Effect of Comprehensive Nursing on Postoperative Complications and Recovery of Elderly Patients Undergoing Prone-Position Lumbar Spine Surgery

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AIM: This study aimed to retrospectively analyze the effects of comprehensive nursing care on postoperative complications and clinical outcomes in elderly patients undergoing prone lumbar spine surgery.

METHODS: A retrospective study was conducted between July 2020 and July 2025, including 130 elderly patients undergoing prone lumbar spine surgery at Taihe County People's Hospital. Based on the nursing model, the patients included were classified into a control group (conventional care, $n = 71$) and an observation group (comprehensive care, $n = 59$). Evaluation criteria included preoperative anxiety and depression, clinical outcomes (time to first in-bed activity, time to first out-of-bed activity, and average length of hospital stay), perioperative hypothermia classification (mild/moderate/severe), incidence of perioperative shivering, postoperative infection rate, postoperative postural nerve damage, and incidence of pressure injuries 12 hours, 24 hours, and 48 hours after surgery.

RESULTS: There were no statistically significant differences in the distribution of depression and anxiety scores and severity between the observation group and the control group before the intervention. After the intervention, the depression and anxiety levels in the observation group were significantly lower than those in the control group ($p < 0.05$), and the severity distribution was significantly better in the observation group than in the control group ($p < 0.05$). Time to first in-bed activity, time to first out-of-bed activity, and average length of hospital stay were significantly shorter in the observation group than in the control group ($p < 0.001$). The incidence rates of mild, moderate, and severe hypothermia were significantly lower in the observation group than in the control group (13.56%, 5.08%, and 1.69% vs 23.94%, 14.08%, and 11.27%, $p < 0.05$). The incidence of perioperative shivering was significantly lower in the observation group than in the control group (15.25% vs 33.81%, $p < 0.05$). There was no significant difference in the incidence of postoperative postural nerve damage between the two groups. The postoperative infection rate in the observation group was 5.08%, which was significantly lower than the 16.90% in the control group. Furthermore, the incidence rates of pressure injuries in the observation group 12 hours, 24 hours, and 48 hours after surgery were significantly lower than those in the control group (0%, 3.39%, and 10.17% vs 2.82%, 18.31%, and 29.58%, $p < 0.05$).

CONCLUSIONS: In this retrospective cohort, the implementation of comprehensive nursing significantly improved psychological status, reduced the incidence of perioperative hypothermia and other complications, and accelerated postoperative recovery in elderly patients undergoing prone lumbar spine surgery.

Keywords: comprehensive nursing care; prone position; lumbar spine surgery; pressure injury

Introduction

The societal progress and lifestyle changes happening in recent years have increasingly accentuated various problems of population aging, with one of them being the ever-rising lumbar spine surgeries performed on elderly patients, which are marked by increasing surgical complexity [1]. Choosing the appropriate body position according to the different types of diseases and surgical characteristics is critical in orthopedic clinics, and sometimes a change of the body position intraoperatively is necessary. Among them, the prone position is widely used because it can provide a clearer surgical field and an ideal surgical approach. In addition, since lumbar spine surgery is mostly performed under general anesthesia, patients often need to remain in a prone position for a long time. Therefore, the prone position is a commonly used body position for lumbar spine surgery [2], placing substantial demands on patients' physiological functions and on nursing management. A lack of effective nursing intervention during the perioperative period may predispose elderly patients to develop multiple complications. Under normal circumstances, the autonomic nervous system stabilizes the core body temperature within the range of 36.5–37.5 °C, which is not significantly affected by the ambient temperature [3]. Because the prone position exposes a large skin surface to the low-temperature operating room environment, and general anesthesia suppresses

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thermoregulation, patients are highly susceptible to perioperative hypothermia (body temperature <36.0 °C). According to literature reports, the incidence of perioperative hypothermia is approximately 4%–70% [4]. Hypothermia, often accompanied by shivering, not only increases the risk of infections but may also delay drug metabolism and postoperative recovery. The mechanism underlying hypothermia is related to abnormal cell metabolism and vasoconstriction induced by low temperature, which weakens the body's immune defense [5].

