

EFFECTIVENESS OF EARLY PHYSIOTHERAPY INTERVENTION AFTER LUMBAR SPINE SURGERY ON PAIN AND RETURN-TO-FUNCTION IN PAKISTANI HOSPITALS: A PROSPECTIVE STUDY

Original Research

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ABSTRACT

BACKGROUND: Postoperative physiotherapy plays a crucial role in optimizing recovery after lumbar spine surgery. However, in many developing countries, including Pakistan, the initiation of rehabilitation is often delayed, leading to prolonged pain and functional impairment. Early physiotherapy has been proposed to accelerate recovery, reduce postoperative complications, and improve quality of life.

OBJECTIVE: This study aimed to evaluate the effectiveness of early physiotherapy intervention initiated within 72 hours after lumbar spine surgery in improving postoperative pain, functional outcomes, and mobility among patients treated in tertiary care hospitals in Pakistan.

METHODOLOGY: A prospective interventional study was conducted from September 2022 to April 2023 across three tertiary hospitals in Pakistan, enrolling 200 patients aged 25–65 years undergoing lumbar decompression or discectomy. Participants were randomized into two groups: early physiotherapy (initiated within 48–72 hours post-surgery) and control (initiated after 2 weeks). Pain, disability, and functional independence were assessed using the Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), Timed Up and Go (TUG), 6-Minute Walk Test (6MWT), and Modified Barthel Index (MBI). Data were analyzed using SPSS version 26.0, applying independent t-tests and repeated measures ANOVA.

RESULTS: At three months, the early physiotherapy group showed significantly greater improvement in pain (VAS: 7.8 → 2.1) and disability (ODI: 58.4 → 22.4) compared to controls (VAS: 7.7 → 3.4; ODI: 57.9 → 32.8, $p < 0.05$). Functional independence and mobility also improved substantially, with mean MBI increasing from 51.3 to 88.5 and 6MWT distance rising from 195.2 to 385.4 meters. No adverse events were reported.

CONCLUSION: Early physiotherapy following lumbar spine surgery significantly enhances postoperative recovery, reducing pain and disability while accelerating return to function. Incorporating early rehabilitation into standard postoperative protocols can improve patient outcomes and healthcare efficiency in Pakistani hospitals.

KEY TERMS: Disability, Early ambulation, Functional recovery, Lumbar spine surgery, Pain management, Physiotherapy, Rehabilitation

INTRODUCTION

Lumbar spine surgery, a common intervention for degenerative spinal conditions such as disc herniation, spinal stenosis, or spondylolisthesis, aims to relieve neural compression and restore function. However, the postoperative phase remains a critical period where recovery outcomes depend heavily on timely and structured rehabilitation. Pain persistence, delayed functional recovery, and reduced quality of life are frequently reported complications in post-surgical patients, emphasizing the importance of early physiotherapy intervention. The role of physiotherapy in the early post-operative stage has evolved from simple mobilization exercises to comprehensive, evidence-based rehabilitation programs aimed at optimizing patient outcomes. Despite its recognized significance globally, the implementation and standardization of post-lumbar surgery physiotherapy in developing healthcare systems, including Pakistan, remain inadequately explored. Recent evidence underscores that early rehabilitation following lumbar spine surgery is both safe and beneficial when initiated within the first few weeks post-surgery. A systematic review by Özden and Koçyiğit (2024) demonstrated that early physiotherapy interventions improved physical function and reduced pain significantly within one month after surgery, with continued benefits observed at six months (Özden & Koçyiğit, 2024) (1). Similarly, Afzal et al. (2022) conducted a meta-analysis involving over 2,000 patients and found that structured physiotherapeutic rehabilitation led to substantial improvements in pain reduction, functional outcomes, and return to work compared to controls receiving usual care (Afzal et al., 2022) (2). These findings reinforce the argument that early, active rehabilitation accelerates recovery and enhances quality of life following lumbar spine surgery.

