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Article

Effects of Empowerment-Based Rehabilitation on Patients Following Lumbar Disc Herniation Surgery: A Retrospective Cohort Study

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Abstract

Aims/Background: Lumbar disc herniation is a common chronic musculoskeletal condition requiring long-term postoperative rehabilitation. However, implementation of existing nursing models is often discontinuous and they are generally not patient-centered. This study aimed to explore the effects of a continuous rehabilitation intervention program based on empowerment theory on pain severity, lumbar function, self-efficacy and quality of life in postoperative patients with lumbar disc herniation from the perspective of internal medicine and chronic disease management. **Methods**: A retrospective cohort study was conducted at Cangnan County Hospital of Traditional Chinese Medicine, including 147 patients who underwent single-level lumbar discectomy between January 2023 and June 2025. The patients underwent single-level lumbar discectomy of lumbar disc prolapse and were divided into a control group (n = 75) and an intervention group (n = 72). The control group received routine nursing and health education postoperatively. On the basis of routine nursing, the intervention group received continuous rehabilitation intervention based on empowerment theory for 3 months. The intervention program consisted of three core components: (1) in-hospital empowerment; (2) post-discharge empowerment support (1–12 weeks after surgery); (3) digital empowerment support via the WeChat platform. The effects of the intervention were evaluated before and 3 months after the intervention using the Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), General Self-Efficacy Scale (GSES), and 36-Item Short Form Health Survey (SF-36). **Results**: Baseline characteristics were comparable between the two groups (all $p > 0.05$). After the intervention, the intervention group showed significantly greater improvements than the control group, with significantly lower median VAS score (3.00 vs. 4.00, $p < 0.001$) and median ODI score (28.00 vs. 32.00, $p = 0.005$), as well as significantly higher median GSES score, SF-36 Bodily Pain (BP) score, and Role-Physical (RP) score (all $p < 0.001$). The overall nursing satisfaction rate was also significantly higher in the intervention group (93.06% vs. 78.67%, $p = 0.013$). **Conclusion**: The empowerment-based continuous rehabilitation intervention was associated with lower pain, better lumbar function, enhanced self-efficacy, and improved quality of life in postoperative patients with lumbar disc herniation, offering a patient-centered strategy for long-term rehabilitation management from the perspective of internal medicine and chronic disease care.

Keywords: empowerment; rehabilitation nursing; lumbar disc herniation; chronic disease management

1. Introduction

Lumbar disc herniation (LDH) is a leading cause of chronic low back and radicular pain, putting substantial strains on global health systems and adversely affecting the quality of life among affected patients [1]. While surgical intervention, such as discectomy, is considered for selected patients not responding to conservative treatment [2], the postoperative period is critical for functional recovery and prevention of recurrence. Importantly, LDH is increasingly viewed not merely as a clinical issue amenable to surgical intervention but also as a chronic musculoskeletal condition requiring long-term management, akin to other chronic diseases managed within the internal medicine and rehabilitation frameworks [3,4,5].

At present, the implementation of rehabilitation management in patients following lumbar surgery in China is faced with a range of challenges. The existing model is predominantly hospital-centered, characterized by short-term guidance and one-time discharge instructions, and lacks systematic, personalized, and continuous post-discharge support [6]. This fragmented approach overlooks the chronic nature of LDH and fails to equip patients with the skills and confidence to manage the condition at home during the recovery process. Empowerment theory provides a powerful theoretical framework for solving the above dilemmas. This theory emphasizes helping individuals gain a sense of control, competence and confidence in their own health decisions and behaviors through a series of strategies, and encourages them to take a proactive approach to managing their health, rather than passively receiving interventional care [7]. A recent critical evaluation of patient empowerment proposes a foundational definition emphasizing autonomy, competence, and self-efficacy as the key mechanisms of empowerment [8]. An integrative review of nurse-led empowering educational actions identified three core components: supporting patients'

knowledge and skills, fostering well-being, and building trust-based collaborative relationships [9]. In the field of chronic disease management, empowerment-based interventions have been shown to be effective in improving health outcomes, treatment adherence and quality of life [10]. When applied to postoperative rehabilitation, it shifts the focus from simply "educating" and "guiding" patients to "collaborating" and "empowering" them to build self-efficacy [11]. The novelty of our study lies in integrating this theory with a digital platform (WeChat) to provide a structured, continuous, and patient-centered rehabilitation model that spans from hospital to home, addressing the critical gap in transitional care for this chronic condition. With the popularization of mobile health technology, digital platforms, such as WeChat, enable the provision of continuous empowerment support outside the hospital with low cost, high efficiency and wide coverage [12].

