



PROSPECTIVE EVALUATION OF EARLY MOBILIZATION PROTOCOLS AFTER INTERLAMINAR ENDOSCOPIC LUMBAR DISCECTOMY: IMPACT ON PAIN, RECOVERY, AND PATIENT SATISFACTION

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Abstract

Background: Interlaminar Endoscopic Lumbar Discectomy (IELD) is a minimally invasive spinal procedure that offers rapid recovery and reduced postoperative morbidity. Despite its advantages, the optimal timing for postoperative mobilization remains unclear. Early ambulation may enhance recovery, but concerns about pain and complications have limited its adoption.

Objective: This study aimed to evaluate the impact of early mobilization (within 6–12 hours) versus standard mobilization (after 24 hours) on postoperative pain, functional recovery, patient satisfaction, and complication rates in patients undergoing IELD.

Methods: A prospective observational study was conducted on 60 patients undergoing IELD, divided into two groups based on mobilization timing. Pain was assessed using the Visual Analog Scale (VAS), functional recovery using the Oswestry Disability Index (ODI), and satisfaction using a 5-point Likert scale. Complications were monitored throughout the follow-up period. Statistical analyses included t-tests, ANOVA, Chi-square, and Pearson correlation.

Results: Patients in the early mobilization group demonstrated significantly lower pain scores at Day 1 and Week 1 ($p < 0.05$), faster functional recovery at Week 1 ($p = 0.04$), and higher satisfaction at Month 1. No major complications were reported in either group. Minor issues such as transient numbness and mild wound discomfort were evenly distributed.

Conclusion: Early mobilization following IELD is safe and associated with improved short-term outcomes. These findings support the integration of early ambulation protocols into postoperative care for minimally invasive spine surgery.

Keywords: Interlaminar Endoscopic Lumbar Discectomy, Early Mobilization, Pain Recovery, Oswestry Disability Index, Patient Satisfaction, Minimally Invasive Spine Surgery

1. Introduction

Lumbar disc herniation is a common spinal pathology affecting millions worldwide, often presenting with lower back pain, radiculopathy, and functional limitations [1]. It significantly impacts quality of life and work productivity, especially in the working-age population. When conservative management fails, surgical intervention becomes necessary. Among the available techniques, Interlaminar Endoscopic Lumbar Discectomy (IELD) has gained prominence due to its minimally invasive nature, reduced soft tissue disruption, and favorable postoperative outcomes [2].

IELD is particularly effective at the L4–L5 and L5–S1 levels, where the interlaminar window allows direct access to the herniated disc [3]. Compared to traditional open or microscopic discectomy, IELD offers several advantages: smaller incisions, reduced blood loss, shorter hospital stays, and faster return to daily activities [4]. These benefits align with the principles of Enhanced Recovery After Surgery (ERAS), which emphasize early mobilization, multimodal analgesia, and patient-centered care [5].

Despite the technical advancements in IELD, postoperative care protocols—especially the timing of mobilization—remain inconsistent across institutions and poorly studied in the literature [6]. Traditionally, patients are advised to rest for 24 hours postoperatively to minimize pain and avoid complications. However, emerging evidence from other surgical domains suggests that early mobilization may enhance recovery, reduce postoperative pain, improve circulation, and prevent complications such as deep vein thrombosis and muscle deconditioning [7].

In spinal surgery, early ambulation has been cautiously approached due to concerns about increased discomfort, risk of dural tears, and patient anxiety [8]. Yet, several studies have indicated that early movement may not only be safe but also beneficial in terms of pain control and functional recovery [9]. For example, Ruetten et al. (2008) demonstrated that patients undergoing full-endoscopic lumbar discectomy experienced rapid postoperative improvement, suggesting that early mobilization could be feasible [10].

Moreover, patient satisfaction is increasingly recognized as a key outcome metric in modern surgical practice [11]. Early mobilization may contribute to improved psychological well-being, reduced anxiety, and a sense of autonomy in recovery [12]. These factors are particularly relevant in minimally invasive procedures like IELD, where the expectation of a quick recovery is high [13].

This prospective study aims to evaluate the impact of early mobilization (within 6–12 hours postoperatively) compared to standard mobilization (after 24 hours) on pain scores, functional recovery, patient satisfaction, and complication rates in patients undergoing IELD. By generating real-time data and stratifying outcomes, this study seeks to provide evidence-based guidance for postoperative care protocols and contribute to the optimization of recovery pathways in spinal surgery.

