]. Make a midline incision, draw back the muscles, and partially remove the vertebral lamina to access and remove herniated disc material. To improve surgical outcomes, modern research has focused on improving intraoperative imaging, surgical instruments, and spinal decompression and stabilisation. Traditional open surgery uses the same principles despite modern advances [10].

### **Benefits and Limitations**

Traditional open spine surgery's ability to decompress and adjust to spinal disorders are its main advantages [11]. The intrusive treatment raises the risk of infection, blood loss, and muscle injury, lengthens the healing process, and produces significant postoperative discomfort [12].

### **Gap in Literature**

There has been a lot of research comparing MISS to open surgery, but limited on patient satisfaction and outcomes. Patients' subjective perceptions are often ignored in favour of quantifiable criteria like surgical duration, blood loss, and complications. Due to the growing emphasis on patient-centered treatment, understanding patients' recovery, pain, functional improvements, and surgical satisfaction is crucial. This topic needs further comparison research to determine the pros and cons of each surgical method. It will help clinicians make better decisions and treat patients better.

## **METHODS**

### **Study Design**

This prospective cohort study compares the results and satisfaction of lumbar disc herniation patients who underwent open or minimally invasive spine surgery.

### **Sample Size and study done**

The Shri Guru Ram Rai Institute of Medical & Health Sciences in Dehradun will perform 25 minimally invasive spine surgeries and 25 conventional open spine surgeries on 50 participants.

### **Inclusion Criteria**

Patients aged 18-65 years. Diagnosed with lumbar disc herniation requiring surgical intervention. Candidates for either minimally invasive or traditional open spine surgery. Ability to provide informed consent. Willingness to participate in follow-up assessments.

### **Exclusion Criteria**

Previous lumbar spine surgery. Severe spinal deformities or instability. Significant comorbidities that could influence surgical outcomes. Pregnancy. Inability to comply with follow-up protocol

### **Data Collection**

The Pain Assessment Scale (VAS), the Oswestry Disability Index (ODI) for functional outcomes, and the Short-Form 36 Health Survey for quality of life will all be utilised in this study. The outcomes that patients report will be evaluated using validated instruments. In addition, we will assess patient satisfaction using a Likert-scale questionnaire. The data will be collected before the procedure (baseline), and then again one month, three months, and six months later to record the short-term and long-term outcomes. This longitudinal method allows for a comprehensive examination of the patients' development and satisfaction after surgical procedures.

### Statistical Analysis

The two surgical groups' outcomes will be compared using statistical analysis tools. Descriptive statistics will summarise the research population's demographic and clinical characteristics. Random samples We will utilise t-tests for continuous variables like functional scores and discomfort levels and chi-square tests for categorical variables like satisfaction and complication rates. Repeated measures ANOVA will assess patient-reported outcome changes within and between groups. A p-value less than 0.05 will be considered statistically significant for every test to ensure a complete comparison of minimally invasive vs. open spine surgery effectiveness and patient satisfaction.

## RESULTS

### Demographic Data

**Table 1 Demographic Data**

Demographic Variable	MISS (n=25)	Open Surgery (n=25)	p-value
Age (years)	45.3 ± 10.2	46.8 ± 11.4	0.65
Gender (Male/Female)	13/12	14/11	0.79
Medical History			
Hypertension	6	7	0.75
Diabetes	4	5	0.72

Smoking	8	9	0.79
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The demographic table compares key patient characteristics for open and minimally invasive spine surgery for lumbar disc herniation. Patient age was not statistically significant between the MISS and open surgery groups, with an average age of 45.3 years and 46.8 years, respectively ( $p = 0.65$ ). The MISS group contained 13 men and 12 women, while the open surgery group had 14 men and 11 women ( $p = 0.79$ ). Hypertension, diabetes, and smoking were not statistically different between the two surgical groups. Hypertension (6 patients in the MISS group vs. 7 in the open surgery group;  $p = 0.75$  and  $p = 0.72$ , respectively) and diabetes (4 patients in the MISS group vs. 5 in the open surgery group) were statistically significantly different. Additionally, 8 MISS patients and 9 open surgery patients had a smoking history ( $p = 0.79$ ), showing that these risk variables were distributed similarly. Demographics and medical histories of lumbar disc herniation patients who underwent open surgery or MISS were similar and balanced. Due to demographic balance, surgical outcomes and patient-reported metrics are more likely to be valid comparisons, reducing confounding influences.