This study aimed to develop and evaluate a structured empowerment-based rehabilitation intervention spanning in-hospital initiation and post-discharge digital support. Through a retrospective cohort design, we systematically assessed its effects on pain, lumbar function, self-efficacy, and quality of life in postoperative patients with lumbar disc herniation, providing evidence for optimizing chronic disease-oriented rehabilitation practices.

2. Methods

2.1 Participants

A retrospective cohort study was conducted involving patients who underwent single-level lumbar discectomy at Cangnan County Hospital of Traditional Chinese Medicine between January 2023 and June 2025. Inclusion criteria were as follows: (1) First-time single-level surgery for LDH; (2) Age $\geq$18 years; (3) Clear consciousness with adequate communication ability; and (4) Regular smartphone use. Exclusion criteria were as follows: (1) Significant comorbidities (e.g., severe cardiac, pulmonary, or renal disease), psychiatric disorders, or cognitive impairment; (2) Prior history of lumbar surgery; (3) Major postoperative complications (e.g., infection, neurologic deficit); (4) Incomplete follow-up data.

In this retrospective cohort study, patients were divided into two groups based on the type of postoperative care received. The control group (n = 75) consisted of patients admitted between January 2023 and December 2024, who received routine postoperative care. The intervention group (n = 72) consisted of patients admitted between January 2025 and June 2025, who received the empowerment-based rehabilitation program in addition to routine care.

The patient selection process is illustrated in Fig. 1.

2.2 Intervention Methods

The control group received standard post-discharge care, which consisted of routine advice on activity modification, pain medication guidance, wound care instructions, and scheduling of follow-up visits. This protocol included the following components:

(1) In-hospital care: During hospitalization, patients received routine postoperative nursing care, including wound care, pain management as prescribed, and basic guidance on early mobilization (e.g., log-rolling technique, ankle pump exercises).

(2) Discharge education: Before discharge, a ward nurse delivered a standardized 20–30 minute discharge education session covering activity restrictions (e.g., avoiding bending, lifting, or twisting for 4 weeks), wound care instructions (e.g., keeping the dressing dry, reporting signs of infection), pain medication guidance (e.g., taking analgesics as needed, potential side effects), and a brief demonstration of home exercises (e.g., straight-leg raises, ankle pumps). Patients were provided with a standard printed discharge summary outlining key information; however, no personalized rehabilitation handbook was given.

(3) Follow-up: Patients were scheduled for routine outpatient follow-up visits at 1 month and 3 months after surgery. These visits were conducted by the attending orthopedic surgeon and included clinical examination, assessment of surgical wound healing, review of any complications, and a brief assessment of functional status. No additional structured rehabilitation counseling, proactive telephone follow-up, or digital support (e.g., WeChat groups) was provided beyond these scheduled visits.

The control group received only the routine care described above, with no additional structured intervention. The control group received routine care from ward nurses, but the nurses had not received specialized training in empowerment theory.

The intervention group received a 12-week empowerment-based rehabilitation program led by a trained nurse-led team, structured as follows:

(1) Phase 1: In-hospital empowerment initiation (during postoperative hospital stay)

Participatory assessment and relationship building (postoperative days 1–2): Rehabilitation nurses used motivational interviewing techniques to engage patients in exploring their understanding of the recovery process, pain experience, rehabilitation expectations, personal concerns, and available family support, thereby establishing a collaborative nurse-patient relationship.

Collaborative development of rehabilitation goals (postoperative days 2–3): Nurses guided patients to jointly set one or two clear short-term discharge goals (e.g., "able to walk independently to the ward door with a walking aid before discharge") and outline a framework for medium- to long-term goals, based on their individual condition and utilizing the SMART (Specific, Measurable, Achievable, Relevant, Time-bound) principle.