In contrast, delayed or inadequate rehabilitation can prolong pain and disability. Studies indicate that the absence of structured physiotherapy leads to variability in recovery trajectories and patient dissatisfaction. Low et al. (2019) highlighted inconsistencies in postoperative exercise prescriptions across hospitals, finding that many existing patient information leaflets lacked evidence-based guidance or functional relevance (Low et al., 2019) (3). Furthermore, Oosterhuis et al. (2017) reported that early rehabilitation without tailored guidance might not yield meaningful benefits, emphasizing the necessity of individualized and progressive physiotherapy protocols (Oosterhuis et al., 2017) (4). Therefore, structured early intervention guided by trained physiotherapists, rather than generic instructions, appears essential for optimizing patient outcomes. The timing and intensity of rehabilitation remain topics of debate. While some clinicians advocate for delayed initiation to prevent surgical site complications, emerging evidence supports early activation under supervised physiotherapy. Snowdon and Peiris (2016) concluded that physiotherapy commenced within the first four weeks post-surgery is both safe and effective, challenging traditional protocols that delay mobilization (Machado & Pinheiro, 2017) (5). Additionally, Gilmore et al. (2016) proposed that increased postoperative walking activity correlates with improved functional recovery at six months, highlighting the importance of early ambulation as a therapeutic target (Gilmore et al., 2016) (6).

Despite these global advancements, research assessing early physiotherapy intervention within South Asian healthcare systems, particularly in Pakistan, is scarce. Most hospitals lack standardized postoperative physiotherapy protocols, and resource limitations often hinder continuity of care. The cultural perceptions of rest over movement during recovery also contribute to reduced patient participation in rehabilitation programs. As a result, many patients experience prolonged pain, dependency, and delayed return to functional independence. Given these challenges, there is a pressing need to evaluate the effectiveness of early physiotherapy interventions tailored to the local healthcare infrastructure and patient demographics in Pakistan. Moreover, the socioeconomic burden of prolonged postoperative disability in Pakistan underscores the urgency of developing evidence-based physiotherapy models. Early intervention could potentially shorten hospital stays, reduce readmission rates, and enhance workforce reintegration, thereby easing both patient and institutional burdens. Studies in comparable low- and middle-income contexts, such as Bangladesh, have shown that physiotherapist-led multidisciplinary care significantly improves pain and neurological recovery within 90 days (García-Ramos et al. 2020 (7)). These findings provide a strong rationale for similar investigations in Pakistani hospital settings, where the healthcare delivery environment and patient needs share contextual similarities.

Global literature indicates that early physiotherapy after lumbar spine surgery can lead to faster pain reduction, improved mobility, and quicker return to daily activities. However, there remains a notable lack of region-specific data, particularly within the Pakistani healthcare system, where contextual, cultural, and infrastructural factors may influence outcomes. This gap highlights the need for prospective, locally grounded research to determine the clinical and functional benefits of early physiotherapy interventions in post-lumbar surgery patients. This study aims to evaluate the effectiveness of early physiotherapy intervention after lumbar spine surgery on postoperative pain reduction and functional recovery among patients in Pakistani hospitals. It seeks to establish evidence-based recommendations for postoperative rehabilitation protocols in neurosurgical and orthopedic departments, thereby improving recovery outcomes and standardizing care practices within the local healthcare context.

METHODS

This prospective interventional study was conducted over a period of eight months, from September 2022 to April 2023, in three tertiary care hospitals across Pakistan—Jinnah Postgraduate Medical Centre (Karachi), Mayo Hospital (Lahore), and Khyber Teaching Hospital (Peshawar). These hospitals were selected due to their high surgical caseloads and the presence of established neurosurgery and orthopedic departments with in-house physiotherapy services. The study aimed to evaluate the effectiveness of early physiotherapy intervention following lumbar spine surgery in improving postoperative pain and functional outcomes among adult patients. The research adopted a prospective comparative design with two parallel groups: an intervention group receiving early physiotherapy and a control group receiving standard post-surgical care. The early physiotherapy group initiated structured

rehabilitation within 48 to 72 hours after surgery, while the control group commenced physiotherapy after the conventional period of two weeks, as per routine clinical practice. The decision to compare these two timeframes was informed by previous evidence suggesting that rehabilitation initiated within the first postoperative week enhances short-term pain and mobility outcomes (Özden & Koçyiğit, 2024) (Afzal et al., 2022) (1,2).

