

Current Status and Influencing Factors of Pressure Injury Occurrence in ICU Patients with Indwelling Artificial Airways

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Abstract [Objectives] To investigate the current status of pressure injury occurrence in ICU patients with indwelling artificial airways and to analyze its associated factors. [Methods] A prospective observational study was performed involving 300 ICU patients with indwelling artificial airways admitted to Taihe Hospital, Shiyan City, between January 2024 and December 2025. Data on general demographics, artificial airway-related parameters, and Braden Scale scores were collected using a self-designed questionnaire. The patients were categorized into pressure injury and non-pressure injury groups. Univariate analysis followed by multivariate Logistic regression analysis was employed to determine the independent influencing factors. [Results] Among the 300 patients, 54 cases of artificial airway-related pressure injuries were identified, yielding an incidence rate of 18.0%. The lips and oral commissures were the most frequently affected sites, accounting for 53.7% of all injuries. Multivariate Logistic regression analysis revealed that prolonged indwelling time, use of subglottic suction catheters, and lateral displacement of the tracheal tube were independent risk factors for pressure injuries, whereas a higher moisture score served as a protective factor ($P < 0.05$). [Conclusions] The incidence of pressure injuries in ICU patients with indwelling artificial airways is notably high. Nurses should prioritize monitoring of indwelling duration, catheter type, catheter position, and local moisture status, and implement timely preventive interventions.

Key words ICU, Artificial airway, Pressure injury, Influencing factors, Care

1 Introduction

Artificial airway is an important therapeutic intervention for critically ill patients in the intensive care unit (ICU) to maintain airway patency, facilitate mechanical ventilation, and improve oxygenation. The common types include orotracheal intubation, nasotracheal intubation, and tracheostomy tube placement. However, during the course of treatment, artificial airways require fixation with various devices such as catheters, bite blocks, securing tapes, and adhesive plasters. These devices are prone to exert sustained pressure, friction, and shear forces on the lips, oral commissures, nasal alae, cheeks, neck, and the peristomal skin or mucosa surrounding the tracheostomy site, thereby leading to local pressure injuries^[1–3]. Patients in the ICU are critically ill and frequently present with impaired consciousness, restricted mobility, edema, poor nutritional status, and simultaneous use of multiple medical devices, all of which reduce the tolerance of skin and mucosa^[4–5]. The early manifestations of artificial airway-related pressure injuries are often inconspicuous; if they are not identified in a timely manner, they may increase the risk of infection, complicate nursing care, and prolong the length of hospital stay^[6]. Therefore, it is of great clinical significance to understand the occurrence of pressure injuries in ICU patients with indwelling artificial airways and to analyze their influencing factors, so as to facilitate clinical prevention. The present study was conducted to investigate

the current status of pressure injury occurrence in ICU patients with indwelling artificial airways and to explore its related influencing factors, with the aim of providing a scientific basis for the formulation of nursing intervention strategies.

2 Data and methods

2.1 Study subjects A prospective observational study design was adopted. A total of 300 patients who were hospitalized in the ICU of Taihe Hospital, Shiyan, from January 2024 to December 2025 and had indwelling artificial airways were enrolled as the study subjects. The inclusion criteria were as follows: age ≥ 18 years; presence of orotracheal intubation, nasotracheal intubation, or tracheostomy tube; duration of artificial airway indwelling ≥ 24 h; intact skin and mucosa at the relevant sites at the time of enrollment; and complete clinical data. The exclusion criteria were: presence of pressure injuries at the relevant sites upon admission or upon transfer to the ICU; concomitant facial or cervical trauma, burns, severe dermatological diseases, or local infections; artificial airway indwelling for less than 24 h; and missing clinical data. This study was reviewed and approved by the institutional ethics committee of the hospital, and written informed consent was obtained from all patients or their legal representatives.