Collaborative development of rehabilitation plan (the day before discharge): A personalized lumbar surgery rehabilitation Action Plan Handbook that incorporates input

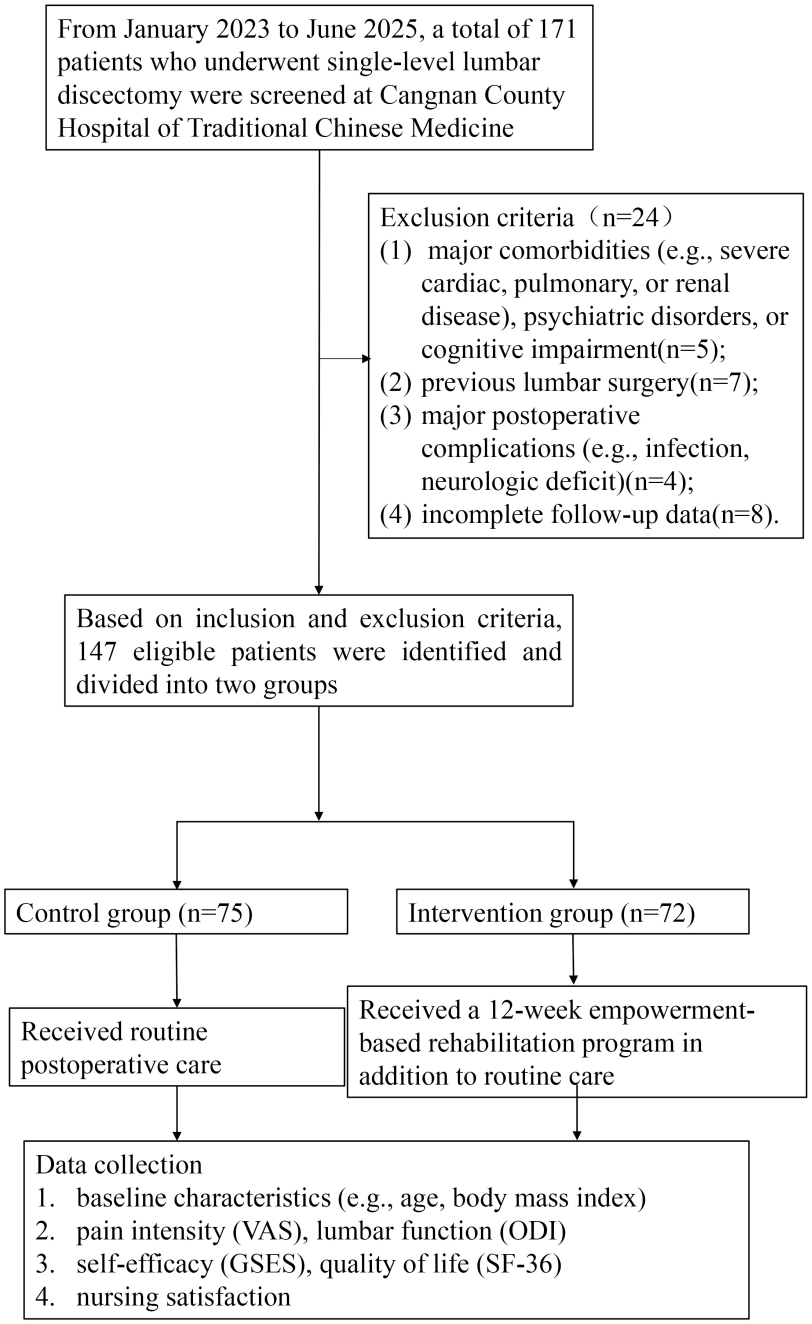

Fig. 1. Flowchart depicting patient selection in this study. Abbreviations: GSES, General Self-Efficacy Scale; ODI, Oswestry Disability Index; SF-36, 36-Item Short Form Health Survey; VAS, Visual Analogue Scale.

from rehabilitation physicians was developed in collaboration with the patient and family. This handbook included a phased activity progression table (e.g., ankle pumps, straight leg raises, with recommended frequency and duration for ambulation), a Visual Analogue Scale (VAS)-based diary instrument for self-recording extent of pain, standard answers to frequently asked questions, and guidelines for managing commonly seen situations or emergencies.

