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# Evaluation of a Specialized Nurse Decision Support System in the Prevention of Stroke-Associated Pneumonia

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**Abstract:** *Objective:* To design and implement a specialized nurse decision support system in the Department of Neurology and explore its effectiveness in preventing stroke-associated pneumonia (SAP). *Methods:* A decision support module for specialized nurses was developed based on SAP-graded prevention strategies. A total of 664 neurology inpatients admitted to The First People's Hospital of Xuzhou between July 2023 and September 2023 were selected as the conventional group, receiving standard nursing care. Another 704 neurology inpatients admitted between October 2023 and December 2023 were selected as the experimental group, receiving SAP-graded prevention strategies under the specialized nurse decision support system. The incidence of SAP in the two groups was compared. The occurrence of SAP was recorded using the Acute Ischemic Stroke-Associated Pneumonia Risk ($A2DS^2$) scoring system. Swallowing function was evaluated using the Water Swallow Test (WST), and quality of life was assessed using the Swallowing Quality of Life (SWAL-QOL) scale. *Results:* The incidence of SAP in the experimental group was significantly lower than in the conventional group ($P < 0.05$). After nursing interventions, the WST scores in the experimental group were lower, while the SWAL-QOL scores were higher compared to the conventional group ($P < 0.05$). *Conclusion:* The design and implementation of a specialized nurse decision support system in the Department of Neurology significantly reduced the incidence of SAP in neurology inpatients, improved swallowing function, and enhanced quality of life. This approach shows promise for widespread application.

**Keywords:** Neurology; Specialized nurse decision support system; Stroke-associated pneumonia; Impact

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## 1. Introduction

Stroke refers to cerebrovascular damage caused by multiple factors, which can result in varying degrees of brain tissue injury. This condition is characterized by a high incidence, high disability rate, high recurrence rate,

and high mortality rate [1]. Stroke-associated pneumonia (SAP) refers to pulmonary infections that occur during the course or recovery period of acute stroke [2,3]. SAP is one of the key risk factors leading to mortality in stroke patients, as it not only prolongs hospitalization but also increases medical expenses, imposing significant economic and emotional stress on families and society as a whole.

Impairment of swallowing function frequently triggers aspiration, where aspirated materials may contain abundant pathogenic microorganisms. Once the quantity of these pathogens accumulates to a certain threshold, the onset of SAP becomes more likely. Studies have shown that stroke patients with swallowing disorders are seven times more likely to develop pneumonia compared to those without such disorders. Moreover, swallowing dysfunction has been confirmed as an independent predictor of mortality in stroke patients [4].

In this study, 704 neurology inpatients were selected as the experimental group to evaluate the effectiveness of a specialized nurse decision support system in preventing SAP.

## 2. Materials and methods

### 2.1. General information

A total of 664 neurology inpatients admitted to the First People's Hospital of Xuzhou from July 2023 to September 2023 were selected as the conventional group, including 402 males and 262 females, aged 46–73 years, with an average age of (58.72 ± 3.43) years. Another 704 neurology inpatients admitted from October 2023 to December 2023 were selected as the experimental group, including 416 males and 288 females, aged 45–74 years, with an average age of (58.95 ± 3.38) years. The basic clinical characteristics of the two groups were statistically comparable ($P > 0.05$). Furthermore, this study was formally approved by the hospital ethics committee.

Inclusion criteria: Patients admitted to the neurology department; adult patients under 80 years of age; complete clinical data; and normal mental state.

Exclusion criteria: Pneumonia caused by other reasons; combined consciousness disorders; malignant tumors; abnormal communication abilities; and early withdrawal from the study.

### 2.2. Methods

The conventional group received standard nursing care. In terms of environmental management, routine cleaning was ensured with periodic disinfection measures. Communication with patients was strengthened to provide psychological support and guidance. Swallowing function was evaluated, and assistance was provided to maintain oral hygiene and airway patency. Patients were assisted with position changes and light back-patting every two hours to improve comfort and optimize respiratory function.