Another common complication is pressure injury, also known as pressure sore, which is considered one of the most challenging problems in nursing work [6]. The occurrence of pressure sores is closely related to external pressure, friction and shear force. Prolonged pressure on the skin can lead to local blood perfusion deficiency, followed by the formation of erythema, blisters and ulcers. In severe cases, it can lead to deep tissue necrosis, which seriously affects postoperative recovery [7,8]. Perioperative peripheral nerve injury is also closely related to the surgical position, and is often manifested as brachial artery spasm, nerve plexus damage or single nerve damage, among which ulnar nerve damage is the most common [9]. Because lumbar spine surgery involves an extended period of prone positioning, the patient's upper and lower limbs may suffer nerve damage due to pressure or traction, typically manifested as numbness, tingling, or decreased sensation in the inner forearm and the ring and little fingers. In severe cases, there may even be symptoms such as decreased hand grip strength and fine motor disorder. In addition, the nerves of the lower limbs may also be affected [10,11]. Once this type of positional nerve injury occurs, it often delays the patient's recovery and affects the patient's health and quality of life [12]. The patient's preoperative psychological state also has a significant impact on the surgical outcome. Some elderly patients often express tension, anxiety, fear, and other emotions due to concerns about surgical risks and prognosis, which affects the patient's recovery (time to first in-bed activity, time to first out-of-bed activity, and average length of hospital stay) [13,14]. Therefore, implementing comprehensive nursing intervention is particularly important to patients undergoing prone-position lumbar spine surgery in this demographic.

Comprehensive nursing intervention involves a nursing team composed of experts in psychology, nutrition, and nursing, who provide comprehensive, multidisciplinary interventions to patients to minimize the risk of complications [15]. The multi-comprehensive nursing model can provide continuous, systematic, and refined nursing services throughout the patient's treatment cycle, helping to improve the patient's clinical outcomes [16,17]. However, specific research is still lacking on the construction, implementation pathways, and clinical effects of comprehensive nursing care programs for certain high-risk surgical populations—such as elderly patients undergoing prone lumbar spine surgery. Due to age-related decline in physiological reserves, multiple comorbidities, and the unique surgical position, elderly patients are more susceptible to hypothermia, pressure injuries, nerve traction injuries, and delayed postoperative recovery, which are not fully addressed by the conventional nursing models. Therefore, this retrospective study aims to systematically evaluate the impact of comprehensive nursing care programs on postoperative complications and recovery progress in elderly patients, filling the evidence gap in current nursing practice in this specific context and providing a basis for constructing specialized and refined nursing pathways.

Methods

Participants

This study included 130 elderly patients who underwent prone lumbar spine surgery between July 2020 and July 2025. The inclusion criteria were as follows: (1) age between 55 and 80 years; (2) a confirmed clinical indication for prone lumbar spine surgery; (3) no preoperative movement difficulty; and (4) good cognitive function with adequate reading and communication skills. The exclusion criteria were as follows: (1) incomplete medical records; (2) associated with malignant tumors or other acute complications; (3) combined with severe heart, lung, liver, kidney, or other major organ dysfunction, unable to tolerate surgery; and (4) refusal to sign the informed consent form. The patients included were divided into a control group and an observation group according to the nursing care they received. This study was approved by the Ethics Committee of Taihe County People's Hospital (approval number: 2020-10) and was conducted in accordance with the Declaration of Helsinki.

Nursing Plan

Patients in the control group received routine perioperative orthopedic care without any additional interventions. Preoperatively, the assigned nurse collected the patient's basic information and medical history, assisted with routine examinations—including blood tests, electrocardiogram, and imaging studies—and instructed the patient to abstain from alcohol for 48 hours and from food and water for 8–12 hours before surgery. The nurse also provided detailed explanations to the patient and family regarding the surgical procedure, anesthesia method, potential complications, and relevant precautions, thereby reinforcing preoperative education.

