

## Review Article

# Pressure ulcer nursing for patients undergoing spinal surgery can reduce the incidence of pressure ulcers and improve the quality of life

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**Abstract:** To explore the effects of pressure ulcer nursing on patients undergoing spinal surgery. Patients who underwent spinal surgery in our hospital were selected, among which 110 cases given routine nursing were included as the control group (CG), and 121 cases given specific nursing for pressure ulcers were enrolled as the observation group (OG). The incidence of pressure ulcers and quality of life (QOL) scores were compared between the two groups. The Braden scale score did not differ markedly between the two groups before the intervention ( $P>0.05$ ), while it improved in both groups after the intervention, and the Braden scale score in the OG was significantly higher than that in the CG ( $P<0.05$ ). The post-nursing total incidence of pressure ulcers in the OG was notably lower than that in the CG ( $P<0.001$ ). After intervention, the scores of negative emotions were improved in both groups, while the effect was more significant in the OG. The visual analog score (VAS) in the OG was evidently lower than that in the CG ( $P<0.05$ ). Short-Form 36 Item Health Survey (SF-36) was employed to evaluate the QOL of patients in the two groups after intervention. The scores for role, social, physical and emotional functions of the patients in the OG were higher than those in the CG ( $P<0.05$ ). Through the statistical investigation, it was found that the nursing satisfaction in the OG was remarkably higher than that in the CG ( $P<0.05$ ). Logistic regression analysis showed that older age, high body mass index (BMI), long operation time and lack of nursing care were all risk factors affecting the occurrence of pressure ulcers. Pressure ulcer nursing can profoundly reduce the incidence of pressure ulcers after spinal surgery and improve the QOL of patients.

**Keywords:** Pressure ulcer nursing, spinal surgery, incidence of pressure ulcers, quality of life

## Introduction

Pressure ulcers, which are mainly characterized by epidermal damage and ulcers in the early stage, that can generate into cavities with long lasting pus and fluid flow induced by deep dermal infiltration in the later stages, is a disease that stems from long-term compression and poor blood circulation that gives rise to ischemic necrosis of tissues, and as such it has become focus of global medical care [1, 2]. Pressure ulcers account for up to 30% of medical health problems around the world, of which patients with spinal injuries account for a large proportion, and the incidence of pressure ulcers in amputations are as high as 86% [3]. Spinal surgery is relatively traumatic, and it can

trigger significant impacts on systemic resistance, plus since the length of the operation is long, pressure ulcers can easily occur [4]. Once a pressure ulcer occurs in patients with spinal injuries, it will both cause a long-term unhealed condition, and be secondary to bacterial infection, which can easily stress the body, and eventually lead to death [5]. However, patients with spinal injury are prone to develop infections due to their catabolic status [6, 7]. Therefore, timely treatment and nursing care for patients with spinal surgery is crucial to reduce the occurrence of pressure ulcers.

With the continuous development of better social interactions and medical technology and the continuous improvement of people's QOL,

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the nursing intervention model has played an indispensable role in clinical diagnosis and treatment [8]. Whereas, the conventional nursing intervention model can no longer meet the growing needs of patients, thus it is necessary to find a model that lives up to people's needs [9]. A related review describes the application of comprehensive nursing management in patients with spinal injury and proposes the concept of local wound care [1]. Therefore, this study mainly explores the effect of pressure ulcer nursing on patients undergoing spinal surgery, where targeted surgical nursing was carried out, preoperative evaluation on patients was conducted, possible postoperative complications were predicted, and relevant measures were taken in a timely manner to intervene in combination with rich nursing care, so as to minimize the incidence of pressure ulcers.

## Methods

### *General information*

A total of 231 patients who underwent spinal surgery in Cangzhou Central Hospital were collected as the research participants. Among them, 110 patients receiving routine nursing were set as the CG, including 59 males and 51 females, with an average age of  $(48.76 \pm 8.13)$  years old. While the other 121 patients, including 65 males and 56 females, with an average age of  $(48.32 \pm 8.01)$  years, received pressure ulcer nursing in addition to the treatment in the CG were selected as the OG.

**Inclusion criteria:** All patients who chose the prone position to receive surgery, and were accompanied by family members at admission and willing to receive reexamination and follow-up, with complete clinical data. This study was informed and patients and their families signed the informed consent, and this study was approved by the Medical Ethics Committee of Cangzhou Central Hospital.

