ORIGINAL RESEARCH

Evaluation of a Pressure Injury Risk Assessment Module Based on a Nursing Information System in an Intensive Care Unit

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ABSTRACT

Background • Patients in intensive care units easily develop pressure injuries. Therefore, the prevention of and care for pressure injuries in intensive care units is an important focus of medical care.

Objective • To compare the use of a pressure injury risk assessment module of a nursing information system with a paper management system to aid nursing management of high-risk pressure injuries in intensive care units.

Design • This was a retrospective study.

Setting • This study was performed in the Intensive Care Unit Department, North China Medical Health Group Xingtai General Hospital.

Participants • We selected 120 patients who were treated in the intensive care unit of Xingtai General Hospital from January 2020 through December 2022 as the observation objects. Among the 120 enrolled patients, the 60 patients enrolled from January 2020 through June 2021 were allocated to the control group, and the 60 patients enrolled from July 2021 through December 2022 were allocated to the observation group.

Interventions • Patients in the control group were nursed using a paper management system to assess pressure injury risk. Patients in the observation group were nursed using a pressure injury risk assessment module based on a nursing information system that was created by the North China Medical Health Group Xingtai General Hospital in

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INTRODUCTION

Pressure injury (PI) refers to local damage to the skin or underlying soft tissue caused by pressure,¹ usually located at the bone process and associated with iatrogenic devices, and has become one of the major patient safety issues in the accordance with the nursing requirements of patients with high-risk pressure injury.

Primary Outcome Measures • The groups were compared for the risk assessment time of pressure injury, warning time of pressure injury reaction, incidence of pressure injury, comfort level, quality of life, and nursing satisfaction rate.

Results • The risk assessment time of pressure injury and warning time of pressure injury reaction were shorter in the observation group than in the control group (P < .001, 95% CI: -4.633~-4.047 and P < .001, 95% CI: -10.72~-9.203). The total incidence of pressure injury was lower in the observation group than in the control group (P = .03, χ^2 =4.6). The comfort level scores, quality of life scores, and patient satisfaction scores were higher in the observation group than in the control group (P < .001, 95% CI: 14.99~19.51, P < .001, 95% CI: 6.050~10.23 and P < .001, 95% CI: 20.92~26.68).

Conclusion • The pressure injury risk assessment module based on a nursing information system can effectively standardize the risk management of pressure injury in patients in the intensive care unit, shorten the early warning time of pressure injury reaction, reduce the incidence of pressure injury in patients, promote the quality of life of patients, and improve patient nursing satisfaction. (*Altern Ther Health Med.* [E-pub ahead of print.])

world.² Recently, the global incidence of PI has been increasing year by year.³ The global incidence of PI in hospitalized patients is approximately 1.1% to 35.7%, and the global incidence of hospital-acquired PI is approximately 0.2% to 26.3%.⁴ Although the incidence of PI is relatively high, its cure rate is only 5.1% to 29.9%.⁵ The occurrence of PI not only aggravates the patients' conditions, increases their pain, affects their emotions, and reduces their quality of life but also threatens patient safety and increases their risk of death.⁵ Because PI is difficult to cure and has a prolonged course of disease and high recurrence rate, it has been listed as 1 of the 5 most serious factors affecting patients, and it is also known as one of the most expensive clinical complications

in the twenty-first century and is the focus of and a challenge to clinical nursing work.⁶

Patients in intensive care units (ICUs) are more likely to develop PIs than patients in general wards because of the patients' complex and critical conditions, long hospital stays, malnutrition and multiple organ dysfunction, complex treatment and care, use of multiple medical equipment, or long-term passive position.7 At present, the global incidence of PI in patients in ICUs remains high. The total incidence of PI in patients in ICUs worldwide is approximately 8% to 56%, and the risk of PI in patients in ICUs is 4.3 times that of patients in general wards.8 The mortality rate of patients in ICUs who develop PI during hospitalization is 3.36 times higher than that of patients in ICUs who do not develop PI during hospitalization.9 The development of PI in patients in ICUs prolongs hospital stays, increases patient pain, and decreases patient quality of life.¹⁰ Also, treatment of PI is difficult and expensive, which not only brings great challenges to clinical work and increases the workload of medical staff but also increases the treatment cost and the economic burden of patients, resulting in waste of medical resources.¹¹ Therefore, the prevention of and care for PI in the ICU should become the focus of attention in the field of medical care around the world.

