MINIMALLY INVASIVE OPEN LUMBAR DISCECTOMY IN NEPALESE PATIENTS: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

INTRODUCTION

Minimally Invasive Open Lumbar Discectomy (MIOLD) is a muscle-sparing technique for lumbar disc herniation that may accelerate recovery while reducing morbidity. This study assessed its effectiveness, recovery profile, and safety in a Nepalese cohort.

MATERIAL AND METHODS

In this prospective observational study, 70 adults (18–75 years) with MRI-confirmed lumbar disc herniation underwent MIOLD. Pain (Visual Analog Scale—VAS) and disability (Oswestry Disability Index—ODI) were recorded pre-operatively and at 24 h, 48 h, 1 month, and 3 months post-operatively. Additional outcomes included time to ambulation, hospital stay, return to daily activities, analgesic use, and complications. Continuous data are presented as mean ± SD; categorical data as n (%).

RESULTS

Mean age was 46.8 ± 17.3 years; 60% male. Baseline VAS and ODI were 7.7 ± 1.2 and 55.1 ± 4.7%, respectively. At 24 h, VAS decreased to 2.4 ± 1.2; by 3 months it was 0.8 ± 0.4. ODI improved to 22.1 ± 2.3% at 1 month and 12.6 ± 1.6% at 3 months. Patients ambulated at 11.0 ± 2.0 h, achieved independent mobility in 3.0 ± 1.0 days, and resumed activities in 13.4 ± 2.4 days. All received NSAIDs; 31.4% received gabapentinoids, and 4.3% required opioids. Two dural tears (2.9%) and seven superficial wound infections (10.0%) occurred; no persistent CSF leaks or new neurological deficits were observed.

CONCLUSION

MIOLD offers rapid and substantial pain relief, functional recovery and a low complication rate, with early mobilization and short hospitalization, making it a viable option in resource-limites settings.

KEYWORDS

Lumbar disc herniation, Minimally invasive open discectomy, Visual analog scale, Oswestry disability index, Postoperative recovery

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INTRODUCTION

Lumbar disc herniation and lumbar degenerative disc disease (LDDD) are among the most common causes of low back pain (LBP) and sciatica worldwide. [1] LBP is extremely prevalent—about 80% of individuals experience an episode in their lifetime and it remains the leading cause of disability (measured in years lived with disability) globally. South Asia bears a particularly large share of this burden; in 2017 an estimated 96 million people in South Asia suffered from LBP, the highest of any region.[2] In Nepal, where many engage in physically demanding labor, the socio-economic impact of disc-related back pain is substantial. Indeed, lumbar disc disease is reported as one of the leading causes of medically certified work absence,[3] highlighting the need for effective treatment strategies.

Anatomically, the lumbar spine comprises five vertebrae separated by intervertebral discs, each consisting of a gel-like nucleus pulposus core and a tough annulus fibrosus periphery.[4] Herniation occurs when degenerative changes such as loss of disc water content, weakening of collagen fibers, and annular fissures compromise the disc's integrity. This allows part of the nucleus pulposus to protrude through the annulus, often in a posterolateral direction where the ligamentous support is weakest. The extruded disc material can compress adjacent nerve roots and also triggers local inflammatory cascades.[5,6] Together, mechanical nerve root compression and chemical irritation cause the classic radiculopathy symptoms of lumbar disc herniation (e.g. sciatica, neurological deficits). LDDD, an age-related process of intervertebral disc desiccation and degeneration, underlies many of these herniations and can itself cause chronic back pain. The prevalence of disc degeneration increases with age imaging studies show degenerative changes in over 90% of people above 50 years[7] making LDDD a widespread concern in the aging population.

Conservative management is the first-line approach for most uncomplicated lumbar disc herniations. The majority of patients experience significant improvement or even spontaneous resolution of symptoms within weeks to a few months of non-operative treatment. Recommended conservative measures include activity modification with short rest, physiotherapy, analgesic and anti-inflammatory medications, and epidural steroid injections as needed. In fact, 85–90% of acute lumbar disc herniation cases will see relief of pain within 6–12 weeks without surgical intervention.[1] However, conservative therapy has limitations. Patients with large herniations causing severe nerve compression or those who fail to improve over several weeks may continue to endure disabling pain and progressive neurological deficits despite best non-surgical care. Approximately 10–15% of cases do not respond to conservative measures and require further intervention.[6,8] Surgical decompression becomes indicated when a patient has persistent, debilitating radicular pain or functional impairment after exhaustive conservative treatment, or sooner if there are "red flag" signs. Absolute indications for urgent surgery include the development of cauda equina syndrome or rapidly progressive motor deficits, which necessitate prompt decompression to prevent permanent injury.[9] In the absence of such emergencies, the decision to proceed with surgery is based on failure of non-operative management. Lumbar discectomy is the standard surgical procedure for disc herniation and performing it within about 6–12 months of symptom onset (if indicated) is associated with faster recovery and superior long-term outcomes compared to prolonged watchful management.

