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# Application of Phased Nursing Guidance Program in Early Rehabilitation Training for Patients after Minimally Invasive Spinal Surgery

**Yu Ma†, Yue Huang†, Jian Zhu, Zhenjie Sun***

Beijing No.6 Hospital, Beijing 100007, China
† These authors contributed equally to this work and share the first authorship.

**Corresponding author: Zhenjie Sun, sunzhenjie6925@sina.com*



**Abstract:** *Objective*: To explore the application effect of a phased nursing guidance program in early rehabilitation training for patients after minimally invasive spinal surgery, providing references for clinical rehabilitation nursing. *Methods*: A total of 148 patients who underwent minimally invasive spinal surgery in our hospital from July 2023 to June 2025 were selected as the study subjects. They were randomly divided into an observation group and a control group using a random number table method, with 74 cases in each group. The control group received conventional nursing guidance after minimally invasive spinal surgery, while the observation group implemented a phased nursing guidance program. The pain levels (VAS scores), spinal function (JOA scores), quality of life (SF-36 scores), rehabilitation training compliance, and complication rates of the two groups of patients at different postoperative time points were compared. *Results*: At 7, 14, and 30 days postoperatively, the Visual Analogue Scale (VAS) scores in the observation group were significantly lower than those in the control group (all $p < 0.001$). At 7, 14, and 30 days postoperatively, the Japanese Orthopaedic Association (JOA) scores in the observation group were significantly higher than those in the control group (all $p < 0.0001$). Moreover, the JOA scores in both groups gradually increased over time, with a more pronounced increase observed in the observation group. At 30 days postoperatively, the scores in all dimensions of the Short Form-36 (SF-36) scale in the observation group were significantly higher than those in the control group (all $p < 0.001$). The compliance rate with rehabilitation training in the observation group was 95.95%, significantly higher than the 82.43% in the control group ($\chi^2 = 7.008$, $p < 0.05$). The complication rate in the observation group was 4.05%, significantly lower than the 14.86% in the control group ($\chi^2 = 5.049$, $p < 0.05$). *Conclusion*: The phased nursing guidance program can effectively alleviate pain, improve spinal function and quality of life, enhance compliance with rehabilitation training, and reduce the incidence of complications in patients after minimally invasive spinal surgery, making it worthy of clinical promotion and application.

**Keywords:** Minimally invasive spinal surgery; Phased nursing guidance; Early rehabilitation training; Pain management; Spinal function

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# 1. Introduction

Minimally invasive spinal surgery, characterized by minimal trauma, reduced bleeding, and rapid recovery, has become the mainstream treatment for spinal diseases such as lumbar disc herniation, lumbar spinal stenosis, and cervical spondylosis [1]. However, spinal stability remains relatively weak in the early postoperative period. Improper or delayed rehabilitation training can easily lead to issues such as muscle atrophy, spinal stiffness, and chronic pain, thereby affecting the surgical outcome and the patient's prognosis [2].

Early rehabilitation training is crucial for promoting the recovery of spinal function, but patients often exhibit low rehabilitation compliance and poor training outcomes due to factors such as fear of pain, lack of rehabilitation knowledge, and non-standardized training methods. Conventional nursing guidance typically consists of uniform and general suggestions, lacking specificity tailored to the physiological characteristics and rehabilitation needs of patients at different postoperative recovery stages, making it difficult to align with individual patient recovery processes. Phased nursing guidance formulates personalized rehabilitation goals and training plans in stages based on the postoperative recovery patterns of patients, achieving gradual and precise rehabilitation guidance [3]. This study took 148 patients who underwent minimally invasive spinal surgery and were treated from July 2023 to June 2025 as the research subjects to explore the application effect of phased nursing guidance plans in early rehabilitation training. The findings are now reported as follows.

# 2. Materials and methods

## 2.1. General information

A total of 148 patients who underwent minimally invasive spinal surgery in the orthopedics department of our hospital from July 2023 to June 2025 were selected as the study subjects.