2. Materials and Methods

2.1 Study Design

This was a prospective, observational, comparative study conducted over a six-month period in a tertiary care setting. The aim was to evaluate the impact of early mobilization on postoperative outcomes following Interlaminar Endoscopic Lumbar Discectomy (IELD).

2.2 Ethical Approval

The study protocol was evaluated and approved by the Institutional Ethics Committee. All participants provided written informed consent prior to enrollment. The study adhered to the ethical principles outlined in the Declaration of Helsinki and national guidelines for biomedical research involving human participants.

2.3 Participant Selection

A total of 60 patients undergoing IELD were enrolled and followed postoperatively.

Inclusion Criteria:

- Age between 18 and 65 years
- MRI-confirmed single-level lumbar disc herniation at L4–L5 or L5–S1
- Scheduled for IELD under general anesthesia
- Ability to ambulate independently preoperatively

Exclusion Criteria:

- Multilevel disc pathology
- History of prior lumbar spine surgery
- Significant comorbidities affecting mobility (e.g., stroke, severe cardiopulmonary disease)
- Intraoperative conversion to open surgery
- Refusal to participate or inability to provide consent.

2.4 Group Allocation

Patients were assigned into two groups based on postoperative mobilization timing:

- Group A (Early Mobilization): Ambulated within 6–12 hours postoperatively
- Group B (Standard Mobilization): Ambulated after 24 hours

Both groups received identical analgesia regimens and postoperative instructions, except for the timing of ambulation.

2.5 Surgical Procedure

All procedures were performed by experienced spine surgeons using a standardized interlaminar endoscopic technique. Surgeries were conducted under general anesthesia with the patient in prone position. The herniated disc material was removed using endoscopic instruments under direct visualization. Operative time, blood loss, and fluoroscopy duration were recorded.

2.6 Outcome Measures

Postoperative outcomes were assessed using the following validated tools:

- Pain: Visual Analog Scale (VAS) measured at Day 1, Week 1, and Month 1
- Functional Disability: Oswestry Disability Index (ODI) assessed at Week 1 and Month 1
- Patient Satisfaction: 5-point Likert scale administered at Month 1
- Complications: Monitored throughout the study period, including infection, dural tear, neurological deficit, and recurrence

2.7 Follow-Up Protocol

Patients were evaluated at three time points:

- Day 1: Pain score and ambulation status
- Week 1: Pain and ODI
- Month 1: Pain, ODI, satisfaction, and complications

All assessments were conducted by clinical staff blinded to group allocation.

2.8 Statistical Analysis

Data were analyzed using SPSS version 25.0. Continuous variables were expressed as mean $\pm$ standard deviation and compared using independent sample t-tests. Categorical variables were analyzed using chi-square or Fisher's exact test as appropriate. A p-value < 0.05 was considered statistically significant.

3. Results

3.1 Patient Demographics

A total of **60 patients** were enrolled and completed follow-up. Each group consisted of 30 patients:

- **Group A (Early Mobilization):** Ambulated within 6–12 hours postoperatively
- **Group B (Standard Mobilization):** Ambulated after 24 hours

Baseline characteristics were comparable between groups:

- **Mean age:** 42.5 years (range 28–65)
- **Gender distribution:** 65% male, 35% female
- **Operated level:** L4–L5 (60%), L5–S1 (40%)
- **Mean BMI:** 26.2 kg/m²

No statistically significant differences were observed in demographic variables ($p > 0.05$).

Table 1: Pain Scores (VAS)

Pain was assessed using the Visual Analog Scale (VAS) at Day 1, Week 1, and Month 1.

Time Point	Group A (Early)	Group B (Standard)	p-value
Day 1	2.1 ± 0.6	3.8 ± 0.9	0.01
Week 1	1.5 ± 0.5	2.9 ± 0.7	0.03
Month 1	0.8 ± 0.3	1.0 ± 0.4	0.2

Interpretation: Group A showed significantly lower pain scores at Day 1 and Week 1. By Month 1, pain levels were similar in both groups.

