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Clinical Analysis of Pressure Ulcer Patient Nursing Intervention Based on Braden Scale

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Abstract: Pressure ulcer is one of the most typical complications in clinical nursing, mainly appearing in bedridden patients with weak mobility or the elderly. They not only bring about patients' pain and prolonged hospitalization, but also may cause severe infection and even lead to death, causing a huge burden to the health system. At present, clinical pressure ulcer prevention and nursing exists problems such as very subjective evaluation of pressure ulcer risk, lack of targeted nursing intervention, and nursing quality inconsistency, making it hard to control the incidence of pressure ulcers effectively. This paper establishes the systematic nursing intervention based on the Braden scale. One aspect is to establish the standardized pressure ulcer risk assessment process. Another aspect is to design graded and personalized nursing intervention plan. The last aspect is to establish the comprehensive quality control and effectiveness evaluation mechanism. The prospective controlled study based on the system is conducted in 240 hospitalized patients. The results showed that the incidence of pressure ulcers in the observation group who received systematic nursing intervention based on the Braden scale was only 4%, while the incidence in the control group was 16%. In addition, no patients in the observation group developed pressure ulcers of stage II or above, while 4 patients in the control group developed severe pressure ulcers. The average length of hospital stay in the observation group was 11 days, which was 2 days shorter than that in the control group. It is indicated that nursing intervention based on the Braden scale can effectively reduce the risk of pressure ulcers and improve the quality of clinical nursing.

1. Introduction

Pressure ulcers are also called pressure injuries. They are caused by the damage of local tissues due to the constant pressure, in which the blood supply is cut off, the ischemia, hypoxia and malnutrition cause the ulceration and necrosis of the tissue. It has become a new problem in the world's health field. The incidence of pressure ulcers among inpatients in general hospitals in China is 3% ~ 14%, and it is as high as 18% ~ 39% in the intensive care room. The medical cost for pressure ulcer treatment reaches several billion yuan every year. In addition to seriously affecting the quality of patients' life, increasing the possibility of complications and death, pressure ulcers also increase the nursing workload and medical cost, and is one of the important indicators to

evaluate the quality of nursing. This article aims to study the application value of Braden scale in the risk assessment of pressure ulcers, establish a scientific and standardized nursing intervention system, and provide theoretical basis and reference for the clinical practice of pressure ulcers prevention. The study range is inpatients in internal medicine, surgery, geriatrics and intensive care, focusing on the high-risk group of inpatients who have been lying in bed for a long time, can't move freely and malnutrition. This research project has important practical significance in promoting the scientific and standardized pressure ulcer prevention, reducing the consumption of medical resources and improving the prognosis of patients.

The basis of the analysis in this paper comes from three aspects: first, the systematic review and meta-analysis of the application of Braden scale in pressure ulcer risk assessment show that the Braden scale has good reliability and validity; second, the experience and lessons in the process of clinical nursing work, the experience of pressure ulcer prevention shows that untimely risk assessment and insufficient intervention are the main causes of pressure ulcers; third, the idea of evidence-based nursing and quality improvement method are used to provide the methodological basis for the establishment of systematic nursing intervention based on Braden scale. The main problems to be solved by this paper are as follows: how to establish a standardized Braden scale assessment process and reduce the subjective feelings of assessor; how to develop different nursing interventions according to the risk level and achieve precise nursing; how to establish an effective quality control mechanism and ensure the implementation of nursing measures. The innovation of this paper is reflected in the following three aspects: the first is to accurately match the six dimensions of Braden scale and nursing intervention, and achieve the connection between the results of assessment and interventions; the second is to establish a closed loop of "assessment-intervention-monitoring-feedback" and form a continuous quality improvement mechanism; the third is to establish a multidisciplinary collaborative pressure ulcer prevention team, and integrate the advantages of doctors, nurses, nutritionists and rehabilitation therapists.