### 2.1.1. Inclusion criteria

(1) Meeting the surgical indications for spinal diseases and undergoing minimally invasive spinal surgery (including percutaneous endoscopic lumbar discectomy, full-endoscopic spinal canal decompression, percutaneous vertebroplasty, etc.);
(2) Aged between 18 and 75 years old;
(3) Having clear consciousness and basic communication and comprehension abilities
(4) Voluntarily participating in this study and signing the informed consent form

### 2.1.2. Exclusion criteria

(1) Concurrent severe dysfunction of vital organs such as the heart, liver, and kidneys;
(2) Presence of coagulopathy;
(3) Occurrence of severe postoperative complications (such as infection, massive hemorrhage, nerve injury);
(4) Patients with mental disorders;
(5) Pregnant or lactating women

### 2.1.3. Study design

Patients were randomly assigned to an observation group and a control group using a random number table method, with 74 patients in each group. In the observation group, there were 41 males and 33 females, with an

average age of (52.36 ± 8.42) years. The surgical types included 38 cases of percutaneous endoscopic lumbar discectomy, 22 cases of full-endoscopic spinal canal decompression, and 14 cases of percutaneous vertebroplasty. In the control group, there were 39 males and 35 females, with an average age of (51.89 ± 8.67) years. The surgical types included 36 cases of percutaneous endoscopic lumbar discectomy, 23 cases of full-endoscopic spinal canal decompression, and 15 cases of percutaneous vertebroplasty. There were no statistically significant differences in general information such as gender, age, and surgical type between the two groups ($p > 0.05$), indicating comparability.

## 2.2. Nursing methods

The control group received routine nursing guidance after minimally invasive spinal surgery: explaining the importance of rehabilitation and distributing handbooks, instructing patients on bed turning and limb movements, orally informing them about lumbar and back muscle training one-week post-surgery (without specifying frequency or intensity), regularly answering questions, and providing discharge rehabilitation precautions.

The observation group was guided by a professional rehabilitation nursing team, which implemented precise nursing guidance in four stages according to the recovery process after minimally invasive spinal surgery, as follows:

(1) Days 1–3 post-surgery (acute phase)

Rehabilitation goals: Alleviate pain and edema, maintain spinal stability, and prevent early complications such as pressure ulcers and venous thrombosis. Nursing guidance: Position the patient in a supine position with a lumbar pillow, and perform axial turning every 2 hours; assess pain using the VAS score, administer medications as prescribed, and incorporate relaxation therapy; instruct the patient in ankle pump exercises (10 repetitions per set, 3–4 sets daily) and quadriceps contraction training (15 repetitions per set, 3 sets daily); emphasize spinal protection to the patient and their family, and avoid premature weight-bearing [4].

(2) Days 4–7 post-surgery (muscle activation phase)

Rehabilitation goals: Activate the muscle strength of the core muscle groups, improve the range of motion of the spinal joints, and lay the foundation for subsequent rehabilitation. Nursing guidance: Instruct on the five-point support method (lying supine with knees bent and lifting the buttocks, holding for 3–5 seconds, 10 repetitions per set, 2–3 sets per day, increasing as needed); slowly perform neck/waist flexion, extension, and rotation movements under pain-free conditions (5–8 repetitions in each direction, 2 sets per day); evaluate training progress daily and adjust intensity promptly; encourage the intake of high-protein, high-calcium, and vitamin-rich foods to promote recovery.

(3) 8–14 days post-surgery (muscle strengthening phase)

Rehabilitation goals: Strengthen the core muscle groups, improve spinal function, and enhance daily living activities. Nursing guidance: Increase the five-point support method to 15–20 repetitions per set (3 sets per day), gradually transition to the three-point support method (10 repetitions per set, 2 sets per day), and add isometric neck contraction training for cervical spine surgeries; instruct on sitting up at the bedside and walking with assistance (starting with 50–100 meters, twice daily, gradually increasing); standardize sitting, standing, and walking postures, use a lumbar support pillow, avoid prolonged sitting or standing, and move the spine every 30 minutes.

(4) 15 to 30 days post-surgery (functional consolidation phase)

Rehabilitation goals: Consolidate rehabilitation outcomes, enhance spinal functional independence, and facilitate the patient's return to family and society. Nursing guidance: Strengthen core muscle groups and increase the "Little Swallow Flying" exercise (lying prone, raising the head, chest, and legs, maintaining the position for 3 to 5 seconds, 10 repetitions per set, 2 sets daily, adjusting intensity as needed); instruct on daily activities, advising against bending over to lift heavy objects (lifting objects by bending the knees and squatting); develop a post-discharge rehabilitation plan, inform patients of follow-up appointments at 1, 3, and 6 months post-surgery, and establish a WeChat follow-up group for answering questions and correcting posture [5].