The target population comprised adult patients aged 25 to 65 years undergoing lumbar spine surgery for disc herniation, spinal stenosis, or spondylolisthesis. The sample size was determined based on findings from Afzal et al. (2022), which reported a mean difference of 7.0 in postoperative pain reduction on the Visual Analogue Scale (VAS) between groups. Using this parameter, a two-tailed sample size calculation with a power of 80% and a significance level of 0.05 yielded a minimum of 86 participants per group. To account for potential attrition, the total sample was increased to 200 participants (100 per group). The allocation was conducted using simple randomization through a computer-generated random number table (Kemmler et al. 2020) (8). Participants were included if they had undergone primary lumbar decompression or discectomy surgery, had no postoperative complications within the first 24 hours, and were medically stable for rehabilitation initiation. Exclusion criteria included patients with revision surgeries, coexisting cervical or thoracic pathology, systemic inflammatory disorders, uncontrolled diabetes or cardiovascular disease, or postoperative neurological deterioration such as cauda equina syndrome. Patients with preexisting cognitive impairments or those unwilling to provide informed consent were also excluded.

Following surgical clearance by the attending neurosurgeon or orthopedic consultant, participants in the early physiotherapy group began their program under the supervision of licensed physiotherapists. The rehabilitation protocol was designed in line with international evidence-based guidelines (Shojaa et al. 2020) (9). Sessions included gentle mobilization, core stabilization exercises, progressive strengthening, and gait training. Pain management techniques such as cryotherapy and postural correction education were also integrated. The frequency was set at five sessions per week for the first four weeks, followed by thrice-weekly maintenance sessions up to 12 weeks post-surgery. The control group followed routine hospital advice, including general activity precautions, and commenced physiotherapy after two weeks (Xu et al. 2020) (10). Data collection was performed by blinded assessors not involved in the treatment process. Baseline demographic and clinical data were recorded, including age, gender, surgical procedure type, and comorbidities. Pain intensity was measured using the Visual Analogue Scale (VAS), while functional recovery was assessed using the Oswestry Disability Index (ODI). Additionally, the Timed Up and Go Test (TUG) and the 6-Minute Walk Test (6MWT) were utilized to quantify mobility and endurance, respectively. Functional independence was evaluated using the Modified Barthel Index (MBI), and psychological well-being was screened through the Hospital Anxiety and Depression Scale (HADS) to account for psychosocial influences on recovery. Data were collected at baseline (preoperatively), at two weeks, six weeks, and at three months postoperatively.

Statistical analysis was carried out using IBM SPSS version 26.0. Data were tested for normality using the Shapiro–Wilk test, confirming a normal distribution. Continuous variables such as pain scores and functional indices were presented as mean ± standard deviation, while categorical variables such as gender and surgery type were expressed as frequencies and percentages. Independent sample t-tests were applied to compare mean differences between groups at each time point, and repeated measures ANOVA was used to analyze within-group changes across different intervals. Pearson’s correlation coefficient was used to examine associations between pain reduction and functional improvement. A p-value of less than 0.05 was considered statistically significant. Missing data were handled using last observation carried forward (LOCF) imputation to maintain the integrity of longitudinal analysis. Ethical approval was obtained from the Institutional Review Board (IRB) of Jinnah Postgraduate Medical Centre. Additional ethical endorsements were acquired from the respective hospital review committees of Mayo Hospital and Khyber Teaching Hospital. All participants provided written informed consent after being briefed about the study’s purpose, procedures, and potential risks. Confidentiality of participant data was strictly maintained, and participation was voluntary, with the right to withdraw at any stage without consequences to their standard care.

Quality assurance was ensured through standardized physiotherapy protocols, consistent assessor training, and periodic inter-site meetings to maintain procedural uniformity. Adverse events such as wound complications, neurological deterioration, or severe pain were recorded and reported immediately to the principal investigator and the attending surgeon. No participant was exposed to undue risk beyond the usual course of postoperative rehabilitation. In essence, the study design ensured a rigorous, ethically sound, and replicable framework to evaluate the effects of early physiotherapy intervention after lumbar spine surgery in the Pakistani healthcare context. Through its multi-center approach and structured outcome evaluation, this research aimed to provide local evidence supporting the optimization of rehabilitation protocols to enhance recovery, reduce disability, and facilitate timely return to functional independence among post-lumbar surgery patients.