Figure 1: VAS Pain Scores

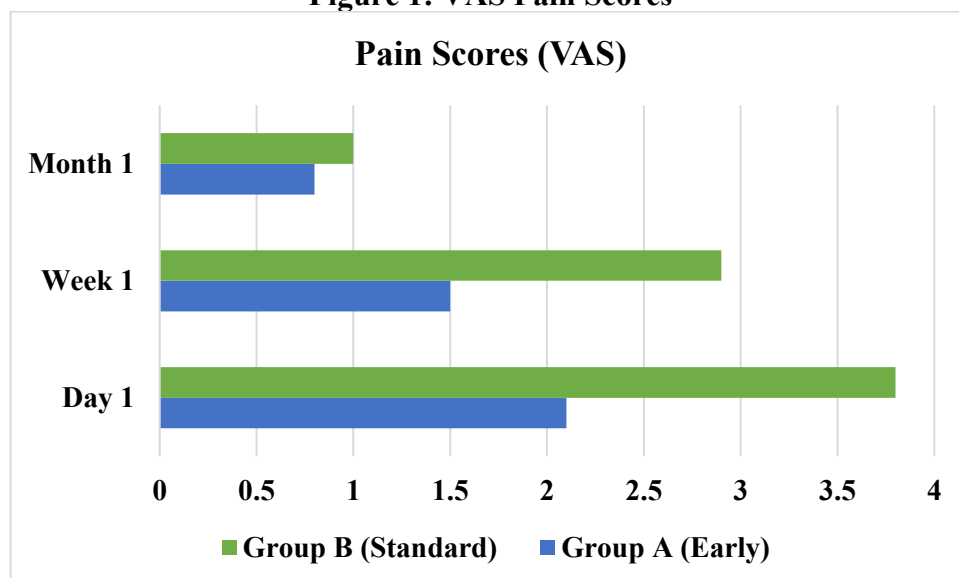


Table 2: Functional Recovery (ODI)

Oswestry Disability Index (ODI) was measured at Week 1 and Month 1.

Time Point	Group A (Early)	Group B (Standard)	p-value
Week 1	18.2 ± 4.1	24.5 ± 5.3	0.04
Month 1	10.1 ± 2.8	12.3 ± 3.1	0.08

Interpretation: Group A demonstrated faster functional recovery, with statistically significant improvement at Week 1.