This study adopted prospective controlled method, randomly chose 240 hospitalized patients who met inclusion criteria as the research objects and extracted observation group and control group randomly, 120 in each. The control group adopted routine nursing. Observation group adopted nursing interventional according to Braden scale. The technical approach of implementation: firstly, training for nursing staff is taken, making them master the operation and scoring of Braden scale. Secondly, dynamic assessment method is established. It includes assessment within 24 hours after admission initially, and then assessment every day for high risk patients and assessment for changing in their condition. Thirdly, patients are classified into 4 levels according to Braden score: low level (15-18 points), intermediate level (13-14 points), high risk level (10-12 points) and very high risk level (≤9 points) and corresponding nursing intervention is taken for them. At last, pressure ulcer monitoring and registration system is established, effect is evaluated, and data is analyzed periodically. Effectiveness of nursing interventional based on Braden scale was evaluated by comparing incidence, time of onset, severity, length of hospital stay and nursing satisfaction between 2 groups. Logistic regression analysis was adopted to explore independent risk factor of pressure ulcer onset for providing basis for further optimization of prevention.

2. Related Work

Systematic nursing according to the Braden scale is widely used in pressure ulcer prevention, but scholars are still trying to improve Braden assessment, intervention and quality control from different angles. Osuagwu et al. promoted the development of pressure monitoring technology based on the lack of objective and continuous risk assessment of pressure ulcer with traditional Braden assessment based on subjective experience, and verified the feasibility of obtaining

real-time pressure information for each body part of patients in objective pressure assessment [1]. Hümeyra noticed the weakest link of home care after discharge, and found that the family caregiver training research could improve the prevention knowledge and skills of caregivers, enhance the compliance of pressure ulcer prevention in bedridden patients who had a long stay in hospital, and reduce the incidence of pressure ulcer [2]. Javid et al. designed an automatic mattress to solve the problem of poor compliance of manual turning. Wearable sensors were used to remind the caregiver to turn over the patient in time, and the turning rate was increased from 64% to 98% [3]. Collier et al. discussed the basis of science of patient positioning and protective equipment. They believed that improper positioning was an important iatrogenic factor. If standardized positioning was used in combination with appropriate pressure-reducing equipment, the incidence would be reduced [4]. Joo et al. did initial clinical trial of wearable sensors (Leaf patient monitoring system), put sensors on the chest to monitor the change of body position, send real-time wireless alarm to patients and nurses at the same time, and verified that wearable sensors were effective in improving compliance of turning [5]. Babaei et al. systematically reviewed the application of information technology in pressure ulcer prevention, including mobile risk assessment apps, electronic nursing records, remote monitoring and online health education, and concluded that informatization could standardize management and improve nursing work efficiency by 35% [6]. Isaifan et al. promoted the implementation of pressure ulcer prevention program in hospital (including Braden assessment, skin care, nutritional support and staff training), and found that the incidence of hospital-acquired pressure ulcers decreased from 11.7% to 2.1% [7]. Nieva-Sausa et al. selected newborns and children as a special population and systematically reviewed the preventive measures of skin care, nutritional support and body positioning, and found that neonatal pressure ulcers were associated with preterm birth, low birth weight and pressure from medical devices [8]. Shouli et al. studied the knowledge and attitudes of Palestinian hospital nurses on pressure ulcer prevention, and found that insufficient training was the main cause of the lack of implementation of prevention programs, and called for standardized training [9]. Elesawy et al. studied the effect of pressure ulcer prevention program on nurse performance and orthopedic patients' outcomes, and found that multidisciplinary training and evidence-based protocols training could reduce incidence, and improve healing quality [10]. In summary, the above studies have validated the key role of Braden scale in risk stratification, and proved that the technology-assisted monitoring, caregiver training, and bundled intervention could all get the expected effect. However, most of the above studies focused on either technology or education, and rarely combined standardized assessment, stratified intervention, and closed-loop quality control into a whole systematic model. Moreover, the long-term implementation effect and cross-scenario effect of above integrated models need further study.

