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Original Article

The preventive effect of seamless nursing care on pressure ulcer and related complications in elderly inpatients

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Abstract: Objective: To study the preventive effect of seamless nursing care on pressure ulcer and related complications in elderly inpatients. Methods: This study was performed in 132 elderly patients aged over 65 years. According to the random number table, these patients were allocated to the control group (n=66) and the experimental group (n=66). Patients in the control group received routine care, while those in the experimental group received both routine care and seamless nursing care. The number and grade of pressure ulcer during hospitalization, average length of stay, satisfaction in care, and incidence of complications during hospitalization were compared between the two groups. Results: The incidence of pressure ulcer in the experimental group, which consisted of grade 1 pressure ulcer (2 cases) was significantly lower than that in the control group (P=0.001), which consisted of grade 1 pressure ulcer (9 cases) and grade 2 pressure ulcer (5 cases). The incidence of complications (wound infection and muscle aches) in the experimental group was significantly lower than that in the control group (P<0.05). Compared with the control group, the average length of stay in the experimental group was decreased (P<0.001). Satisfaction with care in the experimental group was significantly higher than that in the control group (P<0.01). Conclusion: Seamless nursing care contributes to the reduced number of pressure ulcer, reduced incidence of related complications, and improved satisfaction with care.

Keywords: Seamless nursing care, elderly inpatients, pressure ulcer, complications

Introduction

Pressure ulcer is a serious disease. The mobility and sensation of many elderly patients with pressure ulcer are decreased [1]. The treatment of pressure ulcer is expensive. In patients who are weak, elderly, bedridden, malnourished, and unable to take care of themselves, the incidence of pressure ulcer is high [2]. Its development is rapid and can spread from small superficial zone to extensive tissue, such as skin, muscle, and skeleton. For patients with pressure ulcer, the economic burden is increased while physical health is damaged. Accordingly, their social function is declined. What's worse, their independence and freedom are lost, increasing the pain [3]. In recent years, the overall incidence of pressure ulcer in the world has increased [4]. Among them, the incidence of pressure ulcer in elderly inpatients is between 10% and 25%. For these patients, the mortality rate is increased by 3 times. If pressure ulcer continues to be unhealed, the mortality rate will be raised by 5 times [5].

At present, symptomatic treatment is the essential therapy for pressure ulcer. To be specific, the treatment includes: actively treat the sore surface to prevent it from further expanding; timely antibiotic treatment when the sore surface is infected; administrate analgesic drugs in time [6, 7]. However, symptomatic treatment is a remedial therapy. In other words, it cannot avoid causing pain to patients. In clinical practice, prevention of pressure ulcer is still the main focus.

Whole-course seamless nursing care is a brand-new nursing model that has been implemented in present clinical practice. During the entire hospitalization period, whole-course seamless nursing care is carried out. In this case, the success rate of surgery is increased and the prognosis of elderly surgical patients