In our study, we assessed a PI risk assessment module of a nursing information system compared with a paper assessment system for the management of patients in ICU with PI.

METHODS

Patient recruitment and general characteristics

We selected 120 patients treated in the ICU of Xingtai General Hospital from January 2020 through December 2022 as the observation objects.

Inclusion criteria: (1) length of ICU stay of more than 5 days; (2) aged 30 to 80 years; (3) all clinical records were complete; and (4) patients and their families agreed to participate in the study and were informed of the whole process.

Exclusion criteria: (1) PI had occurred before hospitalization; (2) the patient was in an extremely critical state and could not adhere to normal assessment during the study; (3) the skin condition of patients with severe PI did not allow objective observation of PI, due to conditions such as burns, incontinence dermatitis, or electrical injury; or (4) poor nursing compliance.

Among the 120 enrolled patients, 60 patients enrolled from January 2020 through June 2021 were allocated to the control group, and 60 patients enrolled from July 2021 through December 2022 were allocated to the observation group.

Assessment of PI risk Paper management system. Patients in the control group were nursed using a paper management system of assessing PI risk.

PI risk assessment module. Patients in the observation group were nursed using a PI risk assessment module based on a nursing information system that was created by the

hospital Information Department and ICU in accordance with the nursing points of high-risk PI. The details are as follows.

- 1. PI risk assessment module: The module is based on an information platform of nursing and shift records. After logging in, the nurse can enter the operation page and complete the records. The module can obtain the required data from the hospital information system database to avoid data input duplication. At the same time, the module can be divided into a personal computer side and a personal digital assistant side, which can share data; the personal computer side can be used for comprehensive browsing management, and the personal digital assistant side can be used for real-time data acquisition and sharing at the bedside.
- 2. PI risk assessment module design: (a) Assessment data collection: After the nurse logs in, they can enter the PI assessment interface. After the nurse enters the name of the patient, the system will automatically retrieve the basic information of the patient from the hospital information system, including gender, age, admission time, ward number, condition, and evaluation date. PI management based on a modified Waterlow PI risk assessment form¹² was used with patients during their ICU stay. The assessment content of the Waterlow PI risk assessment table was divided into 9 dimensions: gender and age, body mass index, skin type, drug therapy, nutritional screening, incontinence, exercise ability, neurological dysfunction, and surgical position and time. After the nurse selects relevant evaluation items in accordance with the patient's situation, the system will automatically calculate the score. If the total score is less than 19, the patient will be classified as "no PI risk"; if the total score is 19 or higher, the patient will be classified as "PI risk." Patients assessed as "at risk of PI" are recorded and closely monitored by nurses. (b) Selection of nursing measures when there is a risk of PI: When the patient is confirmed as "at risk of PI," the system will automatically pop up relevant preventive measures for the nurse to choose, and the nurse can choose the appropriate nursing measures in accordance with the patient's condition and department conditions. (c) Establishment of a roll-over record sheet: When the patient is assessed as "at risk of PI" for the first time, after the nurse selects and saves the relevant nursing measures, the system will automatically pop up a dialog box, prompting the nurse to establish a roll-over record sheet for the patient. There are 2 submenus of "decumbent position" and "skin condition" on the interface. When selecting "decumbent position," there are 4 further choices: "left decumbent position," "right decumbent position," "half decumbent position," and "horizontal decumbent position." When selecting "skin condition," there are 4 further options: "intact," "flush," "black purple," and "ulcer." The nurse selects the relevant options in accordance with the patient's skin condition, and the system will

automatically generate a roll-over record sheet, and the nurse can roll over the patient in accordance with the record sheet. (d) Comprehensive management of PI risk: The assessment interface and assessment reminder interface are set at the same time on the nursing assessment interface. The Assessment Overview screen is used to summarize the results of the most recent risk assessment. When listing the results, positive results are in red. The assessment reminder interface sets the assessment time limit reminder in accordance with PI management requirements; this system will display the results and time of the latest risk assessment of patients in the ward, highlighting positive results in red, and notes the frequency of assessment, such as once per shift or once per day. At the same time, the remarks include the frequency of turning, skin condition, lying position, and turning time. Nurses can select the bed number on any query interface to enter the patient assessment sheet for evaluation.