Open laminectomy and discectomy were the traditional surgical methods for lumbar disc herniation, but over time the trend has shifted toward less invasive techniques. Microsurgical discectomy (removal of the herniated fragment through a small incision, often with an operating microscope) has become the gold standard, yielding high success rates with reduced morbidity.[3,10] Modern minimally invasive spine surgery techniques such as tubular retractors or endoscopic discectomy—allow the same pathology to be addressed with minimal muscle dissection and bone removal. These approaches have demonstrated benefits like shorter operative times, less intraoperative blood loss, reduced postoperative pain, and quicker mobilization, while showing no increase in complication or reoperation rates compared to conventional open discectomy.[1] Importantly, long-term outcomes (in terms of pain relief and functional recovery) are equivalent between minimally invasive and open procedures, meaning the primary advantages of minimally invasive discectomy lie in the perioperative period and patient comfort. However, advanced minimally invasive systems come with drawbacks: they require specialized equipment and training, and the costs can be prohibitive for many institutions in low-resource settings.[3] In Nepal and similar developing contexts, state-of-the-art endoscopic or laser spine systems are not widely available. As a practical solution, Minimally Invasive Open Lumbar Discectomy (MIOLD) has been proposed as an alternative technique that adheres to the principles of tissue-sparing surgery without relying on expensive technology.[3] MIOLD involves an extradural removal of the disc fragment via a limited fenestration, avoiding a full laminectomy and minimizing muscle damage. Notably, it can often be performed without an operating microscope, using simple operative tools that most general neurosurgical centers possess. Early reports from Nepal have shown that this approach yields outcomes comparable to standard microdiscectomy: in the series by Devkota et al, over 97% of patients achieved good to excellent functional results at 6-month follow-up after MIOLD, with immediate postoperative ambulation and effective radicular pain relief in the vast majority.[3] These findings suggest that MIOLD can confer the benefits of minimally invasive surgery (low morbidity and rapid recovery) in a cost-effective manner, making it highly relevant for resource-constrained healthcare systems.

In this context, we conducted a prospective observational study to evaluate the outcomes of MIOLD in Nepalese patients with lumbar disc herniation. The objective of this study is to assess the effectiveness of the MIOLD technique in relieving symptoms and improving functional status in patients with lumbar disc prolapse, and to determine whether this minimally invasive open approach is a viable surgical option in a resource-limited setting like Nepal.

MATERIAL AND METHODS

This observational study evaluated MIOLD outcomes in 70 patients (18–75 years) with radiologically confirmed lumbar disc herniation treated at a single center. Inclusion criteria were elective surgical indication and informed consent.

Exclusion criteria included prior lumbar spine surgery, significant comorbidities (e.g.,uncontrolled diabetes or cardiovascular disease) and incomplete follow-up.

Baseline demographics, including age, gender, BMI, and symptom duration, and preoperative pain (VAS) and disability (ODI) were recorded. Intraoperative data, such as operative level and duration, were documented. Postoperative evaluations at 24 h, 48 h, 1 month, and 3 months included VAS, ODI, time to ambulation, length of hospital stay, and complications (dural tears, infections, nerve injuries).

Postoperative analgesia protocol consisted of NSAIDs for all patients, with gabapentinoids added selectively and opioids reserved for uncontrolled pain. Primary outcomes were VAS and ODI changes; secondary outcomes included recovery metrics and complications.

Statistical analysis utilized SPSS version 26. Continuous variables are presented as mean ± SD; categorical variables as frequencies and percentages. Inferential tests were applied as appropriate, with significance defined at $p < 0.05$.

Ethical approval was obtained from the Institutional Review Board of Nepal APF Hospital, and informed consent was secured from all participants. Data confidentiality was maintained.