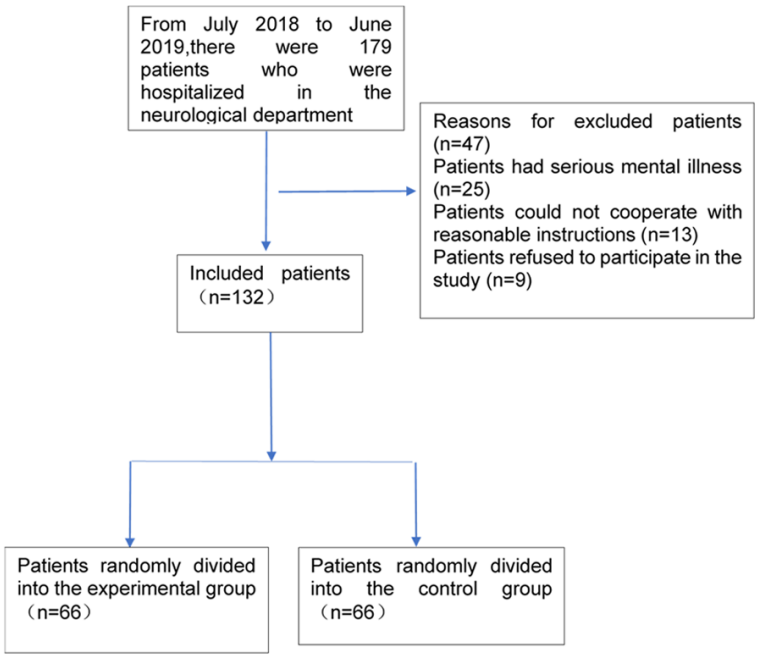

Figure 1. CONSORT flow chart.

is improved [8]. However, there are very few studies on the application of whole-course seamless nursing care in preventing pressure ulcer in elderly inpatients. In this study, we studied the effect of seamless nursing care on the prevention of pressure ulcer in elderly inpatients.

Materials and methods

General information

In total, there were 179 elderly patients who were admitted to Fifth Affiliated Hospital of Sun Yat-sen University between July 2018 and June 2019. Among them, 132 patients were enrolled in this study in accordance with the inclusion criteria and exclusion criteria. According to the random number table, these patients were divided into the control group (n=66) and the experimental group (n=66). Patients in the control group received routine care, while those in the experimental group received both routine care and whole-course seamless nursing care. Braden pressure ulcer risk-assessment scale was used to evaluate all recruited patients [9]. The result was divided into 4 levels: very high risk (below 9 points), high risk (9-12 points), medium risk (12-14 points), and low risk (14-18 points). This study was approved by the Ethics Committee of Fifth Affiliated Hospital of Sun Yat-sen University. Informed consent was signed by the patients or their family members.

Inclusion criteria: Bedridden patients had cerebral infarction, dementia, and diabetic encephalopathy; patients receiving treatment in Fifth Affiliated Hospital of Sun Yat-sen University were to be in bed for more than 1 week and unable to be discharged within a short time; patients aged 60-85 years old; patients or their family members voluntarily participated in this study.

Exclusion criteria: Patients had severe heart, lung, liver, or kidney damage; patients had mental illness; patients failed to cooperate; patients withdrew spontaneously; patients had history of prior pressure ulcer and presence of current pressure ulcer.

During the treatment period, there were no uncontrollable accidents and evacuations. All recruited patients successfully completed the trial (**Figure 1**).

Methods

According to the medical advice, patients in the control group received routine care. It was composed of the following measures: (1) patients received routine pre-operative education and post-operative care; (2) after surgery, dressing change was completed based on the medical advice and family members were required to help patients turn over and scrub; (3) patients and family members were asked to use the turning pad.

Besides routine care, patients in the experimental group received seamless nursing. Measures were described in detail below. (1) Admission care: The basic condition of patients admitted was comprehensively evaluated. The skin condition was predominantly evaluated, and body parts prone to pressure ulcer were the focus of the assessment. Basic examination items, such as blood biochemistry, blood routine, and coagulation function were performed in patients. Antithrombotic stockings or