(2) Phase 2: Post-discharge empowerment support (1–12 weeks after surgery)

Self-monitoring and diary recording: Patients used the Action Plan Handbook to document daily pain intensity using the VAS (e.g., morning and post-activity scores), rehabilitation activities performed, any discomfort, and personal reflections. They were also encouraged to self-adjust activities according to pre-established pain–activity adjustment principles.

(3) Phase 3: Digital empowerment support via the WeChat platform

Structured follow-up: Rehabilitation nurses conducted structured follow-up via a dedicated WeChat group

Table 1. Comparison of baseline data between control and intervention groups.

Variables	Total (n = 147)	Control group (n = 75)	Intervention group (n = 72)	Statistic	*p*
Age (years), M (Q_1, Q_3)	47.00 (42.00, 52.00)	47.00 (42.00, 51.50)	47.00 (42.00, 52.00)	Z = 0.38	0.705
BMI (kg/m^2), M (Q_1, Q_3)	24.70 (22.90, 26.40)	24.90 (22.75, 26.35)	24.65 (23.08, 26.40)	Z = 0.41	0.681
Gender, n (%)				χ^2 = 0.00	0.962
Male	63 (42.86)	32 (42.67)	31 (43.06)		
Female	84 (57.14)	43 (57.33)	41 (56.94)		
Diseased segment, n (%)				χ^2 = 0.00	0.994
L4/5	100 (68.03)	51 (68.00)	49 (68.06)		
L5/S1	47 (31.97)	24 (32.00)	23 (31.94)		
Smoking history, n (%)				χ^2 = 0.50	0.480
No	106 (72.11)	56 (74.67)	50 (69.44)		
Yes	41 (27.89)	19 (25.33)	22 (30.56)		
Surgical method, n (%)				χ^2 = 0.07	0.798
Transforaminal endoscopy	113 (76.87)	57 (76.00)	56 (77.78)		
Microscope	34 (23.13)	18 (24.00)	16 (22.22)		
Disease duration (months), M (Q_1, Q_3)	16.00 (10.50, 20.00)	16.00 (10.00, 20.00)	16.00 (11.00, 20.00)	Z = –0.81	0.418
Motor deficit grade, n (%)				χ^2 = 0.18	0.914
No motor deficit	98 (66.67)	51 (68.00)	47 (65.28)		
Mild motor deficit	36 (24.49)	18 (24.00)	18 (25.00)		
Moderate motor deficit	13 (8.84)	6 (8.00)	7 (9.72)		

Abbreviations: BMI, body mass index; M, median.

at predefined time points (1, 2, 4, 8, and 12 weeks after discharge). Patient progress was assessed by reviewing diary summaries or activity-related photos shared by patients. Based on these materials, nurses provided individualized feedback, guidance, and positive reinforcement to support adherence and recovery. To ensure privacy protection, separate WeChat groups were created for each patient cohort admitted during the study period. Each group was accessible only to the enrolled patients, their designated family caregivers, and the rehabilitation nursing team. Patients were assigned aliases (e.g., participant numbers) to minimize exposure of personal information, and all health-related communications were conducted in accordance with hospital data protection policies.

Thematic health education and peer support: Weekly, topic-specific educational content relevant to the recovery process was delivered to the WeChat group in the form of short videos or infographics (e.g., "Week 2: Safe Techniques for Getting Out of Bed?"; "Week 6: Core Muscle Activation Exercises"). Patients were encouraged to ask questions and share their experiences within the group, thereby fostering a supportive peer community.

Immediate counseling and emotional support: The nursing team provided timely responses (during work hours) to patients' private messages or group questions, offering professional advice, psychological support, and troubleshooting immediate rehabilitation difficulties.