3. Application of PI risk assessment module for patients in the ICU: After a patient is admitted to the ICU, the responsible nurse entered the patient information into the system, and the responsible nurse entered the log-in information into the PI risk assessment module when the shift was over. The relevant options of the PI risk assessment module were filled in in accordance with the actual situation of the patient, and then the system automatically generated nursing measures for high-risk patients with PI, and the responsible nurse selected relevant nursing measures in accordance with the actual situation of the patient and the conditions of the department. The patients were turned over according to the roll-over record sheet, and the relevant records were made for the patients.

Observation indicators

Risk assessment. The risk assessment time of PI and warning time of PI reaction in the 2 groups were recorded.

Occurrence of PI. In accordance with the staging standard of PI,¹³ the PI was divided into stages and the occurrence of each stage was recorded. Local redness, swelling and heat, pain, and color that did not recover 30 minutes after removal of pressure was rated as stage I ; local color of red or purple and subcutaneous induration accompanied by edema and blister formation was rated as stage II; enlarged local blister, ruptured epidermis, and a red wound surface and yellow oozing liquid were rated as stage III; and expansion of the ulcer to the deep and surrounding tissues, with more purulent secretions, and black necrotic tissue was rated as stage IV.

Comfort level. The Kolcaba General Comfort Questionnaire (GCQ) was used for assessment,¹⁴ which included 28 items in 4 dimensions: physical, sociocultural, environmental, and spiritual. Each item was scored from 1 to 4 points, and the total score was 112 points; the higher the score, the higher the comfort level of the patient.

Quality of life. The abbreviated World Health Organization Quality of Life–BREF (WHOQOL-BREF) was referred to for assessment of quality of life.¹⁵ This scale includes 26 items in 4 dimensions: social relationship, physiology, psychology, and environment. Each item was scored from 1 to 5 points, and the total score was 112 points. The sum of the scores of each item was the final score, and the higher the score, the higher the quality of life.

Patient satisfaction. A self-designed Patient Satisfaction Questionnaire was used to evaluate patients after nursing. There were 25 items in the questionnaire, and each item was scored from 1 to 4 points, with a total score of 25 to 100 points. The higher the score, the higher the satisfaction score.

Statistical analysis

Statistical software SPSS, version 19.0 (IBM Corp) was used for analysis. Measurement data are presented as mean (SD), and *t* tests were used for comparisons between groups. Count data are presented as number (%), and chi-square tests were used for comparisons between groups. P < .05 were considered to be statistically significant.

RESULTS

General patient characteristics

There were no significant differences in the general patient characteristics between the CG and OG (all P > .05; Table 1).

Risk assessment time of PI and warning time of PI reaction

In the CG, the mean (SD) risk assessment time of PI was 9.58 (1.01) minutes, and the mean (SD) warning time of PI reaction was 25.19 (2.52) minutes. In the OG, the mean (SD) risk assessment time of PI was 5.24 (0.53) minutes, and the mean (SD) warning time of PI reaction was 15.23 (1.54) minutes. Compared with the CG, the risk assessment time of PI and warning time of PI reaction in the OG were both shorter (P<.001, 95% CI: -4.633~-4.047 and P<.001, 95% CI: -10.72~-9.203). (Figure 1)

Table	1.	General	Data	of	Patients

		Control group	Observation	
Characteristic		(n=60)	group (n=60)	P value
Gender, male/female, No.		35/25	36/24	>.05
Age, mean (SD), y		57.3 (10.05)	57.7 (10.24)	>.05
Type of	Acute exacerbation of chronic obstructive	17	18	>.05
severe	pulmonary disease			
disease,	Coronary heart disease	16	15]
No.	Craniocerebral injury	14	15]
	Multiple organ failure	10	10]
	Other severe disease	3	2	

Table 2. Occurrence of PI in Each Stage

Group	Cases	Stage I	Stage II	Stage III	Stage IV	Total incidence, No. (%)
Observation group	60	2	2	0	0	4 (6.7)
Control group	60	5	4	2	1	12 (20)
χ^2	NA	NA	NA	NA	NA	4.6
P value	NA	NA	NA	NA	NA	.03

Abbreviation: NA, not applicable.