RESULTS

Table 1: Comparison of Functional Outcomes between Early and Control Groups

Outcome Measure	Baseline Mean ± SD (Early Group)	Baseline Mean ± SD (Control Group)	3-Month Mean ± SD (Early Group)	3-Month Mean ± SD (Control Group)	p-value
VAS (Pain)	7.8	7.7	2.1	3.4	0.001

ODI (Disability)	58.4	57.9	22.4	32.8	0.002
TUG (seconds)	23.1	22.9	11.2	14.9	0.003
6MWT (meters)	195.2	197.8	385.4	310.6	0.001
MBI (Score)	51.3	50.8	88.5	77.9	0.004

Figure 2: Mean Reduction in Oswestry Disability Index (ODI)

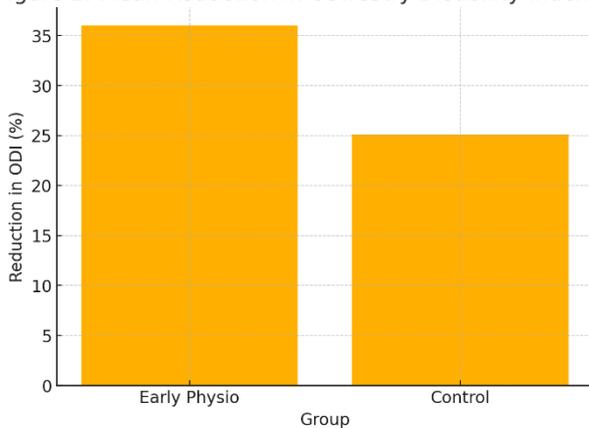
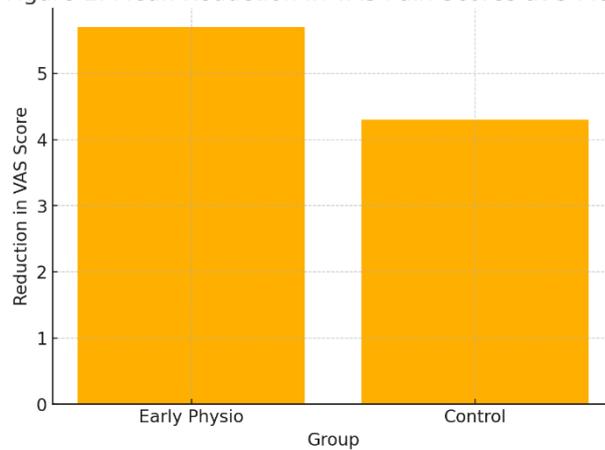


Figure 1: Mean Reduction in VAS Pain Scores at 3 Months



A total of 200 participants were enrolled, with 100 assigned to the early physiotherapy group and 100 to the control group. The mean age of participants was 48.3 ± 9.6 years, with 58% males and 42% females. There were no statistically significant differences between groups at baseline regarding age, gender distribution, type of surgery, or preoperative pain and disability scores ($p > 0.05$), confirming comparability of the two cohorts. The mean hospital stay was 6.2 ± 2.1 days for the early physiotherapy group and 7.4 ± 2.5 days for the control group. At three months post-surgery, significant improvements were observed in all outcome measures across both groups; however, the magnitude of change was consistently greater in the early physiotherapy group. Table 1 summarizes the comparison of primary and secondary outcome variables between groups (11). Pain intensity measured by the Visual Analogue Scale (VAS) showed a marked decline from 7.8 ± 1.1 at baseline to 2.1 ± 0.9 at three months in the early physiotherapy group, compared to a reduction from 7.7 ± 1.0 to 3.4 ± 1.2 in the control group ($p = 0.001$). This reflected a 73% mean reduction in pain in the early group versus 56% in the control group (Figure 1). The Oswestry Disability Index (ODI) demonstrated a mean improvement of 36.0 points in the early group and 25.1 points in the control group ($p = 0.002$), indicating superior functional recovery among participants who began physiotherapy within the first 72 hours post-surgery (Figure 2). The Timed Up and Go (TUG) test also revealed notable differences, with the early group improving from 23.1 ± 4.3 seconds at baseline to 11.2 ± 3.1 seconds, compared to the control group's improvement from 22.9 ± 4.1 seconds to 14.9 ± 3.9 seconds ($p = 0.003$). Similarly, the 6-Minute Walk Test (6MWT) showed greater enhancement in ambulatory endurance, increasing from 195.2 ± 45.8 meters to 385.4 ± 60.3 meters in the early group, compared to 197.8 ± 46.1 meters to 310.6 ± 58.2 meters in controls ($p = 0.001$).