During surgery, nursing staff assisted the patient into the supine position required for lumbar spine procedures, protected bony prominences to prevent pressure ulcers in elderly patients, and established intravenous access. Supplemental oxygen or urinary catheterization was provided as clinically indicated. Nurses continuously monitored vital signs, including blood pressure, heart rate, respiratory rate, oxygen saturation, and body temperature. Strict asep-

tic technique was maintained, the sterile field was preserved, and close collaboration was sustained with the surgical and anesthesia teams. When necessary, based on the patient's condition and intraoperative temperature management needs, warmed intravenous fluids were administered.

Postoperatively, once the patient's vital signs were stable and consciousness gradually returned, nursing personnel safely transferred the patient back to the ward. Key intraoperative information—including medications administered, fluid intake, blood loss, and the patient's intraoperative status—was handed over to the ward nurse to ensure continuity of care.

Patients in the observation group received a comprehensive perioperative nursing model in addition to the same routine care provided to the control group. This intervention was implemented by a nursing team led by a senior orthopedic nurse, with consultation from psychological or rehabilitation specialists when necessary.

Preoperative Interventions: (1) Psychological Assessment and Support. Upon admission, the nursing team assessed the patient's psychological status using the Zung Self-Rating Depression Scale (SDS) and the Generalized Anxiety Disorder-7 (GAD-7) scale. Based on the assessment results, graded psychological support—including emotional communication, reassurance, and coping guidance—was provided to elderly patients to alleviate preoperative anxiety and tension. (2) Individualized Education. Illustrated educational materials and multimedia tools were used to explain preoperative preparation, intraoperative procedures, common complications, and postoperative rehabilitation. For patients with limited comprehension, nurses provided one-on-one explanations to ensure understanding and cooperation. (3) Preoperative Preparation and Psychological Reassurance. On the night before surgery, in addition to routine preparations, nurses offered targeted psychological reassurance to help patients face the surgery in a stable emotional state.

Intraoperative Interventions: (1) Thermal Management. Active warming was maintained using forced-air warming devices to keep the patient's body temperature within the normal range, thereby reducing the risk of perioperative hypothermia. (2) Positioning and Pressure Ulcer Prevention. According to the patient's body shape and surgical requirements, nurses assisted in placing the patient in the supine position and used soft cushions or gel pads to protect vulnerable pressure areas, preventing nerve compression and circulatory impairment. (3) Interdisciplinary Communication. The nursing team maintained real-time communication with the surgeon and anesthetist, assisting in adjusting the patient's position or warming measures in response to physiological fluctuations.

Postoperative Interventions: After surgery, nurses continued to provide psychological support, reinforced rehabilitation guidance, and monitored for early complications to ensure continuity of perioperative care for elderly patients.

Collection and Analysis of Socio-Demographic Data

Baseline characteristics, including age, sex, educational level, body mass index (BMI), comorbidities (such as hypertension, diabetes mellitus, osteoporosis), American Society of Anesthesiologists (ASA) physical status classification, initial body temperature upon entering the operating room, and operating room temperature and other indicators, were collected for both groups of patients. If no significant differences were found in these baseline characteristics between the two groups, further comparisons for other key aspects were conducted.

Assessment of Preoperative Depression and Anxiety

Assessment of Depression in Patients Under Different Nursing Models

The Zung Self-Rating Depression Scale (SDS) was used to assess depressive symptoms in patients of both groups [18]. The scale contains 20 items, with 10 positive statements and 10 negative statements. Each item is scored according to the frequency of symptom occurrence, with a score of 1–4. The scores of all items are summed up to obtain the total score, which is then multiplied by 1.25 and rounded to obtain the standard score (ranging from 25 to 100 points). The higher the score, the more severe the depression. The standard score denotes the severity of depression: no depression ($<$50 points), mild depression (50–59 points), moderate depression (60–69 points), and severe depression ($\geq$70 points).