2.3 Data Collection

The primary outcomes of the study were pain intensity and lumbar function. Secondary outcomes included self-efficacy and quality of life. Satisfaction with nursing care was assessed as a process outcome. Data were collected before intervention (1 day after operation) and 3 months after the intervention. Baseline characteristics included age, body mass index (BMI), gender, diseased segment, smoking history, surgical method, disease duration and motor deficit grade. Disease duration was defined as the time from the onset of LDH-related symptoms (e.g., low back pain, radiating leg pain) to the date of surgery, recorded in months based on outpatient medical records and patient self-report. Motor deficit grade was assessed according to preoperative physical examination using manual muscle testing (MMT), and classified as either 'no motor deficit' (MMT grade 5), 'mild motor deficit' (MMT grade 4), or 'moderate motor deficit' (MMT grade 3). These data were extracted from medical records documented by the attending orthopedic surgeon. Pain intensity was measured using the Visual Analogue Scale (VAS, 0–10 points), with higher scores indicating greater pain intensity [13]. Lumbar function was evaluated using the Oswestry Disability Index (ODI, 0–100%), with higher scores indicating deterioration in lumbar function [14]. Self-efficacy was assessed using the General Self-efficacy Scale (GSES, 10–40 points), with higher scores indicating more enhanced self-efficacy [15]. Patients' quality of life was evaluated using the 36-Item Short Form Health Survey (SF-36), with a focus on body pain and physical role [16]. The SF-36 Bodily Pain (BP) dimension ranges from 0 to 100, with higher scores indicating less pain; the SF-36 Role-Physical (RP) dimension also ranges from 0 to 100, with higher scores representing better physical functioning. After 3 months of intervention, New-

Table 2. Comparison of VAS scores between control and intervention groups before and after nursing.

Variables	Total (n = 147)	Control group (n = 75)	Intervention group (n = 72)	Statistic	*p*
Before nursing, M (Q_1, Q_3)	5.00 (4.00, 6.00)	5.00 (4.00, 6.00)	5.00 (4.00, 6.00)	Z = 1.13	0.258
After nursing, M (Q_1, Q_3)	3.00 (3.00, 4.00)	4.00 (3.00, 5.00)	3.00 (2.00, 4.00)	Z = 6.50	<0.001
Median change (Q_1, Q_3)		–1.00 (–2.00, 0.00)	–2.00 (–3.00, –1.00)		
Between-group median difference (95% CI)		–1.00 (–2.00, –1.00)			
Effect size (r)		0.536			
Statistic		Z = 5.49	Z = 9.75		
p		<0.001	<0.001		

Abbreviation: CI, confidence interval.

Table 3. Comparison of ODI scores between control and intervention groups before and after nursing.

Variables	Total (n = 147)	Control group (n = 75)	Intervention group (n = 72)	Statistic	*p*
Before nursing, M (Q_1, Q_3)	55.00 (47.00, 60.00)	52.00 (48.00, 57.00)	58.00 (45.75, 64.00)	Z = 1.67	0.096
After nursing, M (Q_1, Q_3)	30.00 (24.00, 36.00)	32.00 (24.00, 41.50)	28.00 (24.75, 33.00)	Z = 2.83	0.005
Median change (Q_1, Q_3)		–20.00 (–30.00, –10.00)	–26.00 (–35.00, –18.75)		
Between-group median difference (95% CI)		–4.00 (–10.00, 0.00)			
Effect size (r)		0.234			
Statistic		Z = 9.89	Z = 10.35		
p		<0.001	<0.001		

castle Satisfaction with Nursing Scale was used to evaluate patients' satisfaction, which covered 19 items [17]. The scale uses a Likert 1–5 scoring method, with a full score range of 19 to 95. Degree of satisfaction was stratified into multiple categories according to the total score: very satisfied (scores: $\geq$77), satisfied (scores: 58–76), generally satisfied (scores: 39–57), and dissatisfied (scores: $\leq$38). Overall satisfaction was defined as the proportion of patients reporting either 'very satisfied' or 'satisfied'.