2.2 Survey instruments A self-designed questionnaire, titled *Pressure Injury Survey Form for ICU Patients with Indwelling Artificial Airways*, was developed by the research team. The survey covered the following items: patients' age, sex, body mass index, primary diagnosis, level of consciousness, duration of mechanical ventilation, use of sedative and analgesic medications, use of va-

soactive agents, type of artificial airway, size of the catheter, duration of artificial airway indwelling, whether a subglottic suction catheter was used, catheter position, fixation method, Braden Scale score, and local skin care practices, among others.

2.3 Assessment of pressure injuries and data collection Artificial airway-related pressure injury was defined as local damage caused by continuous compression of the skin or mucosa by devices such as artificial airway catheters, bite blocks, securing tapes, adhesive plasters, or tracheostomy tubes. The sites of observation included the lips, oral commissures, nasal alae, cheeks, neck, peristomal skin around the tracheostomy, and the mucosa at the contact sites with the artificial airway. Skin pressure injuries were assessed according to the pressure injury staging criteria, while mucosal injuries were recorded as mucosal pressure injuries. Prior to the initiation of the study, the data collection personnel received standardized training conducted by wound, ostomy, and continence (WOC) nurses. After patient enrollment, the responsible nurses observed the skin and mucosa at the contact sites of the artificial airway every shift. When suspected injuries were identified, if there was disagreement among the observers, the final judgment was made by the WOC nurses for verification.

2.4 Statistical methods All statistical analyses were performed using SPSS version 28.0 software (IBM Corp., Armonk, NY, USA). Continuous variables that were normally distributed were expressed as mean ± standard deviation (SD), while those not normally distributed were expressed as median (interquartile range). Comparisons between groups were conducted using the independent-samples *t*-test for normally distributed continuous variables and the Mann-Whitney U test for non-normally distributed continuous variables. Categorical variables were presented as frequencies (percentages), and group comparisons were performed using the chi-square (χ^2) test or Fisher's exact test, as appropriate. Variables with a *P*-value <0.10 in the univariate analysis, along with variables considered to be clinically meaningful, were

simultaneously entered into the multivariate Logistic regression analysis. A *P*-value <0.05 was considered to indicate a statistically significant difference.

3 Results and analysis

3.1 Occurrence of pressure injuries in ICU patients with indwelling artificial airways A total of 300 ICU patients with indwelling artificial airways were enrolled in this study, among whom 54 cases developed artificial airway-related pressure injuries, yielding an incidence rate of 18.0%. In terms of the distribution of injury sites, the lips and oral commissures were the most frequently affected sites, accounting for 29 cases (53.7%), followed by the peristomal skin of the neck in 14 cases (25.9%), the nasal alae in 7 cases (13.0%), and the cheeks in 4 cases (7.4%). With regard to injury staging, among the 54 patients with pressure injuries, 22 cases (40.7%) were classified as Stage 1 pressure injuries, 19 cases (35.2%) as Stage 2 pressure injuries, and 13 cases (24.1%) as mucosal pressure injuries.

3.2 Univariate analysis of influencing factors for pressure injuries The results of univariate analysis showed that the duration of artificial airway indwelling in the pressure injury group was significantly longer than that in the non-pressure injury group (*P* <0.001). The proportion of patients using subglottic suction catheters in the pressure injury group (64.8%) was higher than that in the non-pressure injury group (38.2%), and the proportion of patients with lateral displacement of the tracheal tube in the pressure injury group (70.4%) was higher than that in the non-pressure injury group (34.6%), with all differences being statistically significant (*P* <0.001). The scores of the Braden Scale subscales, including moisture, mobility, and friction and shear, in the pressure injury group were significantly lower than those in the non-pressure injury group (*P* <0.001). However, there were no statistically significant differences between the two groups in terms of age, sex, or body mass index (*P* >0.05), as detailed in Table 1.