3. Method

3.1 Standardized Construction of the Braden Scale Assessment System

The Braden Scale consists of six dimensions: perception, moisture level, mobility, mobility, nutritional status, friction, and shear force. Each dimension is scored as 1/4 or 1/3, with a total score ranging from 6 to 23. The lower the score, the higher the risk of pressure ulcers. The formula for calculating the total score of the scale is:

$$S=\sum_{i=1}^{6} s_i \quad (1)$$

Among them, S is the total score of the Braden Scale, and s_i is the actual score of the i-th dimension. Based on the total score, the probability of pressure ulcers in patients can be calculated:

$$P=\frac{1}{1+e^{-(-5.236-0.184S)}} \quad (2)$$

A standardized assessment system is established, requiring patients to complete their initial assessment within 24 hours of admission and within 6 hours after emergency surgery; low-risk patients are assessed weekly, intermediate-risk patients every 3 days, high-risk patients daily, and very high-risk patients once per shift. At the same time, a quality control mechanism has been established, requiring that the proportion of random checks and verifications by specialized nurses should not be less than 30%; an electronic assessment system has been developed and embedded in the hospital information system; an 8-hour training and certification system has been established to ensure that nursing staff master the correct assessment methods [11].

3.2 Design of Personalized Nursing Intervention Programs Based on Risk Stratification

Based on the Braden scale scores, patients are divided into four risk levels. Personalized nursing intervention programs are designed for different risk levels and dimensional deficiencies to achieve precise prevention. This paper introduces a nursing intervention intensity coefficient to quantify the intervention intensity:

$$I=\frac{k}{S} \quad (3)$$

Among them, I is the intervention intensity coefficient, S is the total score of the Braden scale, and k is a constant (k=30 in this paper). The intervention intensity is positively correlated with the risk level. The larger the coefficient, the stronger the intervention. Based on this, a stratified intervention system was established [12]. Low-risk patients (15-18 points) implemented basic prevention, turned over once every 2 hours, used ordinary pressure ulcer mattresses, kept the bed unit dry, and strengthened nutritional support and health education. Intermediate-risk patients (13-14 points) increased decompression measures, used high-density foam mattresses, applied decompression dressings to bony prominences, shortened the turning interval to 1.5 hours, and assessed the skin twice a day. High-risk patients (10-12 points) implemented enhanced prevention, used alternating air-filled decompression mattresses, used silicone foam dressings on key areas, turned over once every 1 hour, adopted a 30-degree lateral decubitus position, with the heels suspended for protection, and received special nutritional guidance from a nutritionist. High-risk patients (≤9 points) receive comprehensive intensive intervention, using a high-end dynamic decompression system for decompression and protection of bony prominences throughout the body, turning them every 30-60 minutes, daily rounds by specialist nurses, and weekly consultations by a multidisciplinary team. Precise interventions are developed for each dimension of deficiency: enhanced rounds and improved support surfaces for patients with sensory impairment; enhanced skin protection and excretion management for patients with dampness; assisted passive movement and early rehabilitation for patients with limited mobility; lifting techniques to reduce friction for patients with limited mobility; personalized nutritional support for malnourished patients; and optimized positioning and skin protection for high-risk patients. A comprehensive evaluation formula for intervention effectiveness is introduced:

$$E=\frac{W_1(1-P)+W_2(1/T)+W_3C}{W_1+W_2+W_3} \quad (4)$$

Among them, E is the overall intervention effect value, P is the incidence of pressure ulcers, T is the average length of hospital stay, C is nursing satisfaction, and W_1, W_2, and W_3 are weighting coefficients (0.4, 0.3, and 0.3, respectively). An intervention implementation verification system was established, with each shift signing off on each item, daily supervision by the head nurse, and weekly spot checks by the nursing department to ensure that the measures were implemented effectively.