anticoagulant drugs were used to prevent deep vein thrombosis. Lower limb infusion was prevented to the utmost. For patients with comorbidities like diabetes and hypertension, their blood sugar and blood pressure were actively controlled. Otherwise, the incidence of pressure ulcer would be increased when there were excessive blood sugar and blood pressure. If patients were unable to get out of bed or walked around occasionally, nursing staff would supervise and assist family members to help them turn over to prevent pressure ulcer. (2) Care in the operating room: Before patients entered the operating room, purpose of the surgery and operations that might be performed during surgery and anesthesia were introduced to patients and their family members. Also, they were asked to cooperate with doctors as much as possible. After entering the operating room, body temperature care was taken. To be specific, nursing staff were supposed to adjust the humidity of the operating room to about 55% in advance, lay a heating blanket on the operating bed, and monitor patients' temperature closely during the operation. The body temperature of patients was kept above 36°C by adjusting the temperature of heating blanket. Intra-operative blood transfusion and infusion were performed with warm-up. Damage to the skin might be induced by hypothermia and hyperthermia, and pressure ulcer can develope. Comfortable care: If venipuncture was included in the operation, nursing staff were supposed to reduce the pain irritated and protect the skin at the puncture site. Additionally, repeated puncture of the same site was avoided. During operation, the anti-pressure ulcer pad was provided to prevent infection from areas where pressure ulcer was likely to be developed due to greater force. During the whole surgery and nursing process, the concept of aseptic operation was followed. Pre-operative antibiotics were administrated according to the medical advice within half an hour of the operation. In order to decrease the risk of incision infection, all nursing operations carried out during surgery were aseptic. Intra-operative nursing staff was supposed to remind the surgeon and anesthesiologist of the concept of aseptic operation. Resuscitation care: After surgery, patients entered the resuscitation process. In this case, nursing staff were supposed to pay close attention to the changes of patients' vital signs and body temperature. Patients' body position was changed to avoid long-lasting gravity before they waked up. If it took too much time to resuscitate, nursing staff would help patients turn over and protect their key body parts. Ultimately, patients were safely sent back to the ward. (3) Post-operative care: Detailed intra-operative handover was conducted between nursing staff and nurses in the operating room. After surgery, patients' vital signs were monitored. Nursing staff carefully and patiently informed patients and their family members of post-operative precautions, and urged them to actively expectorate to reduce the chance of lung infection. As for patients with thick sputum that was difficult to discharge, nebulizer treatment was provided. If bedridden time was increased due to lung infection, the probability of pressure ulcer would increase. Therefore, attention was paid to the surgical incision, especially the site under pressure. Moreover, dressing was changed in time. Patients were advised and assisted to get out of bed as soon as possible to avoid post-operative deep vein thrombosis. In this case, thrombosis at the siltation site was prevented from developing into pressure ulcer. In order to prevent pressure ulcer, patients were timely inspected and assisted to turn over.

If patients had pressure ulcer, they would receive formal pressure ulcer treatment. Wounds would be promptly cleaned and cared for. Analgesics and tranquilizers were applied to relieve patients' pain and anxiety. Also, anti-infective treatment was provided for patients. Patients turned over and got out of bed as much as possible to decrease the pressure time.

Outcome measures

Main outcome measures: The total incidence and grade of pressure ulcer were observed in 15 d after hospitalization and during the hospitalization period. Total incidence of pressure ulcer = the number of pressure ulcer/the total number of patients ×100%. The risk of pressure ulcer was estimated upon admission. Thereafter, it was evaluated every 3 days.

Secondary outcome measures: Average length of stay, satisfaction in care, and number of related complications (wound infection, muscle aches, and malnutrition).

Pressure ulcer classification: Pressure ulcer was divided into 4 grades [10]. Grade I: There is a clear demarcation between the non-pale red skin, which was commonly observed in the bone protrusion and the surrounding skin; ad-

Table 1. Baseline data ($\bar{x}$ ± sd)

	Experimental group (n=66)	Control group (n=66)	t/χ^2	P
Age (years)	69.4±9.4	69.1±9.0	0.194	0.847
BMI (kg/m^2)	28.13±5.60	27.78±5.39	0.366	0.715
Weight (kg)	71.32±11.41	72.58±12.09	-0.616	0.539
Gender (n)				
Male	35	34	0.030	0.862
Female	31	32		
Risk assessment (n)				
No risk	16	18	0.644	0.958
low risk	21	19		
Medium risk	14	15		
High risk	8	9		
Very high risk	7	5		
Diseases (n)				
Ischemic cerebrovascular disease	27	29	1.016	0.907
Hemorrhagic cerebrovascular disease	18	14		
Spinal cord disease	10	11		
Central nervous system infection	6	8		
Others	5	4		
Comorbidities				
Present	41	44	0.297	0.586
Absent	25	22		
Fasting blood glucose (mmol/L)	7.49±3.21	7.77±3.15	-0.506	0.614
Mean blood pressure (mmHg)	84.76±11.43	82.97±13.58	0.819	0.414
Hemoglobin (g/L)	10.51±4.74	10.23±4.46	0.350	0.727
Malnutrition (n)				
Present	18	20	0.148	0.701
Absent	48	46		

