

ORIGINAL RESEARCH

Significance Analysis of the Improvement in Postoperative Recovery of Cardiac Surgery Patients Based on the Graded Management Established Using the Delirium Prediction Model

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ABSTRACT

Objective • To investigate the impact of graded management based on delirium prediction modeling on the improvement of recovery of cardiac surgery patients.

Methods • Three hundred and twenty patients admitted to the Department of Critical Care Medicine of Nanjing Hospital affiliated with Nanjing Medical University from June 2021 to December 2023 after Type A aortic coarctation were selected as study subjects. They were grouped according to the randomized scale method and divided into 160 cases in each the control group and the observation group. In the control group, conventional nursing measures were adopted, and in the observation group, graded nursing interventions were carried out according to the established delirium risk prediction model. Comparison between the two groups in terms of the intensive care unit (ICU)

monitoring time, hospitalization time, duration of delirium, and delirium incidence, and investigated nursing satisfaction, and quality of care scores.

Results • Compared with the control group, the observation group's ICU custody time, hospitalization time, and delirium duration, decreased, and the quality of care, and satisfaction increased ($P < .05$). At the same time, the incidence of delirium in the observation group was also lower than that in the control group ($P < .05$).

Conclusion • The graded management based on the delirium prediction model can effectively reduce the incidence of postoperative delirium in critically ill patients with Type A aortic coarctation, and at the same time improve patient satisfaction and quality of care. (*Altern Ther Health Med.* 2025;31(1):338-342).

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INTRODUCTION

The intimal and medial layers of the aorta tear, causing blood to enter the middle layer of the arterial wall. This leads to the formation of a false lumen through antegrade or retrograde dissection, which communicates with the true lumen of the aorta through one or several openings, known as aortic dissection.¹ The patient mainly presents with sudden severe pain in the anterior chest, back, or abdomen. As the disease progresses, there may also be associated symptoms and signs related to aortic dissection involvement. The Stanford classification, which is commonly used in clinical practice, divides it into Type A and Type B.² With the continuous improvement of aortic surgical techniques, the postoperative mortality rate of patients with aortic dissection has significantly decreased. However, postoperative complications remain an

independent risk factor for in-hospital mortality in patients.³ Postoperative delirium, as one of the common complications in the neurological system, has gradually become a hot topic of concern. Delirium is an acute organic brain dysfunction, characterized by acute, transient, and widespread cognitive impairment, with prominent disturbances in consciousness.⁴ The surgery time for Type A aortic dissection is long, and the duration of deep hypothermic circulatory arrest is also prolonged. Operations within the ascending aorta and aortic arch during the procedure can affect cerebral tissue perfusion, resulting in a higher incidence of postoperative delirium. Once patients develop postoperative delirium, it increases the risk of hospital-acquired infections, elevates mortality rates, prolonged hospital stays, and increases healthcare expenses. Currently, numerous scholars have developed delirium risk prediction models for intensive care unit (ICU) patients. However, there are fewer models specifically for postoperative delirium in cardiac surgery patients, and the proportion of aortic dissection cases included in the model-building process is low. Moreover, the applicability of predictive factors in Type A aortic dissection patients is weak. These issues may lead to biases in the existing models when predicting postoperative delirium for Type A aortic dissection patients.^{5,6}

This study aims to construct a risk prediction scoring model for postoperative delirium in patients with Type A aortic dissection, with the goal of quickly and accurately identifying high-risk patients and implementing timely interventions.

MATERIALS AND METHODS

Clinical Data and Methods

A total of 320 patients who underwent surgery for Type A aortic dissection in the Intensive Care Unit of Nanjing Hospital Affiliated with Nanjing Medical University from June 2021 to June 2023 were selected. The patients were randomly divided into two groups by using a random allocation table method, namely, the control group and the observation group, with an equal number of patients in each group. In the control group, there were 92 males and 68 females; in the observation group, there were 94 males and 66 females. The general information of the two groups of patients was compared, and the results showed no significant difference ($P > .05$), indicating the feasibility of this study. Inclusion criteria: (1) age ≥ 18 years; (2) underwent Sun's surgery and received postoperative ICU monitoring and treatment; (3) obtained consent from the participants and their families and signed informed consent forms. Exclusion criteria: (1) preoperative history of mental disorders (including delirium, Alzheimer's disease, anxiety, etc.); (2) patients with visual, auditory, or functional impairments before surgery; (3) patients who died within 72 hours after surgery; (4) patients who developed stroke and coma after surgery; (5) ICU stay less than 24 hours; (6) patients with contraindications for daily awakenings, such as severe asthma, severe acute respiratory distress syndrome, and myocardial ischemia; (7) patients with incomplete data collection. Before the start of the study, all patients received relevant explanations from the doctors involved to ensure that they fully understood the study objectives, procedures, and purposes before signing the informed consent forms.