**Exclusion criteria:** Patients with communication barriers or if there was any concealment from the medical staff; patients who could not tolerate surgery; patients transferred from other hospitals; patients with severe liver and kidney dysfunction; patients combined with malignant tumors, immune system issues or other diseases.

### *Nursing methods*

**CG:** The routine nursing intervention mode was adopted, including assisting patients in routine examination, informing patients of matters needing attention during surgery, closely monitoring vital sign changes of patients, giving patients dietary guidance, and keeping the ward clean and hygienic.

**OG: Preoperative:** A dedicated nursing team was established before surgery, and having well-mastered knowledge about pressure ulcers was a must for all members. The patient's body and skin conditions were evaluated before the surgery, and the risk of pressure ulcers was assessed with the pressure ulcer assessment scale before formulating specific targeted nursing measures. The characteristics, precautions and matters needing attention for pressure ulcers were introduced to the patients and their families. According to the psychological state of the patients, the patient was gently and patiently given some support and comfort, and relevant doctors for counseling were there when needed, as to eliminate any negative emotions and increase their self-confidence. The correct posture for surgery was explained before the operation, and the corresponding drugs or moisturizing products were applied to the areas where they might be easily oppressed for a long time during the operation, and massages were carried out to promote blood circulation of patients. **Intraoperative:** A special arched spine bed frame was prepared for the operation in order to reduce the pressure of the skin, and foam tape was applied in the pressure ulcer-prone areas. The appropriate nursing instruments were selected to help keep the patient's limbs in functional positions as far as possible, and the genitals or breasts of the patients were placed in a hollow position of the posture pad. During the operation, the medical staff performed gentle movements and helped keep patients warm to prevent poor peripheral blood circulation due to low temperature. In addition, a thermal insulation blanket was available for patients to cover the parts that were not surgically operated on, and the appropriate temperature of the fluid was ensured if intraoperative infusion was carried out. At the same time, the compressed part of the patient was massaged regularly, and the skin color of the patient was given close atten-

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**Table 1.** Comparison of clinical data between the two groups (x ± sd)/n [%]

	CG (n = 110)	OG (n = 121)	X <sup>2</sup> /t	P
Gender			0.000	0.990
Male	59 (53.64)	65 (53.72)		
Female	51 (46.36)	56 (46.28)		
Average age (years old)	48.76±8.13	48.32±8.01	0.679	0.414
BMI (kg/m <sup>2</sup> )	22.87±3.42	22.91±3.24	0.091	0.927
History of smoking			0.000	0.989
Yes	39 (35.45)	43 (35.54)		
No	71 (64.55)	78 (64.46)		
History of drinking			0.036	0.849
Yes	45 (40.91)	51 (42.15)		
No	65 (59.09)	70 (57.85)		
Place of residence			0.020	0.889
Urban	30 (27.27)	34 (28.10)		
Rural	80 (72.73)	87 (71.90)		
Type of surgery			0.061	0.970
Thoracolumbar surgery	38 (34.55)	41 (33.88)		
Lumbar surgery	40 (36.36)	43 (35.54)		
Cervical vertebrae surgery	32 (29.09)	37 (30.58)		

tion during the operation. In case of hypoxia and ischemia, corresponding measures were taken in real time. Postoperative: The patient's operative site was kept dry and the examination of the compressed site was intensified. The skin condition was observed and recorded regularly, and any situations were intervened with and dealt with on time. The patients' nutritional intake was enhanced, and they were instructed to wear soft and breathable cotton clothes as much as possible. What's more, the medical staff helped the patients to improve the hospital environment, strengthened the intervention of sanitary conditions in the ward, and actively communicated with patients to dispel their concerns and fears.

### Detection of outcome measures

1) The preoperative pressure ulcer risk of patients in the two groups was evaluated with Braden scale [10], and the difference was compared. According to the pressure ulcer staging [11] standards recommended by the American National Pressure Ulcer Advisory Panel, the occurrence of pressure ulcers in each period in the two groups after surgery was statistically analyzed. 2) The self-rating anxiety scale (SAS) and depression self-rating scale (SDS) scores

[12] were adopted to evaluate any negative emotions before and after the nursing intervention. Visual analogue score (VAS) [13] was utilized to assess the pain of patients at the compression site one day after operation. 3) SF-36 [14], which included role, social, body, and emotional function scores, was used to evaluate the QOL after intervention in two groups of patients, and the satisfaction of the two groups of patients with nursing was calculated.

