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Early Experience of Minimally Invasive Tubular Lumbar Microdiscectomy at a Tertiary Care Centre in Nepal

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ABSTRACT

Introduction

Lumbar disc herniation is a leading cause of low back pain and radiculopathy. Open microdiscectomy, though effective, involves muscle dissection and longer recovery. Minimally invasive tubular microdiscectomy (MIS) aims to reduce these drawbacks. This study evaluates its early outcomes.

Methods

An observational study included patients who underwent MIS tubular lumbar microdiscectomy at our hospital from August 2023 to July 2024. Data on operative duration, blood loss, and return to work time were collected. Functional outcomes were assessed at three months using the Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) for spinal and radicular pain.

Results

A total of 22 patients were included. The mean operative duration was 121.5 ± 31.67 minutes, and mean intraoperative blood loss was 60 ± 20.17 mL. The mean return to work time was 1.86 ± 0.2 weeks. At three months, the mean ODI score significantly improved from 54.36 ± 8.8 to 0.91 ± 1.47 ($p < 0.001$). VAS scores for spinal pain decreased from 3.05 ± 0.84 to 1.5 ± 0.3 ($p < 0.001$), and radicular pain from 4.91 ± 0.86 to 1.36 ± 0.65 ($p < 0.001$). No major complications occurred, and 5% of patients had transient paraesthesia, which resolved spontaneously.

Conclusion

MIS tubular lumbar microdiscectomy is an alternative procedure for lumbar disc herniation, offering short-term functional improvement. Long-term comparative studies are needed to assess its durability against open microdiscectomy.

Keywords

Lumbar microdiscectomy; minimally invasive surgery; Oswestry Disability Index; tubular retractor; Visual Analog Scale.

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INTRODUCTION

Lumbar disc herniation is a leading cause of low back pain and radiculopathy, significantly impacting quality of life and productivity.[1] In patients with persistent symptoms despite conservative management, surgery is usually indicated.[2-4] Traditional open lumbar disc surgery, pioneered by Mixter and Barr in 1934, and later its refinement to microdiscectomy has been the most common procedure for the above condition worldwide.[5-8] However, it involves extensive muscle dissection, increased postoperative pain, longer hospital stays, and delayed recovery, prompting the development of minimally invasive surgical (MIS) techniques to address these concerns.

Minimally invasive tubular lumbar microdiscectomy, pioneered by Foley and Smith in the late 1990s, utilizes a tubular retractor system to minimize soft tissue damage.[9] By preserving paraspinal musculature and reducing incision size in MIS techniqes patients are expected to receive several advantages over open microdiscectomy, including reduced blood loss, shorter hospital stays, faster functional recovery, and lower postoperative pain. Despite these benefits, concerns remain regarding the learning curve, technical challenges, and long-term outcomes compared to traditional approaches. Additionally, limited data exist on its feasibility and effectiveness in resource-limited settings such as Nepal.

While several international studies have demonstrated favorable short-term outcomes of MIS lumbar microdiscectomy, there is a lack of published data from Nepal.[10-12] This study aims to evaluate the early clinical outcomes of MIS tubular lumbar microdiscectomy at a tertiary care center in Nepal, focusing on operative parameters, postoperative recovery, and functional improvement. The findings will contribute local evidence to the global literature and help determine the procedure's viability in Nepalese neurosurgical practice.

METHODS

This was a retrospective observational study conducted at the Department of Neurosurgery, Tribhuvan University Teaching Hospital (TUTH), Kathmandu, Nepal, a major referral center for neurosurgical procedures. The study was conducted over one year, from August 2023 to July 2024. Ethical approval was obtained from the Institutional Review Committee (IRC) of the Institute of Medicine, (Approval No.: [Ref:- 444 081/082]).

Patients aged 18–65 years diagnosed with symptomatic lumbar disc herniation who underwent MIS tubular lumbar microdiscectomy at TUTH and were followed up for at least three months postoperatively were included in the study. Patients with incomplete medical records, those who underwent revision surgeries or multilevel disc herniation cases were excluded. A consecutive sampling technique was used, including all eligible cases within the study period yielding 22 cases. As this was a retrospective study, informed consent was waived by the ethical review board. However, patient confidentiality was strictly maintained. Medical records for demographic, clinical, and operative data, Oswestry Disability Index (ODI) for functional outcomes and Visual Analog Scale (VAS) for pain assessment were used. Data on operative duration, intraoperative blood loss, hospital stay, return to work time, and functional outcomes (ODI, VAS for spinal and radicular pain) were extracted from medical records. Independent variables included age, sex, disc level, operative duration, blood loss. Dependent variables included ODI and VAS scores, time to return to work and complications. Descriptive statistics were used for demographic and clinical data. Paired t-tests were performed to compare preoperative and postoperative ODI and VAS scores. A p-value < 0.05 was considered statistically significant. Data were analyzed using IBM SPSS version 27.