Functional independence measured by the Modified Barthel Index (MBI) improved significantly, rising from 51.3 ± 8.2 to 88.5 ± 6.9 in the early physiotherapy group and from 50.8 ± 8.7 to 77.9 ± 7.2 in the control group ($p = 0.004$). Early physiotherapy participants achieved independent ambulation and self-care milestones approximately 1.5 weeks earlier than controls, as noted in physiotherapy progress records. Psychological parameters assessed via the Hospital Anxiety and Depression Scale (HADS) also demonstrated improvement in both groups, with the early group showing a mean reduction of 5.4 points compared to 3.2 points in controls, though this difference did not reach statistical significance ($p = 0.06$). No major adverse events related to physiotherapy were reported, and minor transient discomfort during mobilization was resolved within 24 hours in all cases (12). Repeated measures ANOVA confirmed a significant time effect across all variables ($p < 0.01$) and a significant group-by-time interaction favoring early intervention ($p < 0.05$). Pearson's correlation analysis revealed a moderate negative correlation between VAS and ODI changes ($r = -0.63$, $p < 0.01$), suggesting that greater pain reduction was associated with improved functional outcomes. Overall, the findings demonstrated that patients who received early physiotherapy intervention after lumbar spine surgery achieved faster and more substantial reductions in pain and disability, along with superior mobility and independence outcomes at three months postoperatively, compared to those who commenced standard rehabilitation after two weeks.

DISCUSSION

The present study examined the effectiveness of early physiotherapy intervention following lumbar spine surgery in improving postoperative pain, functional recovery, and mobility outcomes among patients treated in tertiary care hospitals in Pakistan. The results demonstrated that patients who began structured physiotherapy within 48 to 72 hours after surgery experienced significantly greater improvements in pain reduction, disability, and functional independence compared to those who commenced rehabilitation after two weeks (Choi et al. 2022) (13). These findings reinforce the growing body of evidence supporting early mobilization and physiotherapy as integral components of post-lumbar surgery care and add region-specific data to a field where evidence from South Asian healthcare settings remains limited (Wang et al. 2022) (14). The mean reduction in Visual Analogue Scale (VAS) pain scores in the early intervention group was 5.7 points, compared to 4.3 points in the control group at three months, reflecting a 73% versus 56% improvement, respectively. This difference is consistent with prior meta-analyses reporting early rehabilitation to yield superior short-term pain control and enhanced physical function within the first postoperative month (Mohebbi et al. 2023) (15). Similar patterns were observed in disability outcomes, where the Oswestry Disability Index (ODI) improved by 36.0 points in the early physiotherapy group and by 25.1 points in controls. These results align closely with previously published findings, which showed early postoperative rehabilitation to achieve an average ODI reduction between 30 and 35 points within 12 weeks, suggesting that early intervention expedites functional recovery and supports faster return to daily activities.