Note: BMI: body mass index.

ditionally, the limited skin did not fade under pressure; Grade II: There were epidermis that was red at the base and had superficial ulcer without a scab; alternatively, there was skin with intact or ruptured blood vesicles; Grade III: The full-thickness skin was lost or the skin was present with scabs and subcutaneous tunnels, but without exposed muscles, tendons, and bones; Grade IV: The full-thickness skin was lost; the skin was present with not only scabs and subcutaneous tunnels, but also exposed muscles, tendons, or bones [11].

Satisfaction in care: Before discharge, satisfaction in care was evaluated using a self-made questionnaire. The total score was 100 points. Results were classified into very satisfied (90-100 points), basically satisfied (70-89 points), and dissatisfied (below 70 points). Satisfaction in nursing = (very satisfied + basically satisfied)/the total number of patients ×100%.

Statistical methods

All data were analyzed using SPSS statistical software version 22.0. The enumeration data were expressed as number/percentage (n/%); comparison was conducted with chi-square test. The measurement data were calculated as mean ± standard deviation ($\bar{x}$ ± sd); independent sample t test was used for inter-group comparison, while paired t-test was applied for before-after comparison within the same group. The difference was statistically significant when *P* value was less than 0.05.

Results

Baseline data

There were no significant differences in general information between the two groups (all P>0.05, **Table 1**).

Table 2. The number and grade of pressure ulcer (n, %)

	Experimental group (n=66)	Control group (n=66)	X^2	P
15 d after hospitalization				
Grade I	1	8		
Grade II	0	1		
Grade III	0	0		
Grade IV	0	0		
In total	1	9	6.925	0.009
During hospitalization				
Grade I	2	9		
Grade II	0	5		
Grade III	0	0		
Grade IV	0	0		
In total	2	14	10.241	0.001

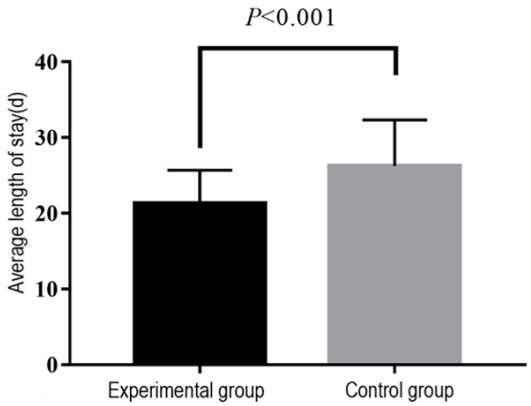

Figure 2. Average length of stay in the two groups.

The number and grade of pressure ulcer

As shown **Table 2**, there was 1 patient who had grade I pressure ulcer 15 d after hospitalization in the experimental group, while 9 patients (grade I: 8 patients; grade II: 1 patient) in the control group (the incidence of pressure ulcer: 1.51% vs. 13.64%, P<0.01); there were 2 patients who had grade I pressure ulcer during hospitalization in the experimental group, while 14 patients (grade I: 9 patients; grade II: 5 patients) in the control group (the incidence of pressure ulcer: 3.03% vs. 21.21%, P=0.001).

Average length of stay

Average length of stay in the experimental group was shorter when compared with the control group (21.34±4.38 d vs. 26.24±6.11 d, t=-5.295, P<0.001, **Figure 2**).

Complications

As displayed in **Table 3**, the incidence of complications in the experimental group was lower than that in the control group; there were significant differences in the incidence of wound infection and muscle aches between the two groups (P<0.05), while no significant difference in the incidence of malnutrition (P> 0.05).

Satisfaction in care

Compared with the control group, satisfaction with care in the experimental group was increased (59.09% vs. 83.33%, P<0.01, **Table 4**).