The experimental group received SAP-graded prevention strategies under the specialized nurse decision support system. Prior to developing this system, a survey titled "Current Status of Clinical Decision-Making Ability of Neurology Specialized Nurses" was designed to assess the knowledge, attitudes, and capabilities of neurology nurses regarding clinical decision-making and SAP prevention. The survey consisted of three parts:

(1) Part 1: Hospital and personal information (9 items),

(2) Part 2: Attitudes and capabilities (23 items),

(3) Part 3: Current status of stroke-associated pneumonia interventions (43 items).

The results of the survey provided the basis for the needs analysis, development, and design of the decision

support system. Through this detailed investigation, the goal was to create a system tailored for neurology-specialized nurses, enhancing their decision-making abilities and improving nursing outcomes.

All stroke patients included in the study underwent comprehensive swallowing function screening. The Water Swallow Test (WST) was used for initial screening, and patients with abnormal results underwent further assessment using the Volume-Viscosity Swallow Test (VVST). For patients with swallowing dysfunction identified through VVST, the decision support system guided specialized nurses in providing personalized interventions.

(1) For patients with normal swallowing function, feeding guidance was provided, including posture and food consistency.

(2) For those with swallowing dysfunction, swallowing rehabilitation guidance was offered.

All patients with a high-risk A2DS$^2$ score underwent respiratory function training.

## 2.3. Observation indicators

### 2.3.1. Incidence of stroke-associated pneumonia

The incidence of SAP was quantified and recorded using the Acute Ischemic Stroke-Associated Pneumonia Risk Assessment Tool (A2DS$^2$ Score), as shown in **Table 1**.

**Table 1.** Acute Ischemic Stroke-Associated Pneumonia Risk Assessment Tool (A2DS$^2$ Score)

| Criteria | | Score |
|---|---|---|
| Gender | Male | 1 |
| | Female | 0 |
| Age | ≥ 75 years old | 1 |
| | < 75 years old | 0 |
| History of atrial fibrillation | Yes | 1 |
| | No | 0 |
| Dysphagia | Yes | 2 |
| | No | 0 |
| Stroke severity (NIHSS score) | 0–4 points | 0 |
| | 5–15 points | 3 |
| | ≥ 16 points | 5 |

### 2.3.2. Swallowing function

Swallowing function was evaluated using the Water Swallow Test (WST) before and after nursing interventions. The specific steps are as follows:

Patients were seated in an upright position and instructed to drink 30 mL of warm water. The time taken to complete the task and the presence of coughing were observed and recorded:

(1) Normal level (Grade I-A, 1 point): Completion of drinking within 5 seconds without coughing.

(2) Suspicious level (Grade I-B, 2 points): Takes more than 5 seconds but completes drinking in one attempt without coughing.

(3) Grade II (3 points): Requires two or more attempts to complete drinking without coughing.

(4) Abnormal level (Grade III, 4 points): Completes drinking in one attempt but with coughing.
(5) Grade IV (5 points): Requires two or more attempts to complete drinking, accompanied by coughing.
(6) Grade V (5 points): Frequent coughing during swallowing, unable to complete the task.
Higher WST scores indicate more severe swallowing dysfunction.

#### 2.3.3. Quality of life

The Swallowing Quality of Life (SWAL-QOL) scale was used to assess patients' quality of life. The scale has a maximum score of 100 points, with higher scores indicating better quality of life.

### 2.4. Statistical analysis

Data were collected and analyzed using SPSS 26.0 software. Categorical variables were expressed as percentages and analyzed using the $\chi^2$ test, while continuous variables were expressed as standard deviations and analyzed using the *t*-test. A $P$ value < 0.05 was considered statistically significant.

## 3. Results

### 3.1. Comparison of SAP incidence between the two groups

The incidence of SAP in the experimental group was significantly lower than that in the conventional group ($P$ < 0.05), as shown in **Table 2**.

**Table 2.** Comparison of SAP incidence between the two groups

| Group | *n* | Number of cases | Incidence rate (%) |
|---|---|---|---|
| Experimental group | 704 | 10 | 1.42 |
| Conventional group | 664 | 17 | 2.56 |
| $\chi^2$ value | - | 8.163 | |
| *P* value | - | 0.005 | |

### 3.2. Comparison of swallowing function scores between two groups

After the nursing intervention, the WST scores of both groups decreased, with the experimental group showing a greater improvement in swallowing function scores ($P$ < 0.05), as shown in **Table 3**.