Table 1 Comparison of relevant factors between the two groups

Group	Duration of artificial airway indwelling [h, M(P ₂₅ , P ₇₅)]	Use of subglottic suction catheter [cases (%)]	Lateral displacement of tracheal tube [cases (%)]	Moisture score points	Mobility score points	Friction and shear score//points
Pressure injury (n=54)	144(96, 216)	35(64.8)	38(70.4)	2.15 ± 0.63	1.87 ± 0.55	1.39 ± 0.49
Non-pressure injury (n=246)	72(48, 120)	94(38.2)	85(34.6)	2.72 ± 0.58	2.42 ± 0.61	1.78 ± 0.42
<i>P</i> value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

3.3 Multivariate logistic regression analysis of influencing factors for pressure injuries Taking the occurrence of artificial airway-related pressure injury as the dependent variable, variables that were statistically significant in the univariate analysis were entered into the multivariate Logistic regression analysis. The results showed that prolonged duration of artificial airway indwelling, use of subglottic suction catheters, and lateral displacement of the tra-

cheal tube were independent risk factors for pressure injuries in ICU patients with indwelling artificial airways, while a higher moisture score was a protective factor. These findings indicate that the occurrence of pressure injuries in ICU patients with indwelling artificial airways is closely associated with the duration of artificial airway indwelling, catheter type, catheter position, and local moisture condition, as presented in Table 2.

Table 2 Multivariate logistic regression analysis of influencing factors for pressure injuries of ICU patients with indwelling artificial airways

Variable	OR value	95% CI	P value
Duration of artificial airway indwelling (per 24-h increase)	1.18	1.10 ~ 1.27	<0.001
Use of subglottic suction catheter	1.92	1.02 ~ 3.63	0.043
Lateral displacement of tracheal tube	2.76	1.45 ~ 5.25	0.002
Moisture score//points	0.56	0.36 ~ 0.87	0.010

4 Discussion

The present study showed that the incidence of pressure injuries in ICU patients with indwelling artificial airways was 18.0% , and the primary injury sites were the lips, oral commissures, nasal alae, and the peristomal skin around the tracheostomy. The subcutaneous tissue at these sites is relatively thin, making them susceptible to local injury following prolonged compression by catheters, bite blocks, securing tapes, or adhesive plasters. Given that ICU patients are often critically ill and have restricted mobility, and that some patients are unable to express pain or discomfort, nursing staff should strengthen the observation of the contact areas surrounding the artificial airway^[7]. Prolonged duration of artificial airway indwelling is an important risk factor for the development of pressure injuries^[8]. The longer the indwelling time, the longer the duration of local tissue exposure to pressure, friction, and shearing forces, thereby increasing the risk of injury. Therefore, extubation criteria should be promptly assessed based on the patient’s clinical condition, and the compressed areas should be appropriately adjusted while ensuring the safety of the catheter. The use of subglottic suction catheters and lateral displacement of the tracheal tube also increase the risk of pressure injuries. Subglottic suction catheters have a relatively complex structure, which may increase compression on the oral cavity and lips. When the catheter is fixed on one side of the oral commissure for a prolonged period, it tends to create sustained compression. In nursing practice, catheter fixation should be standardized to avoid overtightening, and traction from the ventilator circuit should be minimized.

This study also demonstrated that a higher moisture score was a protective factor against pressure injuries. Maintaining local cleanliness and dryness can reduce impairment of the skin barrier.

ICU patients with indwelling artificial airways often have saliva, secretions, or exudate from the tracheostomy site, which should be removed in a timely manner. When necessary, skin protectants or prophylactic dressings may be used. In summary, the incidence of pressure injuries in ICU patients with indwelling artificial airways is relatively high, and is associated with the duration of artificial airway indwelling, the use of subglottic suction catheters, catheter position, and local moisture condition. Nursing staff should strengthen risk assessment and dynamic observation, standardize catheter fixation, maintain local cleanliness and dryness, and implement timely pressure-relieving and skin protection measures for high-risk patients.

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