RESULTS

A total of 22 patients were included in the study, comprising 17 males (77.3%) and 5 females (22.7%). The mean age was 40.91 ± 13.16 years (range: 23–62 years). The most commonly affected disc level was L4-L5 (14 patients, 63.6%), followed by L5-S1 (8 patients, 36.4%). The mean duration of preoperative symptoms was 5.41 ± 1.68 months (Table 1).

The mean operative duration was 121.5 ± 31.67 minutes, with a range of 85–175 minutes. The mean intraoperative blood loss was 60 ± 20.17 mL. The mean postoperative hospital stay was 2.4 ± 0.2

Table 1. Demographics

Parameters	Mean±SD
Sex	
Male	17
Female	5
Age (in years)	40.91±13.16
Duration of symptoms (months)	5.41± 1.68
Level of disc	
L4-5	14
L5-S1	8
Duration of surgery (minutes)	121.5±31.67
Postoperative hospital stay (days)	2.4 ± 0.2
Intraoperative blood loss (ml)	60 ± 20.17

Table 2. Comparison of VAS score

Site	VAS score		p-value
	Preoperative	Postoperative	
Leg	4.91± 0.86	1.36 ± 0.65	<0.001
Back	3.05 ± 0.84	1.5 ± 0.3	<0.001

Table 3. Comparison of ODI score

ODI score		p-value
Preoperative	3-months	
54.36 ± 8.8	0.91 ± 1.47	<0.001

days.

At the three-month follow-up, there was a significant improvement in functional outcomes. Oswestry Disability Index (ODI) Score: Improved from 54.36 ± 8.8 preoperatively to 0.91 ± 1.47 postoperatively ($p < 0.001$). (Table 2).

Visual Analog Scale (VAS) for Radicular Pain: Decreased from 4.91 ± 0.86 preoperatively to 1.36 ± 0.65 postoperatively ($p < 0.001$). Visual Analog Scale (VAS) for Spinal Pain: Reduced from 3.05 ± 0.84 preoperatively to 1.5 ± 0.3 postoperatively ($p < 0.001$). (Table 3).

The mean time to return to work was 1.86 ± 0.2 weeks, with all patients resuming their routine activities within three weeks of surgery.

There were no major intraoperative or postoperative complications reported. Minor complications were observed in one patient (5%), who experienced transient paresthesia that resolved spontaneously within four weeks without intervention. No cases of wound infection, dural tears, or reoperations were recorded.

DISCUSSION

Our study aimed to evaluate the early postoperative outcomes of MIS tubular lumbar microdiscectomy at a tertiary care centre in Nepal. We found that patients experienced significant improvements in functional outcomes, as evidenced by a statistically significant reduction in ODI and VAS scores at three months. MIS tubular lumbar microdiscectomy was associated with few hospital stays, minimal blood loss, consistent with global findings.[13] The mean time to return to work was shorter than what has been reported for open microdiscectomy in prior studies, suggesting a faster functional recovery. These findings align with previous literature that has demonstrated the short-term benefits of MIS techniques.[13] However, long-term comparative outcomes remain a subject of debate, highlighting the need for further research.

Several studies have reported that MIS tubular lumbar microdiscectomy provides early benefits over traditional open techniques in terms of postoperative analgesic use, shorter hospital stay, lesser blood loss and lower cost.[10-14] Cahill et al. found that patients undergoing MIS lumbar discectomy were discharged 1–2 days earlier on average compared to open surgery patients.[15] Our findings, though not comparative with open techniques, show significant reduction in postoperative pain, early functional recovery and return to work.

Although short-term advantages are well-documented, long-term studies have been inconclusive regarding the superiority of MIS techniques over open microdiscectomy. Teli et al. (2010) found no significant difference in recurrence rates between MIS and open microdiscectomy at two years postoperatively.[16] Lee et al. (2020) conducted a five-year prospective study comparing ODI and VAS scores between MIS and open lumbar discectomy, concluding that both groups had similar long-term outcomes.[14] Gibson & Waddell (2007) reviewed multiple randomized controlled trials and suggested that MIS techniques provide early functional benefits, but long-term pain relief and disability outcomes are comparable to open techniques.[17] Arts et al. published the 2-year results of a double blind randomized controlled trial comparing tubular versus microdiscectomy in which there were similar functional and clinical outcomes.[18] These findings suggest that while MIS offers clear short-term benefits, its long-term superiority remains unproven, necessitating further randomized controlled trials (RCTs) with extended follow-up periods.