2.4 Statistical Methods

Statistical analyses were performed using IBM SPSS Statistics software (version 26.0; IBM Corp., Armonk, NY, USA). Normality of continuous data was assessed using the Shapiro–Wilk test. Since all continuous variables were found to be non-normally distributed ($p < 0.05$), they were presented as median with interquartile range (Q_1, Q_3). Between-group comparisons of continuous variables were performed using the Mann–Whitney *U* test, and within-group comparisons were performed using the Wilcoxon signed-rank test. Categorical data were expressed as frequency (percentage) and analyzed using the chi-square test. Report the effect size (r), median difference, and its 95% confidence interval where applicable. And the median change refers to the median of individual pre-post differences, not the difference of group medians. $p < 0.05$ was considered statistically significant.

3. Results

3.1 Comparison of Baseline Data

Before intervention, there were no significant differences in age, gender, BMI, diseased segment, smoking history, surgical method, disease duration, and motor deficit grade between control and intervention groups ($p > 0.05$) (Table 1).

3.2 Comparison of Pain Severity

Before intervention, there was no statistically significant difference in VAS scores between the two groups ($p > 0.05$). At 3 months after the intervention, the scores of the two groups became significantly lower than those before the intervention ($p < 0.001$) (Table 2). The comparison between groups showed that the VAS scores of the intervention group were significantly lower than those of the control group after nursing ($p < 0.001$).

3.3 Comparison of Lumbar Function

Before intervention, there was no statistically significant difference in ODI scores between the control and intervention groups ($p > 0.05$). At 3 months after the intervention, the scores of both groups decreased significantly compared with those before the intervention ($p < 0.001$) (Table 3). The between-group comparison showed that the ODI scores of the intervention group were significantly lower than those of the control group after nursing ($p = 0.005$).

3.4 Comparison of Post-Nursing Self-Efficacy and Quality of Life

Before intervention, there were no significant differences in GSES, SF-36 BP, and SF-36 RP scores between the control and intervention groups (all $p > 0.05$). After 3 months of intervention, both groups showed significant improvements from baseline (all $p < 0.001$). The intervention group demonstrated significantly greater improve-

Table 4. Comparison of self-efficacy (GSES) scores between control and intervention groups before and after nursing.

Variables	Total (n = 147)	Control group (n = 75)	Intervention group (n = 72)	Statistic	*p*
Before nursing, M (Q_1, Q_3)	22.00 (21.00, 23.00)	22.00 (21.00, 23.00)	22.00 (21.00, 23.00)	Z = 0.459	0.646
After nursing, M (Q_1, Q_3)	31.00 (27.00, 34.00)	28.00 (25.50, 32.00)	33.00 (30.00, 37.00)	Z = 6.033	<0.001
Median change (Q_1, Q_3)		7.00 (4.00, 10.00)	12.00 (7.00, 15.00)		
Between-group median difference (95% CI)		5.00 (3.00, 7.00)			
Effect size (r)		0.498			
statistic		Z = 8.92	Z = 9.11		
p		<0.001	<0.001		

Table 5. Comparison of quality of life (SF-36 BP and RP) scores between control and intervention groups before and after nursing.

Variables	Total (n = 147)	Control group (n = 75)	Intervention group (n = 72)	Statistic	*p*
SF-36 Bodily Pain (BP)					
Before nursing, M (Q_1, Q_3)	46.00 (43.00, 48.00)	46.00 (43.00, 48.00)	46.00 (42.00, 48.00)	Z = 0.481	0.631
After nursing, M (Q_1, Q_3)	70.00 (63.00, 76.00)	66.00 (57.00, 72.00)	75.00 (68.75, 78.00)	Z = 5.518	<0.001
Median change (Q_1, Q_3)		21.00 (12.50, 26.50)	29.00 (24.00, 32.25)		
Between-group median difference (95% CI)		9.00 (4.00, 12.50)			
Effect size (r)		0.455			
Statistic		Z = 8.76	Z = 9.05		
p		<0.001	<0.001		
SF-36 Role-Physical (RP)					
Before care, M (Q_1, Q_3)	40.00 (37.00, 43.00)	40.00 (37.00, 43.00)	40.00 (37.00, 42.00)	Z = 0.019	0.985
After nursing, M (Q_1, Q_3)	66.00 (56.00, 74.00)	56.00 (50.00, 67.50)	72.00 (66.00, 77.00)	Z = 6.794	<0.001
Median change (Q_1, Q_3)		16.00 (9.00, 27.50)	31.50 (26.00, 37.00)		
Between-group median difference (95% CI)		16.00 (10.00, 19.00)			
Effect size (r)		0.560			
Statistic		Z = 8.85	Z = 9.21		
p		<0.001	<0.001		

ments than the control group, with higher GSES scores, higher BP scores, and higher RP scores (all $p < 0.001$). Detailed data are presented in Tables 4,5.