3.3 Clinical Implementation Pathway and Comprehensive Quality Control System

An systematic implementation clinical implementation pathway was constructed to standardize the implementation of Braden scale-based nursing interventions into a whole hospital. An pressure ulcer prevention and management committee was established with head nurse as the chief, and wound and ostomy specialist nurses, head nurses from different departments, nutritionists, rehabilitation therapists and physician representatives as members. The tasks of the committee were formulating the hospital-wide pressure ulcer prevention and management system, quality standard and training plan, and coordinating and solving different problems in the implementation process. Each department established a pressure ulcer prevention team simultaneously, headed by head nurse and with important nurses from that department participating in, specifically responsible for the organization, implementation, quality control and continuous quality improvement of Braden scale assessment in that department. A standardized implementation process was constructed: when the responsible nurse implemented Braden scale assessment on admitted patients, the computer could implement nursing interventions automatically according to the risk level determined by the score and add them into nursing plan and assign them to specific shifts and personnel. An three-levels pressure ulcer early warning system was constructed and the computer would automatically screen out the high-risk and very high-risk patients and give alarm prompts to the nurses from different stations, bedside cards and wristbands. Pressure ulcers should be reported to nursing department within 24 h after their occurrence. The location and stage of pressure ulcer should be described in detail and the treatment measures should be recorded. Pressure ulcers brought in from outside the hospital should be registered and reported at the same time [13].

A quality control system was established, and quality management was strengthened in three aspects: structure, process, and result. Structural quality control was focused on personnel allocation, training effect, and equipment and materials allocation to ensure sufficient number of trained nursing staff and adequate pressure-reducing equipment and dressings in each department. Process quality control was focused on the core indicators of timeliness, accuracy, intervention implementation rate, and turning rate; and these indicators were also monitored in multiple aspects by on-site verification, record review, and data analysis of the information system. Result quality was focused on incidence, severity, healing time, and satisfaction of pressure ulcers, and it was incorporated into departmental nursing quality assessment indicators. Continuous quality improvement mechanism was established, and quality analysis meeting was held every month. The PDCA cycle and root cause analysis tool were used to deeply analyze pressure ulcer cases, and improvement was made from the perspectives of systems, processes, and training in a comprehensive manner. Effect of intervention was evaluated continuously, and comparison before and after implementation and analysis of changes in various indicators were used to improve the plan. Close cooperation was strengthened among disciplines, and cross-professional prevention team was established to have regular consultations. At the same time, education of patients and families was strengthened to improve compliance and encourage them to participate in pressure ulcer prevention actively [14].

4. Results and Discussion

4.1 Comparison of Core Indicators for Pressure Ulcer Prevention between the Two Groups

The 240 hospitalized patients included in this study were randomly divided into an observation group and a control group, with 120 patients in each group. There were no statistically significant differences in baseline data between the two groups, making them comparable. The comparison results of the core clinical indicators between the two groups are shown in the table below:

Table 1. Comparison of core indicators for pressure ulcer prevention

indicator	Observation group (n=120)	Control group (n=120)
Pressure ulcer incidence rate	4%	16%
Average length of hospital stay (days)	11	13
nursing satisfaction	96%	84%
Number of cases of stage I pressure ulcers	5	15
Number of cases of pressure ulcers in stage II and above	0	4
Average occurrence time of pressure ulcers (days)	12	7

As shown in Table 1, the incidence of pressure ulcers in the observation group, which received systematic nursing intervention based on the Braden scale, was only 4%, significantly lower than the 16% in the control group. Furthermore, no patients in the observation group developed stage II or higher severe pressure ulcers, while 4 patients in the control group developed severe pressure ulcers. The average length of hospital stay in the observation group was 11 days, 2 days shorter than the control group. The nursing satisfaction rate in the observation group reached 96%, 12 percentage points higher than the control group. Simultaneously, the average time of pressure ulcer onset in the observation group was delayed to 12 days after admission, significantly later than the 7 days in the control group. This indicates that systematic intervention can effectively delay or even prevent the occurrence of pressure ulcers, and the overall preventive effect is significantly better than that of routine nursing care.