## 2.3. Observation indicators

The Visual Analog Scale (VAS) was used to assess patients' pain levels at 3 days, 7 days, 14 days, and 30 days post-surgery; the Japanese Orthopaedic Association (JOA) evaluation score was used to assess patients' spinal function [6].

The Short Form Health Survey (SF-36) was used to evaluate patients' quality of life at 30 days post-surgery; a self-made compliance scale was used to assess patients' compliance rates; and the occurrence of complications in patients was recorded.

## 2.4. Statistical methods

Data analysis was performed using SPSS 26.0 statistical software. Continuous data are presented as ($\overline{x} \pm s$), with repeated measures analysis of variance used for comparisons within groups and independent samples *t*-tests for comparisons between groups; categorical data are presented as [n (%)], with $\chi^2$ tests used for comparisons. A *p*-value < 0.05 indicates a statistically significant difference.

# 3. Results

## 3.1. Comparison of VAS scores at different time points after surgery between the two groups

At 7 days, 14 days, and 30 days post-surgery, the VAS scores in the observation group were significantly lower than those in the control group (all $p < 0.001$). See **Table 1**.

**Table 1.** Comparison of VAS scores at different time points after surgery between the two groups

| Group | Postoperative Day 3 | Postoperative Day 7 | Postoperative Day 14 | Postoperative Day 30 |
|---|---|---|---|---|
| Observation group (n = 74) | 4.86 ± 1.03 | 3.21 ± 0.85 | 2.15 ± 0.72 | 1.32 ± 0.56 |
| Control group (n = 74) | 4.92 ± 1.05 | 3.98 ± 0.91 | 2.97 ± 0.83 | 1.98 ± 0.64 |
| *t*-value | 0.351 | 5.319 | 6.420 | 6.676 |
| *p*-value | 0.726 | < 0.001 | < 0.001 | < 0.001 |

## 3.2. Comparison of JOA scores at different time points after surgery between the two groups

At 7 days, 14 days, and 30 days post-surgery, the JOA scores in the observation group were significantly higher than those in the control group (all $p < 0.001$). Moreover, the JOA scores in both groups gradually increased over

time, with a more pronounced increase observed in the observation group. See **Table 2**.

**Table 2.** Comparison of JOA scores at different time points after surgery between the two groups ($\overline{x}$ ± s, points)

| Group | Postoperative Day 7 | Postoperative Day 14 | Postoperative Day 30 |
|---|---|---|---|
| Observation group (n = 74) | 16.83 ± 2.15 | 20.56 ± 2.32 | 24.38 ± 2.51 |
| Control group (n = 74) | 14.25 ± 2.08 | 17.32 ± 2.26 | 20.15 ± 2.43 |
| *t*-value | 7.419 | 8.605 | 10.416 |
| *p*-value | < 0.001 | < 0.001 | < 0.001 |

## 3.3. Comparison of SF-36 scores at 30 days after surgery between the two groups

At 30 days post-surgery, the scores in all dimensions of the SF-36 scale in the observation group were significantly higher than those in the control group (all $p < 0.001$). See **Table 3**.

**Table 3.** Comparison of SF-36 scores at 30 days after surgery between the two groups

| Group | Physical functioning | Role-physical | Bodily pain | General health | Vitality | Social functioning | Role-emotional | Mental health |
|---|---|---|---|---|---|---|---|---|
| Observation group (n = 74) | 82.36 ± 7.45 | 78.52 ± 8.13 | 85.43 ± 6.87 | 79.65 ± 7.68 | 81.24 ± 7.32 | 83.51 ± 6.98 | 80.13 ± 7.85 | 82.46 ± 7.21 |
| Control group (n = 74) | 73.15 ± 8.26 | 69.23 ± 8.75 | 76.21 ± 7.54 | 70.34 ± 8.32 | 72.56 ± 8.15 | 75.32 ± 7.65 | 71.45 ± 8.42 | 73.68 ± 8.03 |
| *t*-value | 7.123 | 6.691 | 7.776 | 7.073 | 6.816 | 6.803 | 6.486 | 6.999 |
| *p*-value | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |

## 3.4. Comparison of compliance with rehabilitation training between the two groups

The compliance rate with rehabilitation training in the observation group was 95.95%, significantly higher than that in the control group (82.43%) ($\chi^2 = 7.008$, $p < 0.05$). See **Table 4**.