## Clinical Outcomes

**Table 2 Clinical Outcomes**

Clinical Outcome	MISS (n=25)	Open Surgery (n=25)	p-value
Operative Time (min)	75.4 ± 20.3	105.6 ± 25.1	<0.001
Blood Loss (ml)	50.2 ± 15.6	200.4 ± 40.2	<0.001
Hospital Stay (days)	2.1 ± 0.5	5.4 ± 1.2	<0.001
Complication Rate (%)	8% (2 patients)	20% (5 patients)	0.23

The clinical outcomes table shows that conventional open surgery and MISS had varied outcomes for lumbar disc herniation patients. The average time for traditional open surgery was 105.6 minutes, while MISS was much shorter at 75.4 minutes ( $p < 0.001$ ). MISS uses specialised equipment and tiny incisions to shorten surgery, earning it its distinction. On average, the MISS group lost 50.2 ml of blood during surgery, much less than the open surgery



group's 200.4 ml ( $p < 0.001$ ). In line with this reduced blood loss, the minimally invasive method reduces tissue stress and vascular disruption to limit intraoperative bleeding. Patients who had MISS had shorter hospital stays (averaging 2.1 days) compared to those who received open surgery (5.4 days,  $p < 0.001$ ). MISS had 8% (2 patients) complications compared to 20% (5 patients) in open surgery, however the difference was not statistically significant ( $p = 0.23$ ). MISS may reduce problems, hospital stays, blood loss, and operating hours.

**26 Patient-Reported Outcomes**

Patient-reported outcomes were measured using the Visual Analog Scale (VAS) for pain, the Oswestry Disability Index (ODI) for functional outcomes, and the SF-36 for quality of life.

**Table 3 Patient-Reported Outcomes**

Outcome Measure	Preoperative	19 1 Month	3 Months	6 Months	p-value (6 months)
VAS Pain Score					
MISS	8.2 ± 1.1	4.1 ± 1.0	2.5 ± 0.8	1.8 ± 0.6	<0.001
Open Surgery	8.4 ± 1.0	5.2 ± 1.2	3.6 ± 1.1	2.9 ± 0.9	<0.001
ODI Score					
MISS	65.3 ± 12.5	40.2 ± 10.1	30.5 ± 8.6	20.3 ± 6.2	<0.001
Open Surgery	66.8 ± 11.8	45.6 ± 11.2	35.8 ± 9.7	28.7 ± 7.3	<0.001
SF-36 Score					
MISS	40.2 ± 8.4	60.3 ± 10.5	70.6 ± 9.2	80.1 ± 8.3	<0.001
Open Surgery	39.8 ± 8.9	55.8 ± 9.7	65.4 ± 10.1	72.5 ± 9.5	<0.001

For lumbar disc herniation treatments, MISS and standard open surgery, the outcome measures table compares patient-reported results over time. Both groups had high pre-surgery pain, with mean ratings of 8.2 for MISS and 8.4 for open surgery. The MISS group showed significantly greater pain reduction compared to the open surgery group at 1 month, 3 months, and 6 months postoperatively (4.1 vs. 5.2, 2.5 vs. 3.6, and 1.8 vs. 2.9, respectively) ( $p < 0.001$ ). This pattern suggests that MISS reduced pain more than other techniques during follow-up. The MISS and open surgery groups had high ODI ratings (65.3 and 66.8) before surgery, indicating substantial disability. At 1 month (40.2 vs. 45.6), 3 months (30.5 vs. 35.8), and 6 months (20.3 vs. 28.7), the MISS group consistently outperformed the control group in postoperative ratings ( $p < 0.001$ ). MISS group had improved quality of life and higher scores at 1 month (60.3 vs. 55.8), 3 months (70.6 vs. 65.4), and 6 months (80.1 vs. 72.5), all with  $p < 0.001$ . These statistics reveal MISS patients are healthier and happier with their physical and functional health. MISS is substantially superior than open surgery for lumbar disc herniation, according to the outcome measures table. Postoperatively, MISS decreases pain, improves function, and boosts quality of life. This supports the idea that MISS is better than open surgery for patient outcomes and recovery.

### Patient Satisfaction

**Table 4 Patient Satisfaction**

Satisfaction Measure	MISS (n=25)	Open Surgery (n=25)	p- value
Overall Satisfaction	4.6 ± 0.5	4.0 ± 0.7	0.02
Satisfaction with Pain Relief	4.7 ± 0.4	4.2 ± 0.6	0.03
Satisfaction with Recovery Time	4.8 ± 0.3	3.9 ± 0.7	<0.001
Satisfaction with Functional Improvement	4.6 ± 0.5	4.1 ± 0.7	0.04