4.2 Incidence of Pressure Ulcers in Patients with Different Risk Levels

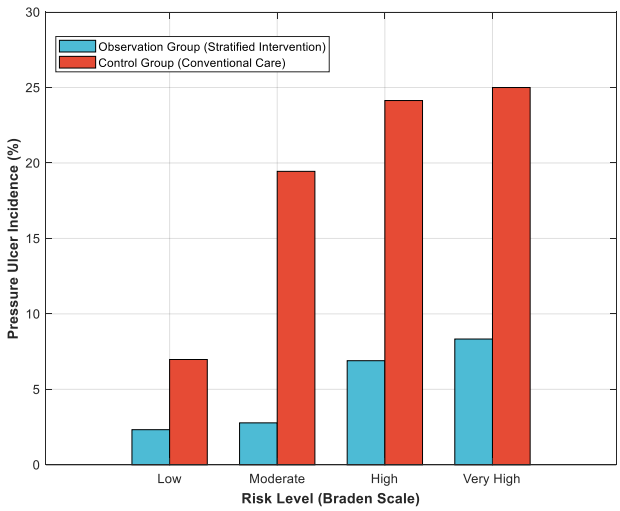

Figure 1. Pressure Ulcer Incidence by Risk Level and Group

This study categorized all patients into four risk levels—low, intermediate, high, and very high—based on the Braden Health Scale scores. Significant differences in the incidence of pressure ulcers were observed among patients at different risk levels (as shown in Figure 1). In the low-risk group (86 patients), only 1 out of 43 patients developed pressure ulcers (2%), compared to 3 out of 43 patients in the control group (7%). In the intermediate-risk group (72 patients), only 1 out of 36 patients developed pressure ulcers (3%), compared to 7 out of 36 patients in the control group (19%). In the high-risk group (58 patients), only 2 out of 29 patients developed pressure ulcers (7%), compared to 7 out of 29 patients in the control group (24%). The very high-risk group included 24

patients. In the observation group (n=12), 1 patient developed pressure ulcers (8%), while in the control group (n=3 out of 12 patients), 3 patients developed pressure ulcers (25%). Overall, the incidence of pressure ulcers increased in both groups as the patient's risk level rose. However, the incidence of pressure ulcers in the observation group was significantly lower than that in the control group at all risk levels. Specifically, the incidence of pressure ulcers in the very high-risk group was 17 percentage points lower than that in the control group, and in the intermediate-risk group, it was 16 percentage points lower. This indicates that risk-stratified personalized intervention is more effective in preventing pressure ulcers in intermediate- and high-risk patients. Furthermore, logistic regression analysis showed that no stratified intervention, a Braden score below 10, bed rest for more than 7 days, and diabetes were independent risk factors for pressure ulcers. The risk of pressure ulcers was four times higher in patients without stratified intervention, further validating the core role of Braden-based stratified intervention in pressure ulcer prevention.