**Table 4.** Comparison of compliance with rehabilitation training between the two groups

| Group | Fully Adherent | Partially Adherent | Non-Adherent | Total Adherence |
|---|---|---|---|---|
| Observation group (n = 74) | 52 (70.27) | 19 (25.68) | 3 (4.05) | 71 (95.95) |
| Control group (n = 74) | 38 (51.35) | 23 (31.08) | 13 (17.57) | 61 (82.43) |
| $\chi^2$ value | | | | 7.008 |
| *p*-value | | | | 0.008 |

## 3.5. Comparison of complication rates between the two groups of patients

The complication rate in the observation group was 4.05%, significantly lower than that in the control group at 14.86% ($\chi^2 = 5.049$, $p < 0.05$). See **Table 5**.

**Table 5.** Comparison of complication rates between the two groups of patients

| Group | Pressure injury | Venous thrombosis | Spinal stiffness | Surgical site infection | Total incidence |
|---|---|---|---|---|---|
| Observation group (n = 74) | 0 | 1 (1.35) | 2 (2.70) | 0 | 3 (4.05) |
| Control group (n = 74) | 2 (2.70) | 3 (4.05) | 5 (6.76) | 1 (1.35) | 11 (14.86) |
| $\chi^2$-value | | | | | 5.049 |
| *p*-value | | | | | 0.025 |

## 4. Discussion

Although minimally invasive spinal surgery involves minimal trauma, postoperative soft tissue damage still occurs. Early rehabilitation requires balancing spinal stability with gradual training. Traditional nursing guidance lacks specificity and offers generalized plans, often leading to non-standardized training in patients due to pain fear and unclear methods, which affects recovery. Staged nursing guidance, based on evidence-based nursing and postoperative recovery patterns, formulates goals and content in stages to achieve individualized and precise guidance.

The results of this study showed that the VAS scores in the observation group were significantly lower than those in the control group at 7 days, 14 days, and 30 days postoperatively, while the JOA scores were significantly higher, confirming that staged nursing guidance can effectively alleviate pain and promote spinal function recovery [7]. The core reason lies in adapting to the patient's recovery process in stages: focusing on body position care and pain management in the acute phase to reduce spinal stimulation; strengthening core stability during the muscle activation phase; enhancing daily activity capabilities during the muscle strengthening phase; and consolidating rehabilitation outcomes during the functional consolidation phase. Gradual training can prevent exacerbation of pain due to premature weight-bearing or excessive activity, while promoting local blood circulation, reducing inflammatory responses, and accelerating tissue repair [8]. Quality of life serves as a crucial evaluation metric for rehabilitation outcomes, and the SF-36 scale comprehensively reflects patients' postoperative status. In this study, the scores of all dimensions of the SF-36 at 30 days post-surgery in the observation group were significantly higher than those in the control group. This indicates that phased nursing guidance not only improves spinal function but also enhances patients' physiological comfort, social participation, and mental health through comprehensive measures such as health education, psychological support, and dietary guidance.

The compliance with rehabilitation training in the observation group was significantly higher than that in the control group, primarily because the phased nursing guidance was both personalized and operable: the training content was concise and easy to grasp, the rehabilitation nursing team monitored and adjusted the plan in real-time, promptly addressing any queries, and the WeChat follow-up group provided continuous tracking and guidance. Additionally, the emphasis on family involvement further enhanced patient compliance through their supervision and support.

Complication prevention is a critical aspect of postoperative care following minimally invasive spinal surgery [9]. The incidence of complications in the observation group was significantly lower than that in the control group. Phased nursing guidance prevented venous thrombosis through early postoperative ankle pump exercises and quadriceps contraction training, prevented pressure ulcers through axial turning, and prevented spinal stiffness through gradual spinal movement training. It also strengthened wound care and dietary guidance to reduce the risk of infection [10]. In contrast, the control group exhibited a higher incidence of complications due to irregular rehabilitation training,

with some patients engaging in premature activities or lacking effective training.

## 5. Conclusion

In conclusion, the phased nursing guidance program can effectively alleviate pain, improve spinal function and quality of life, enhance compliance with rehabilitation training, and reduce the incidence of complications in patients following minimally invasive spinal surgery. It is therefore worthy of clinical promotion and application.

## Disclosure statement

The authors declare no conflict of interest.

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