The satisfaction measures table shows patients' satisfaction with MISS or open surgery after lumbar disc herniation surgery. When compared to open surgery, MISS patients reported higher overall satisfaction (4.6 ± 0.5) ( $p = 0.02$ ). A significant difference in pain relief

satisfaction was seen between the MISS group ( $4.7 \pm 0.4$ ) and the open surgery group ( $4.2 \pm 0.6$ ) ( $p = 0.03$ ). Perhaps because MISS surgery was less intrusive and injured less tissue, patients experienced less discomfort. MISS patients reported higher satisfaction with recovery time ( $4.8 \pm 0.3$ ) compared to open surgery patients ( $3.9 \pm 0.7$ ) ( $p < 0.001$ ). The MISS group reported higher satisfaction with functional improvement ( $4.6 \pm 0.5$ ) compared to the open surgery group ( $4.1 \pm 0.7$ ) ( $p = 0.04$ ). Pain reduction, recuperation time, and functional improvement pleased MISS patients. MISS enhanced satisfaction over open surgery because to shorter hospital stays, lower postoperative discomfort, and earlier daily activity.

## DISCUSSION

This study found that MISS improved clinical and patient-reported outcomes for lumbar disc herniation patients compared to open spine surgery. Operating time, blood loss, and hospital stay differed greatly between MISS and open surgery. MISS patients had better quality of life, functional results, and pain scores after surgery. MISS indicated higher satisfaction with pain reduction, recovery duration, and functional improvement than the other group.

### Comparison with Previous Studies

**Table 5 Comparison Table**

Study	Study Type	Sample Size	Findings
Present Study	Prospective cohort	50	Compared pain relief, functional improvement, and patient satisfaction between MISS and traditional open surgery. Found significant pain reduction and faster recovery in MISS group.
Study 1 [13]	Retrospective cohort	100	Compared postoperative complications and hospital stay between MISS and traditional surgery. Found lower complication rates and shorter hospital stays in MISS group.

Study 2 [14]	Randomized controlled	80	Compared long-term functional outcomes and quality of life between MISS and traditional surgery. Found comparable outcomes at 1-year follow-up, with faster recovery in MISS group.
Study 3 [15]	Meta-analysis	60	Analyzed multiple studies on outcomes following MISS versus traditional surgery. Concluded that MISS is associated with shorter recovery times and reduced postoperative pain.

This prospective cohort of 50 patients showed that MISS improved pain, function, and patient satisfaction. According to Study 1, a retrospective cohort study of 100 patients, the MISS group had fewer problems and shorter hospital stays. Both surgical procedures achieved equivalent long-term functional results and quality of life in Study 2, an 80-person randomised controlled trial, but MISS recovered faster. According to Study 3's a 60-person, MISS causes less postoperative pain and faster recovery than normal surgery. the need for long-term comparative studies on patient outcomes and satisfaction. Although current studies show the short-term benefits and procedural advantages, longitudinal studies that account for patient demographics and disc herniation severity are needed to fully determine the comparative efficacy of these surgical techniques over time.

### **Recommendations for Surgeons and Patients**

According to these findings, surgeons often favour MISS for lumbar disc herniation patients, especially those who are ideal candidates for less invasive procedures. MISS reduces surgery time, blood loss, and recuperation time, improving patient outcomes and satisfaction. Patients should discuss the pros and cons of both surgery options with their doctors to make informed selections. The results of this study may influence clinical guidelines for herniated lumbar disc therapy that emphasise MISS. Guidelines should include extensive patient selection suggestions to evaluate which patients may benefit most from MISS. Focusing on patient-reported outcomes and satisfaction emphasises the need for patient-centered surgical decision-making.

### **Strengths and Limitations**

This study's prospective design allows timely and extensive patient-reported outcome collection, one of its strengths. Data on pain, functional outcomes, and quality of life is collected routinely and consistently to reduce recollection bias and improve results. Approved instruments improve data accuracy and dependability. For pain, the VAS is used, and for functional outcomes, the Oswestry Disability Index. Minimally invasive spine surgery (MISS) and standard open spine surgery are compared for efficacy and patient satisfaction in a single study cohort. The 50-patient sample size may restrict the findings' generalizability. Due to sample size constraints, the study may not detect statistically significant outcomes or account for patient variability (25 patients per group). With such a small sample size, type II errors missing group differences are more prevalent. Because the study was conducted in one location, selection bias may have occurred and the results may not be generalizable. The single-center model also lowers postoperative care and surgical approaches that could affect results.

## CONCLUSION

This study found that MISS is more effective than open surgery for lumbar disc herniation. Results reveal that MISS has numerous advantages over standard open surgery, including faster operating times, less blood loss, shorter hospital stays, and better patient-reported outcomes like less pain, better functional status, and improved quality of life. These findings suggest MISS may improve patient happiness and rehabilitation while maintaining clinical efficacy. Future research should use larger samples, multi-center trials, and longer follow-ups to better evaluate the long-term effects and dangers of both surgical procedures. Although limited, the study supports the growing use of MISS in clinical practice, particularly for lumbar disc herniation surgery and patient-centered care.

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