RESULTS

Seventy patients underwent minimally invasive open lumbar discectomy. Baseline demographic and clinical characteristics are summarized in Table 1. The mean age was 46.8 ± 17.3 years (median 44.5 [32.3–61.0]; range 19–75), and 60% were male. The mean BMI was 27.0 ± 4.5 kg/m² (median 27.6 [23.2–30.4]; range 18.7–34.5), and mean symptom duration was 7.2 ± 2.4 months (median 6.7 [5.2–9.2]; range 3–12). Preoperatively, mean VAS for back pain was 7.7 ± 1.2 (median 8.0 [7.0–9.0]; range 6–9), and mean ODI was 55.1 ± 4.7% (median 54.8 [51.6–58.4]; range 47.1–63.9). Forty patients (40%) had intact neurology; the remainder presented with leg pain (31.4%), radiculopathy (15.7%), or other deficits (12.9%) (Table 1).

Table 1. Baseline demographics, clinical characteristics and neurology status

Variable	Value
Age (years)	46.8 ± 17.3 (44.5 [32.3–61.0]; 19–75)
BMI (kg/m²)	27.0 ± 4.5 (27.6 [23.2–30.4]; 18.7–34.5)
Symptom duration (months)	7.2 ± 2.4 (6.7 [5.2–9.2]; 3–12)
Preop VAS (0–10)	7.7 ± 1.2 (8.0 [7.0–9.0]; 6–9)
Preop ODI (%)	55.1 ± 4.7 (54.8 [51.6–58.4]; 47.1–63.9)
Male sex, n (%)	42 (60.0)
Female sex, n (%)	28 (40.0)
Neurology status, n (%)	
• Intact	28 (40.0)
• Left leg pain	10 (14.3)
• Right leg pain	12 (17.1)
• Left radiculopathy	6 (8.6)
• Right radiculopathy	5 (7.1)
• Other neurological deficits	9 (12.9)

Postoperative pain and functional outcomes are detailed in Table 2. Mean VAS decreased from 7.7 ± 1.2 preoperatively to 2.4 ± 1.2 at 24 hours and 0.8 ± 0.4 at 3 months. Mean ODI improved from 55.1 ± 4.7% at baseline to 22.1 ± 2.3% at 1 month and 12.6 ± 1.6% at 3 months, indicating rapid and sustained functional recovery.

Table 2. Pain (VAS) and functional (ODI) outcomes over time

Time point	VAS mean ± SD (median [IQR]; range)	ODI mean ± SD % (median [IQR]; range)
Preoperative	7.7 ± 1.2 (8.0 [7.0–9.0]; 6–9)	55.1 ± 4.7 (54.8 [51.6–58.4]; 47.1–63.9)
24 h postoperative	2.4 ± 1.2 (2.0 [1.0–3.0]; 1–4)	–
48 h postoperative	0.9 ± 0.8 (1.0 [0.0–2.0]; 0–2)	–
1 month postoperative	1.2 ± 0.5 (1.2 [1.0–1.5]; 0.5–2.0)	22.1 ± 2.3 (22.2 [20.0–24.2]; 18.1–26.0)
3 months postoperative	0.8 ± 0.4 (0.8 [0.5–1.0]; 0.2–1.5)	12.6 ± 1.6 (12.5 [11.2–13.8]; 10.1–15.9)

Recovery metrics (Table 3) showed early mobilization (mean time to ambulation 11.0 ± 2.0 hours), independent ambulation by day 3 (3.0 ± 1.0 days), short hospital stay (3.0 ± 0.8 days), and return to daily activities by 13.4 ± 2.4 days.

Table 3. Recovery metrics

Metric	Mean ± SD (median [IQR]; range)
Time to ambulation (hours)	11.0 ± 2.0 (11.0 [10.0–12.0]; 8–15)
Independent ambulation (days)	3.0 ± 1.0 (3.0 [2.0–4.0]; 2–5)
Hospital stay (days)	3.0 ± 0.8 (3.0 [2.0–4.0]; 2–4)
Time to resume activities (days)	13.4 ± 2.4 (13.0 [11.3–15.0]; 10–17)

Analgesic requirements are summarized in Table 4. All patients received NSAIDs, 31.4% received gabapentinoids, and 4.3% required opioids.

Table 4. Postoperative analgesic use (n=70)

Analgesic	n (%)
NSAIDs	70 (100.0)
Gabapentinoids	22 (31.4)
Opioids	3 (4.3)

Overall complication rates were low (Table 5). Two patients (2.9%) sustained dural tears (repaired without CSF leak); seven (10.0%) had superficial wound infections. Postoperative adverse effects included sedation (12.9%), bleeding (4.2%), nausea (10.0%), constipation (8.6%), and infection (5.1%); 50.0% of patients experienced no postoperative complications.