4.3 Multidimensional Impact of Nursing Intervention Effects

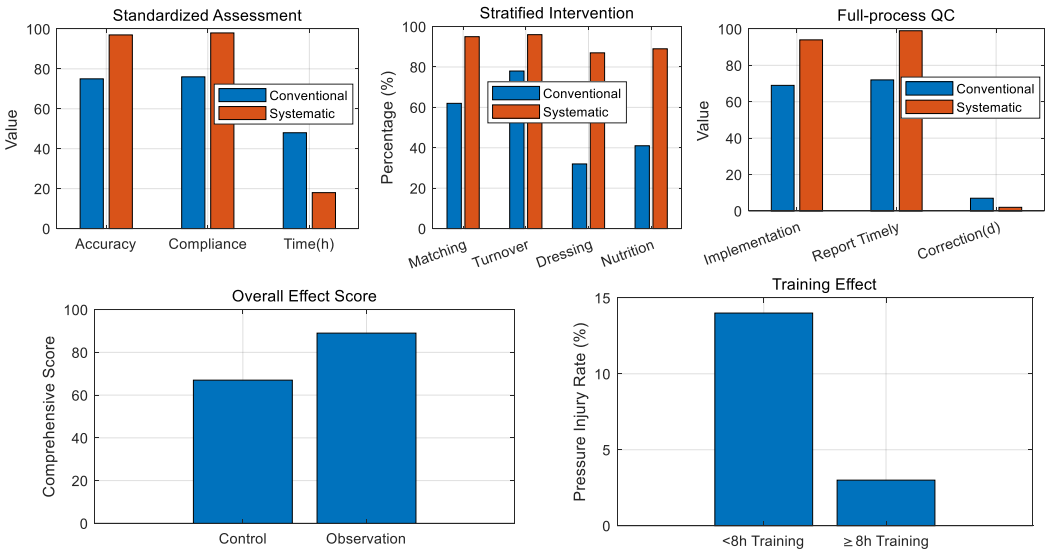

Figure 2. Systematic Nursing Intervention Based on Braden Scale

The systematic nursing intervention based on the Braden scale improves pressure ulcer prevention through three main aspects: standardized assessment, stratified intervention, and comprehensive quality control (as shown in Figure 2). Standardized assessment increased the accuracy of pressure ulcer risk assessment from 75% to 97%, and the assessment compliance rate for high-risk patients from 76% to 98%. It also shortened the time to the first assessment upon admission from 48 hours to 18 hours, effectively addressing issues of missed and delayed assessments. The stratified intervention model significantly optimized the quality of nursing intervention implementation. The intervention matching rate increased from 62% to 95%, and the rates of turning, pressure-reducing dressing usage, and nutritional intervention coverage increased from 78%, 32%, and 41% to 96%, 87%, and 89%, respectively, achieving precise, tiered intervention. Comprehensive quality control increased the implementation rate of nursing interventions and the timeliness of pressure ulcer reporting from 69% and 72% to 94% and 99%, respectively, and shortened the problem rectification cycle from 7 days to 2 days, forming a closed-loop quality improvement system. The comprehensive evaluation showed that the intervention score in the observation group (89 points) was significantly higher than that in the control group (67 points), with an overall intervention efficacy improvement of 33%. Furthermore,

the quality of nursing staff training was closely related to the intervention effect; nurses who received more than 8 hours of systematic training had a pressure ulcer incidence rate of only 3% in their patients, significantly lower than the 14% incidence rate among those without sufficient training. In conclusion, systematic intervention based on the Braden scale can facilitate the transformation of pressure ulcer prevention from experience-based nursing to precision nursing, demonstrating significant clinical application effects.

5. Conclusion

This study established a nursing intervention system according to the Braden scale, which includes a standardized assessment procedure, graded and personalized intervention programs of different levels, and a quality control system. Controlled clinical studies showed that the system could effectively reduce the occurrence of pressure ulcers in hospitalized patients, shorten hospital stays, enhance nursing satisfaction, and lower medical costs in the end. The study proves that the Braden scale is a scientifically effective method to assess the risk of pressure ulcers, and risk-stratified personalized nursing intervention could realize accurate prevention, rationally allocate nursing intervention, and enhance the efficiency of prevention. This study solved the problems of obvious subjectivity in assessment, lack of targeted intervention, and weak quality control in traditional pressure ulcer prevention. It provides an adjustable and scalable practical model with operability for clinical pressure ulcer prevention. Of course, this study also has certain limitations. Firstly, this is a single-center study with limited sample and need more samples to validate. Secondly, the subgroup analysis of specific population is insufficient. Finally, the long-term effect needed further observation. From the theoretical point of view, this study enriched the theoretical system of pressure ulcer prevention, and validated the application value of Braden scale in Chinese population. From the practical point of view, it provided the standard operation procedure for clinical nursing, and it has important application value in clinical practice for improving the level of pressure ulcer prevention, ensuring patient safety, and enhancing the quality of nursing.

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