Assessment of Patient Anxiety Levels Under Different Nursing Models

The GAD-7 scale [19] was used to assess the patient's anxiety. This tool contains 7 items, each scored on a scale of 0–3, with a higher total score indicating more severe anxiety. The scoring results are graded as follows: no anxiety (0–4 points), mild anxiety (5–9 points), moderate anxiety (10–14 points), and severe anxiety (15–21 points).

Perioperative Hypothermia and Shivering Assessment

Hypothermia is defined as a state where the patient's core body temperature is below 36.0 °C. According to a previous reference, hypothermia was categorized into three levels in this study: mild (34.0–35.9 °C), moderate (32.0–33.9 °C), and severe ($<$32.0 °C) [20]. The degree of shivering, which was recorded by the anesthesiologist, was graded was based on a previous study: (i) no shivering (level 0); (ii) mild shivering, marked by mild contraction of facial and neck muscles (level 1); (iii) moderate shivering, characterized by obvious shivering of the head, neck, shoulders, and lower limbs (level 2); and (iv) severe shivering, manifested by obvious shivering of the entire body (level 3) [21].

Assessment of Postoperative Complications and Recovery

The assessment of postoperative complications incorporated multiple observational indicators, including the inci-

Table 1. Baseline characteristics of participants.

Variables	Observation group (n = 59)	Control group (n = 71)	Statistic	p
Age (years)	71.00 (62.00, 74.00)	67.00 (62.00, 72.50)	Z = –1.21	0.227
BMI (kg/m^2)	25.00 (24.70, 25.10)	25.00 (24.80, 25.20)	Z = –1.24	0.214
Initial body temperature (°C)	37.00 ± 0.19	37.00 ± 0.20	t = –0.02	0.980
Operating room temperature (°C)	21.39 ± 0.45	21.36 ± 0.48	t = 0.39	0.694
Blood loss (mL)	356.00 (222.00, 441.00)	294.00 (205.00, 387.50)	Z = –1.33	0.183
Surgery type, n (%)			χ^2 = 0.09	0.762
Open surgery	47 (79.66)	55 (77.46)		
Minimal invasive surgery	12 (20.34)	16 (22.54)		
Number of segments exposed, n (%)			χ^2 = 0.09	0.953
1–2	41 (69.49)	49 (69.01)		
3–5	18 (30.51)	22 (30.99)		
Operation time, n (%)			χ^2 = 0.43	0.513
<2 h	18 (30.51)	18 (25.35)		
≥2 h	41 (69.49)	53 (74.65)		
ASA analysis, n (%)			χ^2 = 1.24	0.537
I	4 (6.78)	9 (12.68)		
II	3 9 (66.10)	44 (61.97)		
III	16 (27.12)	18 (25.35)		
Gender, n (%)			χ^2 = 0.06	0.809
Male	32 (54.24)	37 (52.11)		
Female	27 (45.76)	34 (47.89)		
Education level, n (%)			-	0.600
Junior high or below	44 (74.58)	50 (70.42)		
High school	11 (18.64)	18 (25.35)		
College or higher	4 (6.78)	3 (4.23)		
Smoking history, n (%)			χ^2 = 0.01	0.931
No	51 (86.44)	61 (85.92)		
Yes	8 (13.56)	10 (14.08)		
Hypertension, n (%)			χ^2 = 0.10	0.747
No	40 (67.80)	50 (70.42)		
Yes	19 (32.20)	21 (29.58)		
Diabetes, n (%)			χ^2 = 0.04	0.840
No	49 (83.05)	58 (81.69)		
Yes	10 (16.95)	13 (18.31)		
Osteoporosis, n (%)			χ^2 = 0.07	0.797
No	46 (77.97)	54 (76.06)		
Yes	13 (22.03)	17 (23.94)		

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index.