### Statistical methods

SPSS 19.0 software system (IBM, SPSS, Chicago, IL, USA) was employed for statistical analysis of the experimental data. The counting data were represented by [n (%)], and chi-square test was adopted for

comparison between groups. The measurement data were described as (x ± s), the inter-group comparison was performed by t test, while the multi-group comparison before and after intervention was conducted by repeated measures ANOVA, and LSD-t was utilized for the post-hoc test. Logistic regression was utilized for multivariate analysis. A significant difference was indicated by P<0.05.

## Results

### Comparison of general clinical data between the two groups

Sorting out the clinical data of the two groups for comparison (**Table 1**), it was found that there was no significant difference in general data between the two groups such as gender, age, body mass index (BMI), smoking and drinking, place of residence and type of surgery (P>0.05), suggesting comparability.

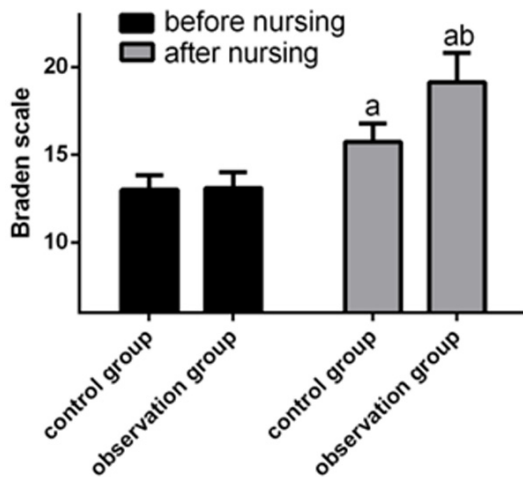
### Risk assessment and comparison of pressure ulcers before and after intervention between the two groups

The pressure ulcers risk of patients in the two groups before intervention was rated by Braden scale, and the results are shown in **Table 2**.

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**Table 2.** Risk assessment of pressure ulcers in the two groups n [%]

	No risk	Low risk	High risk	Extremely high risk
CG (n = 110)	49 (44.55)	29 (26.36)	19 (17.27)	13 (11.82)
OG (n = 121)	57 (47.11)	35 (28.92)	18 (14.88)	11 (9.09)
$\chi^2$	0.152	0.189	0.246	0.460
P	0.696	0.664	0.620	0.498



**Figure 1.** Comparison of Braden scale scores between the two groups. After the intervention, the Braden scale scores improved in the two groups, and the scores in the OG were remarkably higher than those in the CG ( $P < 0.05$ ). Note: a indicates  $P < 0.05$  compared with that before intervention, and b indicates  $P < 0.05$  compared with the CG.

There was no significantly different in the risk rating of all levels between the two groups ( $P > 0.05$ ). As shown in **Figure 1**, the Braden scale scores in the two groups before the nursing intervention were not remarkably different ( $P > 0.05$ ). While the scores became elevated in both groups after the intervention, the scores in the OG were noticeably higher than the CG ( $P < 0.05$ ).

### Comparison of the incidence of postoperative pressure ulcers between the two groups

Statistics on the incidence of postoperative pressure ulcers in the two groups are shown in **Table 3**. As we can see, the incidence of pressure ulcers in the OG was 5.78% without any case of degree III and IV ulcers; while the incidence of pressure ulcers in the CG was 24.55%. Inter-group comparison revealed that the total incidence of pressure ulcers in the OG was sig-

nificantly lower than that in the CG ( $P < 0.001$ ).

### Emotional changes before and after intervention in the two groups

The SAS and SDS scores of the two groups before nursing intervention were observed (**Figure 2**). The scores of negative emotions before nursing did not reveal any marked difference between the two groups ( $P > 0.05$ ). While after intervening by different nursing modes, the SAS and SDS scores decreased in both groups, and the SAS and SDS scores in the OG were lower than those in the CG ( $P < 0.05$ ).

### Comparison of pain in the compressed area between the two groups

VAS was applied to evaluate the pain in the compressed area of the patients. The results (**Figure 3**) revealed a difference in post-nursing VAS score between the two groups, and the VAS score in the OG was lower than that in the CG, with a statistically significant difference ( $P < 0.05$ ).

### Comparison of QOL between the two groups

SF-36 was used to evaluate the post-nursing QOL of patients in the two groups, and the results are shown in **Figure 4**. It can be seen that there were differences between the two groups in the scores of role, social, body and emotional functions, and the scores in the OG were higher than those in the CG ( $P < 0.05$ ).