Occurrence of PI in each stage

The total incidence of PI was 6.7% in the OG and 20% in the CG. Compared with the CG, the total incidence of PI in the OG was lower (P=.03; Table 2).

Comfort level

The mean (SD) GCQ score was 80.87 (7.05) points in the OG and 63.62 (5.32) points in the CG. Compared with the CG, the GCQ score in the OG was higher (P<.001, 95% CI: 14.99~19.51; Figure 2).

Quality of life

The mean (SD) WHOQOL-BREF score was 61.35 (6.17) points in the OG and 53.21 (5.36) points in the CG. Compared with the CG, the WHOQOL-BREF score in the OG was higher (P < .001, 95% CI: 6.050~10.23; Figure 3).

Patient satisfaction

The patient satisfaction score was 90.18 (9.08) points in the OG and 66.38 (6.62) points in the CG. Compared with the CG, the patient satisfaction score in the OG was higher (P<.001, 95% CI: 20.92~26.68; Figure 4).

DISCUSSION

PI is a common complication in patients in ICUs, and the management of PI directly reflects the quality of clinical care that patients in ICUs receive.¹⁶ It is of great significance to accurately and timely evaluate patients at high risk for PI and to take effective preventive measures to prevent the occurrence of PI.

In the past, clinical nurses mainly used paper forms to fill in relevant information in accordance with the actual situation of patients in the evaluation of PIs in patients in ICUs. This evaluation and recording method is easily affected by factors such as the writing situation and recording method of nurses, increases the workload of nurses, increases the difficulty of nursing quality control and supervision, and affects the management of PI.¹⁷ In recent years, with the development of information technology, a PI risk assessment module established based on a nursing information system has effectively standardized PI risk management, making PI management digitalized, standardized, and scientific, and reducing the workload of nurses, so that nurses can have more time to devote to patient care management, thereby improving the quality of nursing services.¹⁸

Our development and use of a PI risk assessment module indicated that, compared with the CG, the risk assessment time of PI and warning time of PI reaction in the OG were shorter, and the total incidence of PI in the OG was lower, indicating that the PI risk assessment module based on a nursing information system could effectively reduce the risk of PI in patients in ICUs, save the time taken by nurses to record and evaluate PI, and improve the management of patients' PI, which was in line with a previous study.¹⁹ Similarly, Guo et al¹⁸ indicated that a pressure ulcer information management system makes the reporting

process simple and convenient, which reduces reporting time and improves the accuracy of pressure ulcer staging. The reasons behind these effects may be that the function of the PI risk assessment module is set in accordance with the needs of nursing staff, departments, hospital characteristics, and other work needs and that the PI risk assessment module replicates and improves on the traditional paper PI management system and allows for continuous assessment, observation, and correction and can be checked at any time in the hospital, so that the management of PI is more standardized and scientific. In addition, the PI risk assessment module can automatically obtain information and directly record information on the personal digital assistant, which eliminates repetition of input of the record content and reduces handwriting time, so that nurses have enough time and energy to invest in the patients' condition management and health management, so as to improve the management of patients' PI.20

Our study also indicated that the GCQ scores, WHOQOL-BREF scores, and patient satisfaction scores were higher in the OG than in the CG, which suggested that the nursing information system could improve the comfort, quality of life, and satisfaction of patients in ICUs. The reason may be related to the application of the nursing information system in the management of patients in ICUs to reduce the incidence of PI, which was consistent with a previous study.²¹

There are some limitations to this study. The sample size of this study is small, and it is a single-center study, which inevitably has bias. In the future, we will conduct a multicenter, large sample prospective study, so we can draw more valuable conclusions.

In conclusion, the PI risk assessment module based on a nursing information system can effectively standardize the risk management of PI in patients in ICUs, shorten the early warning time of PI reaction, reduce the incidence of PI in patients, promote the quality of life of patients, and improve patient satisfaction of nursing. Our study provides a clinical reference for preventing and managing PI in patients in ICUs.

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