Notes: "-" indicates that Fisher's exact test was used for the inter-group comparison of the variable, as the data did not satisfy the assumptions required for the Chi-square test (e.g., low expected frequency).

dence rates of postoperative infection, pressure ulcers, and positional nerve injury. Pressure ulcers were evaluated at three specific postoperative time points—at 12 hours, at 24 hours, and at 48 hours—to capture their early onset and dynamic progression. Evaluations were conducted in accordance with standardized criteria to ensure consistency.

The documentation of positional nerve injury was based on the emergence of postoperative neurological symptoms, such as lower limb weakness or numbness, and was subsequently confirmed through clinical assessment by the orthopedic or anesthesia team. This methodology ensured the accurate identification of neurological complications potentially associated with surgical positioning. Recovery indicators encompassed the time to first bedside mobilization, time to first ambulation, and the average length of hospital stay. These metrics were utilized to comprehensively assess the patient's postoperative recovery and the clinical effectiveness of the integrated nursing model. The time interval for the first bedside activity is defined as the duration from emergence from anaesthesia to the initiation of any nurse-assisted rehabilitation activity (including turning in bed, active lower limb exercises, or sitting up).

Table 2. Comparison of depression score and severity between the observation and control groups.

Variables	Observation group (n = 59)	Control group (n = 71)	Statistic	p
Depression score before nursing	54.00 (42.50, 60.00)	55.00 (43.50, 61.50)	Z = −0.27	0.788
Depression score after nursing	39.00 (32.50, 53.00)	57.00 (38.50, 64.00)	Z = −3.66	<0.001
Severity of depression before nursing, n (%)			-	0.873
None	22 (37.29)	25 (35.21)		
Mild	22 (37.29)	27 (38.03)		
Moderate	10 (16.95)	15 (21.13)		
Severe	5 (8.47)	4 (5.63)		
Severity of depression after nursing, n (%)			-	0.002
None	41 (69.49)	27 (38.03)		
Mild	12 (20.34)	23 (32.39)		
Moderate	4 (6.78)	16 (22.54)		
Severe	2 (3.39)	5 (7.04)		

Notes: "-" indicates that Fisher's exact test was used for the inter-group comparison of the variable, as the data did not satisfy the assumptions required for the Chi-square test (e.g., low expected frequency).

Statistical Analysis

Data were processed and analyzed using SPSS statistical software version 22.0 (IBM Corp., Armonk, NY, USA). The Kolmogorov–Smirnov test was used to assess the normality of continuous variables. Parametric assumptions such as normality and homogeneity of variance were assessed. Levene's test for homogeneity of variance was performed for normally distributed data. When both assumptions were met, the independent sample t-test was used for comparisons between groups. For normally distributed data with unequal variance (according to Levene's test), the Welch's t-test was used. Data conforming to a normal distribution are expressed as mean ± standard deviation (SD). The Mann–Whitney U test was employed to compare non-normally distributed continuous data, which are expressed as median and interquartile range [M (Q1, Q3)]. Expressed as counts (n) and percentages (%), categorical data were analyzed using the chi-square (χ^2) test or Fisher's exact test (when the expected frequency is <5); the chi-square statistic and corresponding p-value are reported. A p-value < 0.05 was defined the statistical significance threshold in all analyses.

Results

Comparison of Baseline Characteristics

A total of 130 patients were finally enrolled and divided into two groups according to the nursing model: 71 patients who received conventional care were assigned in the control group, whereas 59 patients who received comprehensive care were assigned to the observation group. There was no statistically significant difference in the baseline data between the two groups ($p > 0.05$) (Table 1).

Assessment of Depression

In this study, we utilized the SDS scale to assess preoperative (baseline) depression in the patients before any nursing intervention. At this pre-intervention baseline, there were no significant differences in depression scores or distribution between the two groups ($p > 0.05$). Subjects in the observation group exhibited a significant reduction in depression scores following the implementation of the comprehensive nursing intervention compared with the control group ($p < 0.001$). Furthermore, the distribution of depression severity between the two groups also showed significant differences ($p < 0.05$) (Table 2).