3.5 Satisfaction With Care

Twelve weeks after intervention, the overall nursing satisfaction of the intervention group was 93.06% (67/72), which was significantly higher than 78.67% (59/75) of the control group ($\chi^2 = 6.21$, $p = 0.013$, Table 6).

4. Discussion

This study evaluated an empowerment-based, digitally supported rehabilitation program for postoperative patients with LDH through an internal medicine and chronic care lens. Patients receiving this intervention had significantly better outcomes in pain control, functional recovery, self-efficacy, quality of life, and care satisfaction compared to those receiving routine care.

The effectiveness of this model stems from its success in fostering a fundamental role transition for patients—from passive recipients to active partners in the rehabilitation process. This aligns with chronic disease management principles, where long-term success depends on patient engagement and self-management capacity [18]. In addition, a large individual patient data meta-analysis of self-management interventions in chronic diseases has confirmed their effectiveness in improving health outcomes and reducing hospitalizations [19]. Interviewing procedure integrated into this process plays a role in enhancing intrinsic motivation [20]. Co-creating SMART goals transformed recovery into tangible steps, building self-efficacy—a key predictor of health behavior adoption and maintenance according to social cognitive theory [21]. Enhanced self-efficacy likely enabled patients to engage more confidently in rehabilitation activities, breaking the cycle of pain, fear, and avoidance [22]. Importantly, a recent narrative review concluded that supervised therapeutic exercise following lumbar spine surgery is safe and beneficial, with no increased risk of reherniation [23].

Empowerment is not a one-time indoctrination of knowledge, but a dynamic process that warrants continuous support and reinforcement. The intervention program in this study was constructed as a structured support ecosystem through online and offline integration of the Rehabilitation Action Plan Manual and WeChat platform. As a visual roadmap, the manual reduced the ambiguity and uncertainty of rehabilitation and enhanced patients' sense of

Table 6. Comparison of nursing satisfaction between control and intervention groups.

Variables	Total (n = 147)	Control group (n = 75)	Intervention group (n = 72)	Statistic	*p*
Nursing satisfaction, n (%)					
Overall satisfaction	126 (85.71)	59 (78.67)	67 (93.06)	$\chi^2 = 6.21$	0.013
Very satisfied	59 (40.14)	27 (36.00)	32 (44.44)		
Satisfied	67 (45.58)	32 (42.67)	35 (48.61)		
Generally satisfied	18 (12.24)	13 (17.33)	5 (6.94)		
Dissatisfied	3 (2.04)	3 (4.00)	0 (0.00)		

control. The structured follow-up and instant consultation realized with the utilization of WeChat platform ensured the seamless provision of professional support from hospital to patients at home. This structured, proactive follow-up approach enables timely correction of inappropriate behaviors, reinforcement of correct practices, and provision of necessary emotional support, thereby effectively reducing loss to follow-up and rehabilitation deviation during the post-discharge period [24]. In addition, weekly dissemination of thematic education content and the establishment of peer support groups further enriched patients' access to informational and social support resources. Experience sharing and mutual encouragement among peers provide a form of empathy and role modeling that cannot be fully replaced by medical staff, thereby further strengthening patients' self-efficacy and confidence in rehabilitation and fostering a positive social support network [25]. A recent meta-analysis of continuity of care interventions for patients with lumbar disc herniation confirmed that such models significantly reduce pain, improve function, and enhance patient satisfaction [26]. Digital tools enhanced the intervention's feasibility and scalability, supporting remote patient monitoring and education—a growing trend in chronic musculoskeletal and rehabilitation care [27,28]. A scoping review on digital health technologies for chronic conditions identified three core capabilities enabled by such tools: health information and knowledge management, self-management, and emotional and social support [29]. Furthermore, a meta-analysis focusing on e-health interventions for chronic low back pain demonstrated significant improvements in pain intensity and disability, supporting the integration of digital tools into postoperative care [30].