The faster recovery and improved short-term outcomes observed in our study may be attributed to several key surgical advantages of MIS techniques. Unlike open discectomy, which requires paraspinal muscle detachment, MIS techniques use sequential dilators to create a corridor without excessive soft tissue trauma. This reduces postoperative muscle inflammation and pain, facilitating faster ambulation. The small incision (typically 18–20 mm) and tubular retractor system help minimize iatrogenic tissue injury. Less tissue trauma translates to reduced intraoperative blood loss, less postoperative pain, and shorter hospital stays. Several studies, including our own, have found that patients undergoing MIS microdiscectomy return to work sooner than those undergoing open surgery. This has significant socioeconomic implications, especially in low-resource settings like Nepal, where prolonged absence from work can place financial strain on families.

Despite its benefits, MIS tubular lumbar microdiscectomy is not without challenges. Some of the key concerns include learning curve and

technical complexity. Unlike open microdiscectomy, which offers a wider surgical field, MIS techniques require working through a narrow tubular retractor with limited visualization. Mcloughin et al. concluded that 15 cases are required to achieve a learning curve in minimally invasive techniques.[19] Surgeons unfamiliar with MIS techniques may experience longer operative times during the initial phase of adoption.[20] Some studies have suggested that MIS microdiscectomy may lead to inadequate decompression, particularly in patients with large, migrated, or calcified disc herniations. A meta-analysis by Cheng et al. found that reoperation rates for MIS procedures were slightly higher than for open microdiscectomy, possibly due to incomplete removal of disc material.[21] The requirement for specialized tubular retractors, endoscopic instruments, and fluoroscopy increases operative costs. In resource-limited settings like Nepal, cost constraints may limit widespread adoption, especially in public-sector hospitals. MIS techniques often rely on fluoroscopic guidance, which can lead to higher radiation exposure for both the patient and the surgical team. Some centres have started incorporating neuronavigation and robotic assistance to minimize fluoroscopy use, but these technologies are expensive and not widely available in developing countries.

Given the results of our study, several key clinical implications emerge. MIS microdiscectomy could be considered as a first-line surgical option for young, active patients. Patients who need rapid recovery and early return to work may benefit more from MIS techniques than from traditional open microdiscectomy. While MIS microdiscectomy is suitable for most single-level lumbar disc herniations, patients with large, migrated, or calcified disc herniations may be better managed with open techniques. Structured training programs, hands-on cadaveric workshops, and international collaborations can help surgeons in Nepal overcome the learning curve faster.

While our study provides valuable insights into the short-term outcomes of MIS lumbar microdiscectomy, several questions remain unanswered, necessitating future research. Future RCTs comparing MIS vs. open microdiscectomy in Nepalese patients will be essential to validate long-term outcomes and recurrence rates. A comparative study evaluating the cost-effectiveness of MIS versus open techniques in a low-resource setting like Nepal is crucial to determine economic viability. Extending follow-up beyond three months to one year or longer will provide insights into recurrence rates, patient satisfaction, and overall functional improvement. Evaluating the feasibility of robotic-assisted MIS microdiscectomy or endoscopic spine surgery in Nepalese hospitals could provide valuable insights for future practice.

CONCLUSION

Our study demonstrates that MIS tubular lumbar microdiscectomy is an alternative procedure for lumbar disc herniation, offering short-term functional benefits. However, technical challenges, cost constraints, and long-term outcome concerns remain barriers to widespread adoption. Future randomized trials, cost-effectiveness studies, and long-term follow-ups are essential to establish MIS microdiscectomy as the preferred standard of care in Nepal and other low-resource settings.

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CONFLICT OF INTEREST

The author(s) declare that they do not have any conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHOR CONTRIBUTIONS

Amit Bahadur Pradhanang (Principal Author): Research concept, design, literature review, data collection, data analysis, manuscript preparation; Prabhat Jha: Statistical analysis, manuscript preparation; Anjan Singh Karki: Data collection, manuscript preparation; Sandeep Bohara: Manuscript preparation; Dipendra Kumar Shrestha: Manuscript preparation; Mohan Raj Sharma: Research concept, manuscript preparation; Sushil Krishna Shilpakar: Manuscript preparation; Gopal Sedain (Corresponding Author): Manuscript preparation

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