Assessment of Anxiety

This study used the GAD-7 scale to assess preoperative anxiety in the patients. Prior to the implementation of nursing care, there were no significant differences in anxiety scores or the distribution of anxiety types between the control and observation groups ($p > 0.05$). Subjects in the observation group exhibited a reduction in anxiety scores following nursing care, which was statistically different compared with the control group ($p < 0.05$). Significant differences were also observed between the two groups in terms of anxiety severity ($p < 0.05$) (Table 3).

Assessment of Perioperative Hypothermia

The incidence of perioperative hypothermia was significantly lower in the observation group than in the control group, and significant between-group differences were also observed in severity and recovery time ($p < 0.05$). Furthermore, the incidence of shivering was lower in the observation group than in the control group, and the difference in severity was also statistically significant ($p < 0.05$) (Table 4).

Postoperative Complications of Patients

There was no significant difference in the incidence of pressure injuries at 12 hours after surgery between the control and observation groups ($p > 0.05$). However, the incidence of pressure injuries in the observation group was signifi-

Table 3. Comparison of anxiety score and severity between the observation and control groups.

Variables	Observation group (n = 59)	Control group (n = 71)	Statistic	p
Anxiety score before nursing	6.00 (3.00, 9.50)	7.00 (4.50, 10.50)	Z = −1.49	0.137
Anxiety score after nursing	4.00 (2.00, 7.00)	7.00 (3.00, 10.00)	Z = −2.99	0.003
Severity of anxiety before nursing, n (%)			-	0.220
None	24 (40.68)	18 (25.35)		
Mild	20 (33.90)	34 (47.89)		
Moderate	12 (20.34)	13 (18.31)		
Severe	3 (5.08)	6 (8.45)		
Severity of anxiety after nursing, n (%)			χ^2 = 9.61	0.022
None	35 (59.32)	23 (32.39)		
Mild	14 (23.73)	29 (40.85)		
Moderate	7 (11.86)	12 (16.90)		
Severe	3 (5.08)	7 (9.86)		

Notes: "-" indicates that Fisher's exact test was used for the inter-group comparison of the variable, as the data did not satisfy the assumptions required for the Chi-square test (e.g., low expected frequency).

Table 4. Comparison of perioperative hypothermia and shivering between the observation and control groups.

Variables	Observation group (n = 59)	Control group (n = 71)	Statistic	p
Duration of hypothermia (min)	18.50 (15.75, 25.00)	92.00 (66.50, 117.50)	Z = −5.11	<0.001
Incidence of hypothermia, n (%)			-	0.004
None	47 (79.66)	36 (50.70)		
Mild	8 (13.56)	17 (23.94)		
Moderate	3 (5.08)	10 (14.08)		
Severe	1 (1.69)	8 (11.27)		
Severity of shivering, n (%)			-	0.030
None	50 (84.75)	47 (66.20)		
Mild	8 (13.56)	13 (18.31)		
Moderate	1 (1.69)	8 (11.27)		
Severe	0 (0.00)	3 (4.23)		

Notes: "-" indicates that Fisher's exact test was used for the inter-group comparison of the variable, as the data did not satisfy the assumptions required for the Chi-square test (e.g., low expected frequency).

cantly lower than that in the control group at 24 and 48 hours after surgery ($p < 0.05$). The incidence of postoperative infections in the observation group was also significantly lower than that in the control group ($p < 0.05$). There was a difference in the incidence of postoperative postural nerve damage between the two groups, which was not significant (Table 5).

Assessment of Postoperative Recovery

Data on the time to first in-bed activity, the time to first out-of-bed activity, and the average length of hospital stay for both groups of patients were normally distributed, and an independent samples t-test was performed. The time to first in-bed activity, the time to first out-of-bed activity, and the average duration of hospital stay in the observation group were significantly shorter when compared with the control group, indicating a more rapid recovery process in the patients of the observation group ($p < 0.001$, Table 6).