Table 5. Intraoperative and postoperative complications (n = 70)

Complication	n (%)
Intraoperative	
• Dural tear	2 (2.9)
• Superficial wound infection	7 (10.0)
Postoperative adverse effects	
• None	35 (50.0)
• Sedation	9 (12.9)
• Bleeding	3 (4.2)
• Nausea	7 (10.0)
• Constipation	6 (8.6)
• Infection	4 (5.1)

DISCUSSION

MIOLD in our series of 70 patients achieved excellent short-term results. The mean VAS for pain fell from 7.7 preoperatively to 0.8 at 3 months, and ODI improved from 55.1% (indicating severe disability) to 12.6% (minimal disability). This dramatic relief of radicular pain and restoration of function is comparable to outcomes reported with standard microdiscectomy. For example, Devkota et al. noted 98% of patients had radicular pain improvement and returned to their premorbid functional status after MIOLD.[3] Likewise, large microdiscectomy series show good-to-excellent results in roughly 90% of cases.[11] In a recent randomized trial, patients treated with open or microscopic discectomy similarly attained near-complete leg pain resolution (VAS ~0.5) and minimal ODI scores by 3 months.[12] Our findings align closely with these reports, confirming that a small-incision open approach can deliver pain relief and functional recovery on par with the conventional microscope-assisted technique.

Patients in our study mobilized quickly and resumed activities rapidly. On average, ambulation began ~11 hours post-surgery and full independent mobility was achieved within 3 days. The mean hospital stay was only 3 days, after which most patients returned home. By a mean of 13.4 days post-op, they had resumed routine daily activities. These recovery metrics indicate a swift rehabilitation period. Other authors have observed similar benefits with minimally invasive approaches. Devkota et al reported that ambulation usually began on the first postoperative day in their MIOLD series.[3] In many centers, lumbar microdiscectomy is now done on an ambulatory (same-day) basis with high patient satisfaction.[13] One randomized trial found that using a microscope shortened the hospital stay from 2.1 days (open discectomy) to 1.1 days and enabled patients to return to activities about 3 days earlier than an open technique.[12] Our cohort's 3-day hospitalization likely reflects local practice norms, yet it remains short and complication-free. The average two-week timeframe for return to daily tasks in our series is slightly longer than in some reports, but still represents a rapid recovery by historical standards. Notably, all patients were managed with non-opioid analgesia (NSAIDs for 100%, plus gabapentinoids in ~31%), and only 4.3% required any opioid. This minimal opioid requirement underscores the mild postoperative pain profile. It is consistent with multimodal pain management protocols that prioritize NSAIDs and other non-opioids to control pain.[14] The ability to avoid opioids in over 95% of cases highlights the less invasive nature of MIOLD and its contribution to enhanced recovery.

The MIOLD technique proved safe in our experience, with a low rate of mostly minor complications. We encountered 2 incidental dural tears (2.9%), neither of which led to a persistent CSF leak or neurological injury. This incidence is within the expected range for lumbar discectomy (approximately 1–3% dural tear rate).[15] Seven patients (10%) developed superficial wound infections, all of which were managed conservatively and resolved without sequelae. There were no deep infections or cases of postoperative instability. Overall, roughly 12.8% of patients had some complication, which aligns with published rates for open or minimally invasive discectomy (about 10–13% overall).[16] Importantly, no patient in our series suffered a new permanent neurological deficit. We also observed no reoperations for recurrent herniation within the 3-month follow-up period. By comparison, typical reherniation rates are on the order of 5–7% in the first year after lumbar disc surgery.[16] For instance, Hamawandi et al. reported a ~7% reoperation rate at 4-year follow-up in both open and microdiscectomy groups.[12] While our short follow-up precludes assessment of longer-term recurrences, the absence of early reoperation is encouraging and suggests that adequate decompression was achieved in the index surgery.

This study's strengths include the use of standardized objective measures (VAS and ODI) in a homogeneous cohort undergoing MIOLD with a consistent surgical protocol, demonstrating rapid pain relief and functional recovery without requiring specialized equipment, which is particularly relevant in resource-limited settings. However, its limitations namely the short three-month follow-up precluding long-term outcome assessment, lack of a direct control group, single-center design with a modest sample size and potential variability in what constitutes a "complication" may limit the generalizability and definitive comparative conclusions of our findings.

CONCLUSION

MIOLD provided rapid, durable pain relief and functional improvement with a safety profile comparable to microdiscectomy, supporting its use as a muscle-sparing alternative; longer-term, controlled trials are needed to confirm its equivalence and define its role in spinal surgery.

CONFLICT OF INTEREST

None

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