Discussion

With the intensification of social aging, the number of elderly critically ill patients is gradually increasing. Elderly patients are prone to pressure ulcer as they spend a long time in bed. Pressure ulcer can increase not only the consumption of medical resources, but also the workload of nursing staff. If patients pay insufficient attention to pressure ulcer or its therapeutic effect is not good, complications related to pressure ulcer will be developed [12, 13]. Therefore, more attention is supposed to be paid to timely prevention of pressure ulcer.

Friction, pressure, and skin condition are the main influencing factors of pressure ulcer. As an essential influencing factor, pressure is mainly depended on the time and magnitude of the pressure that the physical body suffers [14, 15]. It was reported that a pressure of about 5 kPa could cause changes in local skin tissue when it lasted for 4 h. In addition, the time that skin tissue needed to change would be halved if the pressure was doubled [16]. Whole-course seamless nursing care emphasizes health education and high-quality care. Specifically, the assessment of patients' general state is carried out. Meanwhile, timely and effective care is carried out. These will provide favorable conditions for the prevention of pressure ulcer [17, 18]. In this study, patients in the experimental group received whole-course

Table 3. Incidence of complications

	Experimental group (n=66)	Control group (n=66)	χ^2	P
Wound infection (n)	0	6	6.286	0.012
Muscle aches (n)	3	10	4.990	0.026
Malnutrition (n)	3	6	1.073	0.300
Incidence of complications (%)	9.09	33.33	17.580	0.000

Table 4. Satisfaction with care (n)

	Experimental group (n=66)	Control group (n=66)	χ^2	P
Very satisfied	36	25	9.478	0.009
Basically satisfied	19	14		
Dissatisfied	11	27		
Satisfaction in care (%)	83.33%	59.09%	9.460	0.002

seamless nursing care. Nursing staff actively assisted and supervised these patients to turn over and get out of bed, assisted doctors to control their blood pressure and blood sugar, and prevented these patients' position from moving during the operation. Our results displayed that whole-course seamless nursing care could decrease the severity and incidence of pressure ulcer. In the care, nursing strategies such as psychological care, health education, high-quality care, and nutritional care are combined. It means that comprehensive care is provided for patients. Accordingly, the therapeutic effect is improved [19]. Here, we also found that whole-course seamless nursing care could reduce the length of stay. What's more, it was confirmed that whole-course seamless nursing care could reduce the incidence of related complications (like incision infection, wound infection, and muscle aches) during treatment.

Skin moisture and nutritional status are the primary conditions of skin. They play a very important role in the occurrence and development of pressure ulcer. Moisture can be timely improved through close observation. However, nutritional status, a long-term influencing factor, must be treated with nutritional care during the whole process. In this way, the ideal state is to be achieved. It was reported that whole-course seamless nursing care could significantly improve the malnutrition of long-term hospitalized patients. For some inpatients, malnutrition is induced by the neglect of family members or the fact that nursing staff forget to guide patients' family members to take care of their nutritional status. If patients with difficulty in dietary intake are not noticed by nursing staff and strengthened nutritional intake is thus not provided, they will be extremely prone to malnutrition [20, 21]. Short-term nutritional care affects the skin condition of patients, yet the ideal goal of nutritional therapy is not realized [22, 23]. In our study, we found that there was no difference in the incidence of malnutrition between the two groups during the treatment process. However, the number of patients with malnutrition in the experimental group was less than that in the control group.

Here, we also found that satisfaction with care and satisfaction with treatment in the experimental group were significantly higher than those in the control group. This might be related to the significantly reduced complications during hospitalization. Also, it could be correlated with the full application of whole-course seamless nursing care, which included the care of psychology and body, the care of prevention and treatment, and the care of family members and patients.

However, the sample size was relatively small and follow-up time was relatively short. These may have caused biased results. A prospective study will be conducted in a larger number of patients to verify our results.

In summary, whole-course seamless nursing care has a significant effect on the prevention of pressure ulcer in elderly inpatients. The quality of life after surgery is thus significantly improved. As a result, it is worthy of further clinical application.

Disclosure of conflict of interest

None.

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