### Survey of nursing satisfaction in the two groups

After a series of follow up surveys (**Table 4**), it was calculated that the nursing satisfaction in the CG was 76.36%, while that in the OG was 89.26%; indicating that the nursing satisfaction in the OG was significantly higher than that in the CG ( $P < 0.05$ ).

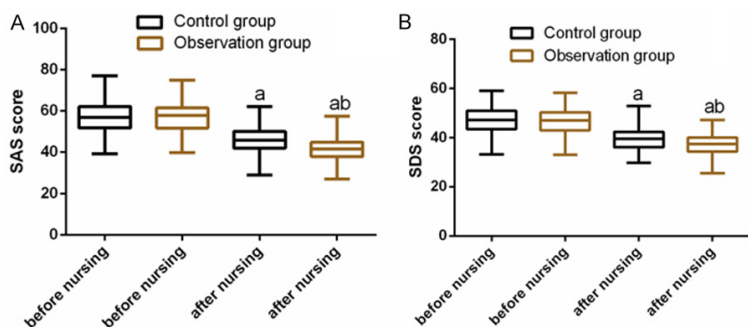
### Analysis of related factors for pressure ulcers

In order to further explore the risk factors affecting pressure ulcers, we collected related data for analysis (**Table 5**). According to whether pressure ulcers occurred, the patients were divided into pressure ulcer group ( $n = 34$ ) and non-pressure ulcer group ( $n = 197$ ). It was

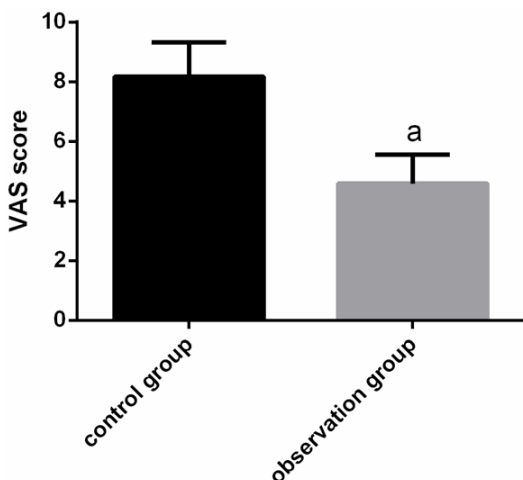
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**Table 3.** Incidence of pressure ulcers in the two groups n [%]

	I	II	III	IV	Incidence
CG (n = 110)	13 (11.82)	8 (7.27)	4 (3.64)	2 (1.82)	24.55%
OG (n = 121)	5 (4.13)	2 (1.65)	0 (0.00)	0 (0.00)	5.78%
$\chi^2$					16.160
P					<0.001



**Figure 2.** Comparison of negative emotional scores between the two groups. A. Comparison of SAS scores between the two groups; B. Comparison of SDS scores between the two groups. Note: an indicates  $P < 0.05$  compared with that before intervention, and b indicates  $P < 0.05$  compared with the CG.



**Figure 3.** Comparison of VAS scores between the two groups. The VAS score in the OG was markedly lower than that in the CG, and the difference was statistically significant ( $P < 0.05$ ). Note: a indicates  $P < 0.05$  compared with the CG.

found that there were differences in age, BMI, operation time, and pressure ulcer nursing between the two groups ( $P < 0.001$ ). Therefore, we further assigned values to the differences (Table 6). The results of Logistic regression analysis are shown in Table 7. It can be seen that old age, high BMI index, long operation

time, and the use of pressure ulcer nursing are all significant factors affecting the occurrence of pressure ulcers in post-operative patients (Table 7).