Discussion

In recent years, comprehensive nursing care has been increasingly applied to patients undergoing various types of surgery, with consistently positive clinical outcomes. The core concept of comprehensive nursing care lies in establishing a multidisciplinary team consisting of various specialty experts to develop and execute systematic and comprehensive nursing measures for patients [22]. As pointed out by Xu *et al.* [23], multidisciplinary nursing can significantly relieve patients' anxiety and depression through preoperative psychological counseling, improve treatment efficacy, and thus speed up postoperative recovery. The application of perioperative temperature management measures (such as the use of a forced-air warming system) in comprehensive nursing has been proven to effectively reduce hypothermia-related complications such as infections, coagulation dysfunction, and delayed awakening [24]. Effective warming measures may reduce the occurrence of infections by minimizing the body's stress response and immunosuppression risk [25]. Elderly patients undergoing lumbar spine surgery are at increased risk for postoperative

Table 5. Comparison of the incidence of postoperative complications between the observation and control groups.

Variables	Observation group (n = 59)	Control group (n = 71)	Statistic	p
Pressure injury—12 hours postoperatively, n (%)			-	0.500
No	59 (100.00)	69 (97.18)		
Yes	0 (0.00)	2 (2.82)		
Pressure injury—24 hours postoperatively, n (%)			χ^2 = 7.03	0.008
No	57 (96.61)	59 (83.10)		
Yes	2 (3.39)	13 (18.31)		
Pressure injury—48 hours postoperatively, n (%)			χ^2 = 7.38	0.007
No	53 (89.83)	50 (70.42)		
Yes	6 (10.17)	21 (29.58)		
Infections, n (%)			χ^2 = 4.41	0.036
No	56 (94.92)	59 (83.10)		
Yes	3 (5.08)	12 (16.90)		
postural nerve damage, n (%)			χ^2 = 0.50	0.481
No	58 (98.31)	67 (94.37)		
Yes	1 (1.69)	4 (5.63)		

Notes: "-" indicates that Fisher's exact test was used for the inter-group comparison of the variable, as the data did not satisfy the assumptions required for the Chi-square test (e.g., low expected frequency).

Table 6. Comparison of postoperative clinical outcomes between the observation and control groups.

Variables	Observation group (n = 59)	Control group (n = 71)	Statistic	p
Time to first in-bed activity (hours)	8.76 ± 2.14	12.07 ± 2.40	t = −8.21	<0.001
Time to first out-of-bed activity (days)	3.83 ± 1.98	5.25 ± 2.11	t = −3.93	<0.001
Average length of hospital stay (days)	9.97 ± 3.05	11.89 ± 2.61	t = −3.87	<0.001

complications due to their advanced age, substantial anxiety and depression, and higher anesthetic dose administered, which often impairs their recovery process [26,27]. Patients undergoing lumbar spine surgery are often required to assume a prone position, which predisposes them to perioperative hypothermia and postoperative positional nerve injury, severely impacting treatment outcomes and quality of life [9,28]. Therefore, a more effective and systematic perioperative nursing intervention should be applied to these patients.

In this retrospective study, 130 elderly patients underwent prone lumbar spine surgery, with 59 patients receiving comprehensive nursing care while 71 subjects received routine care. Both the observation and control groups demonstrated comparable distributions in terms of surgical procedures, which supports our inference that variations in patient outcomes were likely attributed to nursing interventions, rather than surgical factors. The comprehensive nursing care—encompassing preoperative education, psychological support, intraoperative coordination, and forced-air warming—yielded multi-stage benefits. Compared to the controls, the subjects in the intervention group showed reduced preoperative anxiety and depression, lower incidence and severity of perioperative hypothermia and shivering, and lower rates of postoperative pressure injuries and infections. It is particularly noteworthy that the improvements in pressure injuries were primarily observed in the 24-hour and 48-hour stages postoperatively, indicating that individualized posture management in comprehensive nursing care was instrumental in halting the progression of early tissue damage [29]. This finding is consistent with the conclusion of Gu *et al*. [30], whose results suggest that using specialized materials to reduce interface pressure in prone-position surgery can significantly lower the risk of pressure sores and nerve compression injuries.