A recent study highlighted the scarcity of high-quality evidence for post-surgical rehabilitation following lumbar disc herniation, underscoring the clinical relevance of our findings [31]. Complementing this, a large-scale evidence synthesis of 55 randomized controlled trials involving 4311 patients demonstrated that physical therapy after lumbar disc surgery is effective in alleviating pain, improving physical function, and enhancing quality of life [32]. Özden et al. [33] reported that postoperative telerehabilitation significantly improved pain and disability outcomes in patients undergoing lumbar decompression surgery, supporting the value of digitally supported rehabilitation. Lorenzen et al. [34] found that while an mHealth application provided crucial post-discharge support, it did not significantly improve clinical outcomes compared to standard care. Our study extends these findings by demonstrating that an empowerment-based, digitally delivered transitional care program not only improves clinical outcomes but also enhances patient self-efficacy, offering a scalable and patient-centered model for postoperative rehabilitation.

From a clinical perspective, these findings suggest that postoperative management for LDH should integrate strategies from chronic care models. Moving beyond episodic, procedure-focused care to continuous, patient-centered support can yield significant medium-term benefits in symptom control and functional restoration. The improvement in self-efficacy and quality of life points to broader, long-term health gains, including better adherence, psychological well-being, and successful social reintegration [35]. The high satisfaction scores further underscore the value of a collaborative, empowerment-oriented care approach.

Several limitations of this study should be acknowledged. Its retrospective design may introduce selection bias. Furthermore, the non-concurrent enrollment periods introduce a potential chronological bias. Over this two-year period, changes in surgical techniques, perioperative care protocols, or the hospital environment may have independently influenced recovery outcomes, regardless of the specific nursing intervention. Importantly, although adjustments were made for disease duration and motor deficit grade, data on other critical baseline confounders were unavailable, including preoperative pain severity, degree of nerve compression, and detailed symptom severity scores. The absence of these variables precludes the possibility of a multivariable analysis for fully controlling for the effects of potential confounding factors. Consequently, we cannot rule out the possibility that residual confounding influenced the observed associations. The 12-week follow-up captures medium-term outcomes but not long-term recurrence or functional status. The single-center sample and requirement for smartphone use limit generalizability to older or digitally excluded populations. Future research should employ multicenter prospective randomized designs with longer follow-up (e.g., 1–2 years) to assess sustained effects and cost-effectiveness. Adapting empowerment principles for diverse patient populations, including those with limited digital access, is also crucial for equitable implementation.

5. Conclusion

The continuous, empowerment-based rehabilitation intervention was associated with pain amelioration, as well as improvements in lumbar function, self-efficacy, quality of life, and satisfaction with care in postoperative patients with lumbar disc herniation. By placing the patient at the center of recovery through collaborative goal setting, skill building, and sustained digital support, this model aligns with modern principles of internal medicine and chronic disease management. Despite study limitations, these findings provide strong support for integrating patient empowerment and digital transitional care into standard rehabilitation pathways for patients undergoing lumbar surgery, offering a promising strategy to enhance long-term recovery outcomes and quality of life.

Key Points

• The intervention group showed significantly greater improvements in pain (VAS), lumbar function (ODI), self-efficacy (GSES), and quality of life (SF-36) compared to the control group receiving routine care.

• The results highlight the effectiveness of shifting patients from passive recipients of care to active self-managers through collaborative goal setting and skill building.

• This patient-centered, empowerment-based model aligns with chronic disease management principles and offers a promising strategy for long-term rehabilitation.

Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions

XZ and XY designed the research study. XY performed the research. XY analyzed the data. XZ drafted this article. Both authors contributed to the important editorial changes in the manuscript. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was approved by the Ethics Committee of Cangnan County Hospital of Traditional Chinese Medicine (No. 2026-001). Requirement to obtain informed consent was waived due to the following reasons: (1) Minimal risk involved, (2) Utilization of only de-identified data and retrospective analysis. All procedures were performed in adherence to the Declaration of Helsinki.

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Conflicts of Interest

The authors declare no conflicts of interest.

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