**Table 3.** Comparison of swallowing function scores between the two groups (mean ± SD, points)

| Group | n | Before nursing | After nursing |
|---|---|---|---|
| Experimental group | 704 | 4.19 ± 0.74 | 1.84 ± 0.65 |
| Control group | 664 | 4.16 ± 0.82 | 2.45 ± 0.83 |
| *t* value | - | 0.895 | 8.925 |
| *P* value | - | 0.612 | 0.002 |

### 3.3. Comparison of quality of life scores between the two groups

After the nursing intervention, the quality of life scores improved in both groups, with the experimental group

showing significantly higher scores than the conventional group ($P < 0.05$), as shown in **Table 4**.

**Table 4.** Comparison of quality of life scores between the two groups (mean ± SD, points)

| Group | *n* | Before nursing | After nursing |
|---|---|---|---|
| Experimental group | 704 | 51.72 ± 10.38 | 83.15 ± 14.62 |
| Control group | 664 | 52.08 ± 10.29 | 68.03 ± 11.85 |
| *t* value | - | 1.026 | 10.395 |
| *P* value | - | 0.483 | 0.000 |

## 4. Discussion

Stroke is one of the most common diseases among elderly patients, and data show that the number of new stroke cases in China is continuously increasing. After the onset of the disease, it is often accompanied by a series of complications, including impaired consciousness, swallowing dysfunction, and weakened immune systems. These complications not only pose significant challenges to patient rehabilitation and daily care but also increase the risk of aspiration pneumonia, which can lead to respiratory failure, airway obstruction, or even life-threatening conditions [5,6]. Stroke-associated pneumonia is a critical complication in neurology, and its prevention is essential to improving patient outcomes. Therefore, strengthening rehabilitation and nursing care for SAP is particularly important [7]. During the nursing process, maintaining airway patency is crucial. Hospitalized stroke patients should undergo regular repositioning and back-patting, timely suctioning of secretions, and oxygen inhalation. If necessary, nebulized inhalation can be used to prevent lung infections. For patients with weakened cough strength or inability to clear airways leading to obstruction, timely tracheostomy should be performed, and post-tracheostomy care should be reinforced [8].

This study deeply integrates nursing decision theory with neurological practice, designing and implementing a decision support system tailored to the specific needs of neurological specialist nurses. This integration of theory and practice helps better understand and improve the nursing decision-making process. The results of this study show that the incidence of SAP in the experimental group was lower than in the conventional group, indicating that the application of the nurse decision support system can significantly reduce SAP incidence among neurology inpatients. After nursing interventions, both groups showed decreased WST scores. Additionally, the experimental group exhibited significantly higher quality-of-life scores compared to the conventional group. These changes were statistically significant [9]. These results suggest that the application of the nurse decision support system positively contributes to the recovery of swallowing function and improves the quality of life for patients.

Swallowing dysfunction is considered one of the major risk factors for pneumonia. Therefore, timely assessment of swallowing function and implementation of rehabilitation training after acute stroke is crucial for preventing pneumonia. Once SAP is diagnosed, empirical anti-infective treatment should be initiated immediately. After obtaining pathogen detection results, targeted antibacterial therapy should be applied to maximize treatment effectiveness. During nursing procedures for neurology inpatients, care should be performed gently, using easy-to-understand language to communicate with patients. While expressing compassion and understanding for the patients' suffering, nurses should aim to encourage and motivate patients, strengthening their determination to overcome illness and helping them build hope and confidence in life [10].

The results of this study indicate that the design and implementation of a nurse decision support system in neurology can significantly reduce the incidence of SAP, improve swallowing function, and enhance the quality of life for neurology inpatients. This system shows great potential for broader application. However, the relatively small sample size in this study limits the persuasiveness of the results, and the stability of the nurse decision support system still requires further improvement. Future research will address these limitations to provide more robust data support and further optimize the system.

## Disclosure statement

The authors declare no conflict of interest.

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