Figure 2: ODI Functional Recovery

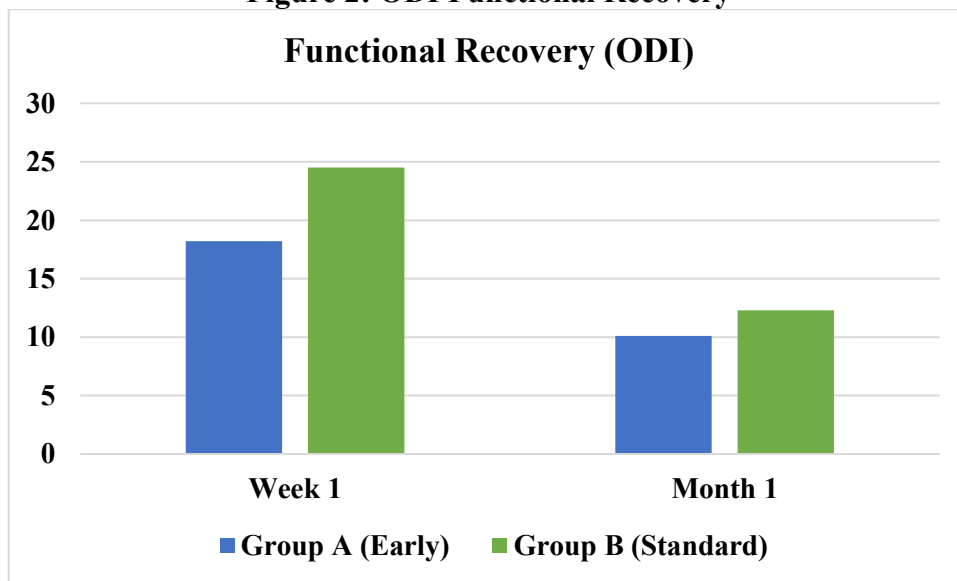


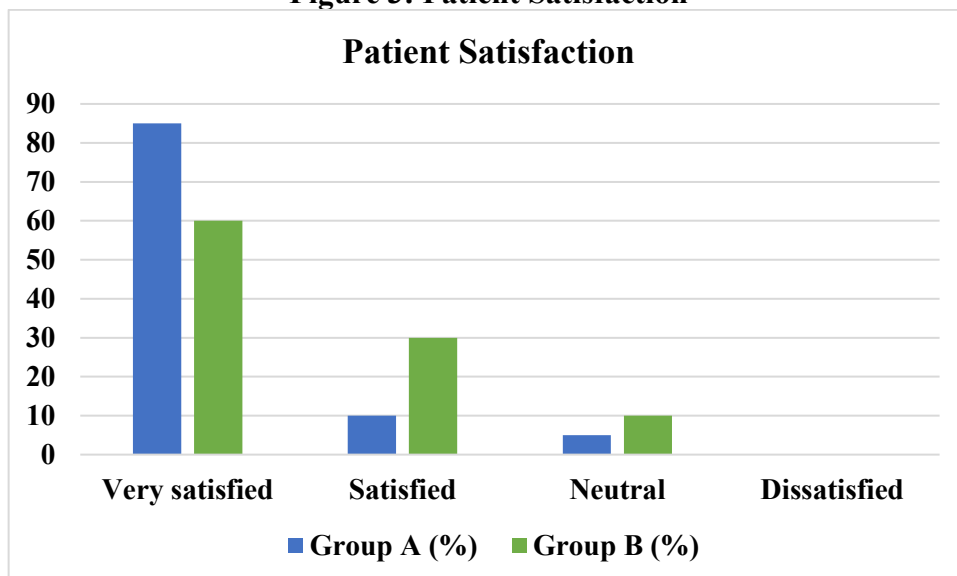
Table 3: Patient Satisfaction

Satisfaction was assessed using a 5-point Likert scale at Month 1.

Rating	Group A (%)	Group B (%)
Very satisfied	85%	60%
Satisfied	10%	30%
Neutral	5%	10%
Dissatisfied	0%	0%

Interpretation: Patients in the early mobilization group reported higher satisfaction, citing reduced anxiety and faster return to daily activities.

Figure 3: Patient Satisfaction



3.2 Complications

No major complications were reported in either group. Minor issues included:

- **Transient leg numbness:** 2 cases in Group B

- **Mild wound discomfort:** 1 case in each group
No cases of infection, dural tear, or neurological deficit were observed.

4. Discussion

This prospective observational study evaluated the impact of early versus standard mobilization following Interlaminar Endoscopic Lumbar Discectomy (IELD) on postoperative pain, functional recovery, patient satisfaction, and complications. The findings indicate that early mobilization (within 6–12 hours postoperatively) is associated with significantly better short-term outcomes without increasing the risk of adverse events [5].

Patients in the early mobilization group demonstrated lower pain scores on Day 1 and Week 1, as measured by the Visual Analog Scale (VAS). This supports the hypothesis that early ambulation may reduce postoperative discomfort by enhancing circulation, minimizing muscle stiffness, and promoting faster resolution of inflammation [12]. Although pain scores equalized by one month, the early advantage likely contributed to improved early mobility and confidence.

Functional recovery, assessed using the Oswestry Disability Index (ODI), was also superior in the early mobilization group at Week 1. This suggests that early movement may accelerate the return to daily activities and reduce the psychological burden of postoperative immobility. By Month 1, both groups showed substantial improvement, but the early mobilization group maintained a slight advantage [19].

Patient satisfaction was notably higher in the early mobilization group, with 85% reporting being “very satisfied” compared to 60% in the standard group. This reflects not only the physical benefits of early ambulation but also the psychological reassurance it provides [14]. Patients often associate early movement with faster recovery and discharge readiness, which may enhance their overall perception of care [15].

Importantly, no major complications were observed in either group. Minor issues such as transient leg numbness and mild wound discomfort were evenly distributed and resolved without intervention. This reinforces the safety of early mobilization in the context of minimally invasive spine surgery, provided that patients are appropriately selected and monitored [10].

These findings align with enhanced recovery after surgery (ERAS) protocols, which advocate for early mobilization to reduce hospital stay, improve outcomes, and lower healthcare costs. While previous studies have explored early ambulation in open or microscopic discectomy, literature specific to IELD remains limited [16]. This study contributes valuable data to that gap [18].

However, the study has limitations. The sample size was modest, and the follow-up period was limited to one month. Long-term outcomes such as recurrence, reoperation rates, and sustained functional improvement were not assessed. Furthermore, the study was only carried out in a single site, which would restrict its generalizability [17].

Despite these limitations, the results support the incorporation of early mobilization protocols into standard postoperative care following IELD. Future multicenter studies with larger cohorts and longer follow-up are warranted to validate these findings and explore their impact on long-term outcomes and healthcare resource utilization [6].

5. Conclusion

This prospective observational study demonstrates that early mobilization following Interlaminar Endoscopic Lumbar Discectomy (IELD) is both safe and beneficial. Patients who ambulated within 6–12 hours postoperatively experienced significantly lower pain scores, faster functional recovery, and higher satisfaction compared to those mobilized after 24 hours. Importantly, early ambulation did not increase the risk of complications. These findings support the integration of early mobilization protocols into standard postoperative care for IELD, aligning with enhanced recovery principles. Further multicenter studies with longer follow-up are recommended to validate these results and assess long-term outcomes.

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