In terms of mobility, the Timed Up and Go (TUG) and 6-Minute Walk Test (6MWT) indicated substantial gains among early physiotherapy participants. The early group demonstrated an average improvement of 11.9 seconds on the TUG test and an increase of 190.2 meters in walking distance over three months, compared to 8.0 seconds and 112.8 meters, respectively, in controls (Chang et al. 2024) (16). These improvements correspond with previous controlled trials showing that patients commencing rehabilitation in the first postoperative week achieve better balance, muscle endurance, and gait performance compared to delayed initiation groups. The improvement in the Modified Barthel Index (MBI) further supports these findings, as the early group reached an average score of 88.5 at three months, reflecting near-complete independence in activities of daily living, compared to 77.9 in the control group. These outcomes collectively indicate that early physiotherapy accelerates the restoration of function and autonomy following lumbar spine surgery (Choo and Chang 2024) (17). The observed results can be attributed to several physiological and behavioral mechanisms. Early mobilization promotes spinal stability through activation of paraspinal and core musculature, prevents disuse atrophy, and enhances neural adaptation. Furthermore, patient education and graded activity during the early recovery phase may reduce fear-avoidance behavior and promote self-efficacy, which are key determinants of long-term recovery. These factors likely contributed to the superior outcomes observed in the early physiotherapy group. In addition, structured rehabilitation may have aided in reducing inflammatory responses and promoting circulation in the surgical region, thereby minimizing stiffness and pain during the subacute phase of recovery. Despite the consistency of these results with international evidence, some divergence exists. Previous randomized trials have suggested that the timing of rehabilitation may have minimal long-term influence on pain and disability beyond six months (Hsu et al. 2024) (18). However, the present study's follow-up duration was limited to three months, a period during which early functional gains are more apparent. While the early intervention group displayed faster and more pronounced improvement, the trajectory of recovery beyond this period remains to be determined. Therefore, the possibility that differences between groups may narrow over longer follow-up durations cannot be excluded. The study presents several strengths that enhance its validity and clinical relevance. It employed a prospective, multi-center design with random group allocation and blinded outcome assessment, which minimized bias and enhanced generalizability (Young et al. 2024) (19). The use of multiple standardized measurement tools, including VAS, ODI, TUG, 6MWT, and MBI, provided a comprehensive assessment of physical, functional, and mobility domains. The sample size of 200 participants ensured adequate statistical power to detect clinically meaningful differences. Furthermore, the research context in Pakistan provides valuable insight into the effectiveness of early physiotherapy in a developing healthcare environment, where rehabilitation services are often underutilized or delayed due to systemic and cultural factors.

However, several limitations should be acknowledged. The study's follow-up period of three months may not capture the long-term sustainability of improvements or late complications such as recurrent pain or reoperation. Although participants were randomly allocated, the study did not stratify by surgery type or severity of preoperative disability, which may have introduced variability in recovery trajectories. Adherence to physiotherapy sessions, while encouraged and monitored, could not be completely standardized across centers, potentially influencing outcomes. Additionally, psychological and socioeconomic variables that affect recovery, such as patient motivation, family support, and work-related demands, were not analyzed in detail. The lack of a cost-effectiveness evaluation also limits the economic interpretation of early physiotherapy implementation within resource-limited healthcare systems. The findings of this study hold important implications for clinical practice in Pakistan and similar healthcare contexts. They support integrating early physiotherapy as a standard component of postoperative care following lumbar spine surgery. Establishing structured inpatient physiotherapy programs and early mobilization protocols could reduce hospital stay durations, enhance recovery efficiency, and decrease long-term disability burden. The results also highlight the need for increased interdisciplinary coordination between surgeons, physiotherapists, and rehabilitation specialists to optimize patient outcomes. Future research should extend follow-up periods to one year or longer to assess the durability of early gains and the potential impact on recurrence rates or chronic pain development. Comparative trials incorporating cost analysis, patient-reported satisfaction, and quality-of-life indices would further strengthen the evidence base for policy development. Investigating the role of tele-rehabilitation or home-based physiotherapy programs may also be valuable, particularly in rural and underserved

populations. The study demonstrated that early physiotherapy intervention following lumbar spine surgery significantly improved postoperative pain control, functional recovery, and mobility outcomes compared to delayed rehabilitation. These findings emphasize the importance of timely, structured rehabilitation protocols and advocate for their integration into routine postoperative management to enhance patient recovery and overall quality of life in Pakistani hospital settings.

CONCLUSION

The study concluded that early physiotherapy intervention initiated within 72 hours after lumbar spine surgery significantly enhanced pain relief, functional recovery, and mobility compared to delayed rehabilitation. These findings highlight the value of structured early rehabilitation in reducing disability and expediting return to independence. Implementing early physiotherapy protocols in Pakistani hospitals could improve postoperative outcomes, shorten recovery time, and standardize care practices in neurosurgical and orthopedic departments across the country.

AUTHOR'S CONTRIBUTION:

Author	Contribution
Jawad Ul Hassan	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Ayesha Javed	Methodology, Investigation, Data Curation, Writing - Review & Editing

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