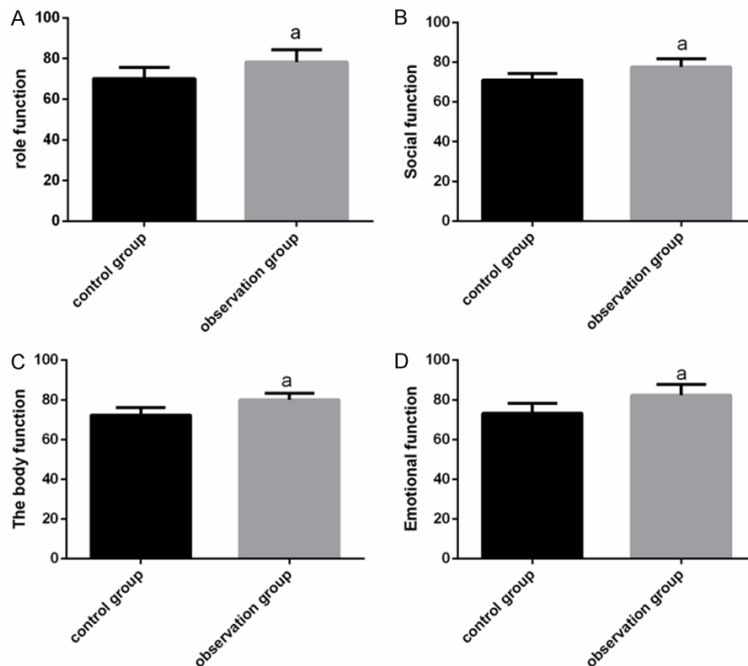
### Discussion

Due to the current advances in medical technology, the life expectancy of patients with spinal injury has been greatly improved in the past few decades [15]. However, pressure ulcers, as one of common post-operative complications, seriously plagues the QOL of patients, and as the incidence and mortality of spinal injuries increase, the prevalence of pressure ulcers may increase by 30-50% [16]. In addition, it is reported that approximately one third of patients have a history of pressure ulcers, and nearly half are diagnosed with

pressure ulcers [17]. For patients with pressure ulcers, proper posture to reduce stress contributes to the healing of stage I and II pressure ulcers; while surgery becomes necessary for those with stage III-IV in most cases. However, it is quite tricky to achieve efficient healing due to the lack of sufficient soft tissue to fill in the gap of deep ulcers [16, 18]. Therefore, early nursing intervention is very important in clinical treatment.

In prone spinal surgery, most patients experience pain in the compressed area and pressure ulcers, which is not conducive to postoperative recovery [19]. The Braden scale is one of the most commonly used risk assessment tools for pressure ulcers, and a higher score indicates a lower risk [20, 21]. In order to better carry out nursing work, we used the Braden scale before surgery, and combined the patient's basic conditions to rate the risk of pressure ulcers. The results showed no noteworthy difference in pressure ulcer risk ratings and scores between the OG and the CG, which provided feasibility for subsequent comparison of experimental research. After the intervention of the pressure ulcer nursing team, the Braden scale scores in both groups improved considerably; and the OG did not experience pressure

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**Figure 4.** QOL scores in the two groups. A. Role function score of the two groups; B. Social function score of the two groups; C. Body function score of the two groups; D. Emotional function score of the two groups. Note: a indicates  $P < 0.05$  compared with the CG.

**Table 4.** Comparison of nursing satisfaction between the two groups

	Very satisfied	Satisfied	Dissatisfied	Satisfaction
CG (n = 110)	31 (28.18)	53 (48.18)	26 (23.64)	76.36%
OG (n = 121)	49 (40.50)	59 (48.76)	13 (10.74)	89.26%
$\chi^2$				6.825
P				0.009

ulcers of III or IV after pressure ulcer nursing; with a remarkably lower incidence of pressure ulcers and notably higher Braden scale score than the CG, indicating that pressure ulcer nursing was effective in patients undergoing spinal surgery. Since the prevention and treatment of pressure ulcers are highly correlated with wound care professionals [22], we hypothesized the reason behind the preceding results may be that pressure ulcer nursing was mainly aimed at the problems of high and frequent incidence of pressure ulcers in patients undergoing spinal surgery in prone position; where specialized and professional preventive measures are taken accordingly, effectively reducing the risk of pressure ulcers. Meanwhile, preoperative risk assessment of intraoperative pressure ulcers and specialized education

and communication of pressure ulcers were strengthened; which laid the foundation for targeted, purposeful and planned posture management in spinal surgery, and thus reduced the occurrence of posture-induced pressure ulcers. What's more, the concept of prevention still ran through after the operation, and the skin management and information processing of patients were strengthened to ensure the timeliness of the diagnosis and treatment of complications.

Being bedridden for a long time often brings about some certain negative emotions in patients undergoing spinal surgery, which will inevitably result in a prolonged recovery time, weighting against the cure of the disease [23, 24]. Moreover, long-term compression of tissue often causes some pain [25]; while as reported by related research, reducing pain can help patients build confidence in early recovery [26]. Therefore, effective relief of patients' pain and negative conditions is of the essence. In this study, the anxiety and depression of the two groups were remarkably relieved after related nursing interventions, the VAS score was notably reduced, and the effect of pressure ulcer nursing was more pronounced. The reason behind it could be that the patients had a certain fear of the operation and complications at first, while after targeted nursing interventions, the occurrence of pressure ulcers was noticeably reduced, increasing their confidence of cure. Furthermore, suitable and soft protective gear was used during the pressure ulcer nursing to reduce the friction of the skin, while reducing the pressure ulcer, the pain caused by the pressure ulcer was also relieved. SF-36 is often used to evaluate the QOL of cured patients with spinal injury [27]. Therefore, we applied SF-36 scale to evaluate the QOL of patients in the two