In this study, compared to the control group, the observation group exhibited a lower incidence of perioperative hypothermia and a postoperative infection rate. This can be explained by the fact that hypothermia is a known risk factor for postoperative infections, providing a reasonable explanation for the significant reduction in postoperative infections when the hypothermia incidence was diminished [31]. A lack of statistical difference in the incidence of postural nerve damage between the two groups is probably attributable to the low incidence of this complication (0.03%–0.1%) [32] and the small sample size of this study. Thus, future studies involving larger samples are warranted to further verify the effect of comprehensive nursing on this rare complication. At the same time, the time to first in-bed activity, the time to first out-of-bed activity, and the average duration of hospital stay in the observation group were significantly shorter when compared with the control group, indicating that the comprehensive nursing model helps accelerate postoperative recovery while improving patients' mental health. The study of Deshpande *et al*. [33] showed that alleviating anxiety and depression has a positive impact

on patient prognosis, with the cortisol level potentially underlying the mechanism. Elevated cortisol levels may delay wound healing. The accelerated postoperative recovery (ERAR) nursing model shares similarities with the approach used in this study. Liu *et al*. [34] reported that ERAR nursing reduces both the average length of hospital stay and the incidence of complications, findings that align with the results of the present study. Combined with existing literature, our results suggest that comprehensive nursing alleviates preoperative depression and anxiety, reduces the incidence of perioperative hypothermia, and improves patient prognosis and clinical outcomes.

This study has several limitations. Firstly, the single-center retrospective design adopted, as well as a small sample size, may restrict the generalizability of our findings. Secondly, this study utilized a lower age limit of 55 years because patients aged $\geq$55 years with degenerative lumbar spine disease often exhibit age-related physiological decline and perioperative risk profiles comparable to those of patients aged $\geq$60 years; nevertheless, it is crucial to interpret the findings with caution, as age-related selection bias could have been introduced. Thirdly, the emphasis on short-term outcomes without long-term follow-up may underestimate the sustained benefits of the intervention. Additionally, the bundled design of the comprehensive nursing model, while clinically realistic, precludes assessment of the effects of individual components. Finally, the use of time-series-based grouping may introduce selection bias due to unaccounted temporal trends. Furthermore, perioperative outcomes could be influenced by multiple factors beyond nursing, including surgical factors such as the increasing use of minimally invasive techniques, which independently affect recovery [35]. Future prospective studies should account for these additional variables.

Conclusions

Comprehensive nursing care represents a multidisciplinary collaborative model that relieves preoperative anxiety and depression in elderly patients undergoing prone lumbar spine surgery, reduces the incidence of perioperative hypothermia and shivering, minimizes postoperative complications such as infections and pressure injuries, and promotes early ambulation and overall recovery. These beneficial impacts likely stem from the synergistic effects of preoperative psychological intervention, perioperative temperature management, and systematic postoperative care. Hence, the comprehensive nursing model should be implemented on a larger scale, and its utility and cost-effectiveness should be further evaluated across diverse clinical specialties.

Availability of Data and Materials

The data used and analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

YL and HY designed the research study. YL performed the research. HY analyzed the data. YL and HY drafted the article. Both authors contributed to the critical revision of the manuscript for important intellectual content. 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 Taihe County People's Hospital (approval number: 2020-10), and all procedures followed the principles of the Declaration of Helsinki. Since this is a retrospective study with fully anonymized data that cannot be traced back to individuals, the requirement for informed consent was waived by the Ethics Committee of Taihe County People's Hospital.

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Conflict of Interest

The authors declare no conflict of interest.

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