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**Table 5.** Relevant factors data for the occurrence of pressure ulcers n [%]

	Pressure ulcer group (n = 34)	Non-pressure ulcer group (n = 197)	X <sup>2</sup>	P
Gender			0.078	0.780
Male	19 (55.88)	105 (53.30)		
Female	15 (44.12)	92 (46.70)		
Age			14.760	<0.001
≥50	24 (70.59)	70 (35.53)		
<50	10 (29.41)	127 (64.47)		
History of smoking			1.294	0.255
Yes	15 (44.12)	67 (34.01)		
No	19 (55.88)	130 (65.99)		
History of drinking			0.181	0.670
Yes	13 (38.24)	83 (42.13)		
No	21 (61.76)	114 (57.87)		
BMI (kg/m <sup>2</sup> )			32.740	<0.001
≥24	27 (79.41)	56 (28.43)		
<24	7 (20.59)	141 (71.57)		
Operation time			17.290	<0.001
≥4 h	25 (73.53)	70 (35.53)		
<4 h	9 (26.47)	127 (64.47)		
Pressure ulcer nursing			16.160	<0.001
Yes	7 (20.59)	114 (57.87)		
No	27 (79.41)	83 (42.13)		

**Table 6.** Assignment table

	Assignment
Age	≥50 years old = 1, <50 years old = 2
BMI	≥24 kg/m <sup>2</sup> = 1, <24 kg/m <sup>2</sup> = 2
Operation time	≥4 h = 1, <4 h = 2
Pressure ulcer nursing	Yes = 1, no = 2

groups after discharge. The results showed that there were differences in role, social, physical and emotional function scores between the two groups, and the scores were higher in the OG with pressure ulcer nursing. It is speculated that the application of pressure ulcer nursing greatly reduced the risk of complications and contributed to the cure of the disease. In addition, the nursing staff always maintained patience and kindness during the intervention, which improved the patient's cooperation in treatment. Studies have suggested that the formation of pressure ulcers is affected by a variety of risk factors such as malnutrition, decreased/lack of sensation, and inactivity [28]. Therefore, after the operation, the nursing staff carried out professional indices and management on the patient's life and diet, which

ensured the proper nutrition needed by the patient's body for recovery, assisted to develop a healthy and active work and rest, and maximally improved the healing time of the wound; thus paving the way for the improvement of the QOL in the future. Finally, we surveyed nursing satisfaction.

The results demonstrated that the satisfaction of the pressure ulcer targeted nursing was higher than that of routine nursing, which indicated that patients recognized the pressure ulcer nursing mode, validating that the pressure ulcer nursing had more clear advantages such as systematicness, initiative and predictability. This nursing method makes the nursing work more standardized, avoids a series of postoperative pressure ulcer triggered problems such as deterioration of diseases, and maximally improves the quality of nursing. It brings better medical experience to patients, helps to improve the doctor-patient relationship, and provides strong evidence for future clinical promotion. Then we analyzed the risk factors of pressure ulcers, and the results showed that older age, high BMI, long operation time, and no use of pressure ulcer nursing

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**Table 7.** Multivariate analysis

	B	SD	X <sup>2</sup>	P	HR (95% CI)
Age	1.301	0.484	7.216	0.007	3.674 (1.422-9.494)
BMI	2.120	0.494	18.382	0.000	8.331 (3.161-21.958)
Operation time	1.383	0.484	8.180	0.004	3.988 (1.545-10.290)
Nursing of pressure sore	-1.508	0.511	8.718	0.003	0.221 (0.081-0.602)

were all risk factors affecting the occurrence of pressure ulcers. This result provides a certain basis for reducing the occurrence of pressure ulcers in the future, so that we can solve the problem at the root and take positive measures to deal with it.

This study mainly explored the application value of pressure ulcer nursing in patients undergoing spinal surgery. However, there are certain limitations since other complications that may have affected the recovery of the disease after spinal surgery were absent in this study. The research in this direction can be strengthened in future study.

In summary, pressure ulcer care can significantly reduce the incidence of pressure ulcers after spinal surgery and improve the QOL of patients.

### Disclosure of conflict of interest

None.

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