RESEARCH METHODS

Data Collection

Three members of the research team completed all data collection using the hospital's electronic medical record system and digital medical record system, based on a pre-designed questionnaire of risk factors. To ensure standardization of data collection and research methodology and to avoid data bias or errors caused by human factors, all research personnel underwent standardized training and assessment before participating in this study. Additionally, to ensure data accuracy, completeness, and authenticity, a double-entry and double-checking process was implemented. In case of any errors or discrepancies, the research personnel needed to be notified for timely correction and clarification.

Research Tools

This study used a self-designed questionnaire called "Risk Factors Investigation Form for Postoperative Delirium

in Patients with Type A Aortic Dissection". It consists of the following three parts.

1. Basic information of the study subjects: including demographic data (name, hospital admission number, age, gender) and disease-related data (alcohol consumption, diabetes, hypertension, Marfan syndrome, cardiac tamponade).

2. Preoperative patient examination data (results of the first examination after hospital admission): including preoperative blood lactate level, preoperative B-type natriuretic peptide, preoperative D-dimer, etc.

3. Intraoperative and postoperative relevant information: including extracorporeal circulation time, aortic clamping time, deep hypothermic circulatory arrest time, duration of mechanical ventilator support, ICU length of stay, postoperative renal dysfunction, and other postoperative complications (such as acute respiratory failure, acute kidney injury, liver dysfunction), etc.

Method

The control group used routine nursing measures, including closely observing changes in the patient's condition; regularly conducting blood gas analysis to detect any abnormalities in the patient promptly; following medical advice, and administering medications in a timely and correct manner to maintain the patient's fluid and electrolyte balance and acid-base balance; providing routine pain and sedation care; providing basic care for the respiratory machine tubing; providing nutritional support; providing psychological care; and using restraints appropriately, timely, and in the appropriate position.

The observational group carried out graded nursing interventions based on the established delirium risk prediction model and classified the risk values as follows: 0-20% as low-risk; >20% - 40% as medium-risk; >40% - 60% as high-risk; >60% as extremely high-risk. Specific contents are as follows:

Low-risk nursing: - Pain assessment: Using the Numeric Rating Scale (NRS) or the Critical-Care Pain Observation Tool (CPOT) to evaluate and intervene based on the assessment results, conducting assessments 4-6 times a day. Administering analgesics when the patient experiences intolerable pain. - Sedation assessment: Evaluating the patient's sedation level using the Richmond Agitation and Sedation Scale (RASS), conducting assessments 10 times a day, and adjusting the sedation status to keep the patient in a lightly sedated state. For patients in a deep sedation state, awakening, and autonomous breathing experiments are performed by professional nursing staff to assess the sedation status. - Routine delirium assessment: Using the Confusion Assessment Method for the intensive care unit (CAM-ICU) to assess delirium in patients twice a day, monitoring consciousness and emotional changes. - Sleep management: Establishing a comfortable and quiet hospital environment for patients, controlling room temperature and humidity, preparing necessary items for nursing before lights out at

night, separating snoring patients from those with insomnia, and keeping detailed records of patient sleep quality. - Preoperative guidance: Providing patients with detailed explanations of aortic dissection and its treatment methods in simple and understandable language, fully encouraging patients and strengthening their confidence in active treatment and care.

Medium-risk nursing: In addition to low-risk nursing, adding muscle strength exercises to enhance knee joint control ability and perform various functional training. The exercises include: - Heel raises against the wall: Standing against the wall with legs shoulder-width apart, raising the heels for 10 seconds, 10 times per set, 3-5 sets per day. - Wall squats: Standing against the wall, legs shoulder-width apart, gradually increasing the angle (15°, 30°, 45°, 60°, 75°, 90°), sliding down slowly while keeping the calves parallel to the wall, maintaining each movement for 10 seconds, 10 times per set, 3 sets per day. - Stair training: When going up the stairs, the unaffected leg goes up first, the foot placed securely, and the affected leg follows with the knee fully extended. When going down the stairs, the affected leg goes down first, the heel placed securely, and the unaffected leg follows with the knee fully extended. 10 times per set, they are continuing until normal gait and unrestricted movement.

High-risk nursing: In addition to medium-risk nursing, providing psychological care. Specific measures include closely observing the patient's words and actions, and encouraging family members to accompany the patient throughout the process to alleviate the patient's feelings of loneliness, and actively encouraging the patient to maintain an optimistic attitude. The attending physicians use simple language to explain the surgical process and the expected treatment effect, providing specialized support. The nursing staff mobilizes all social resources to ensure that the patient's family, friends, and colleagues provide sufficient care and attention.

Extremely high-risk nursing: In addition to highly risky preventive interventions, for agitated patients, intravenous administration of dexmedetomidine at a dose of 0.2-0.7 µg/kg/h is employed. Close monitoring for adverse drug reactions is performed, and timely detection of low blood pressure, nausea, tissue hypoxia, and atrial fibrillation, among others.

Observation indicators

Incidence rate of delirium; delirium diagnosis criteria: obtaining information about the patient's postoperative mental state based on medical history records and consultation records, and determining the diagnosis based on the CAM-ICU. Incidence rate of delirium = (Number of delirium cases) / (Total number of cases) x 100%.

Satisfaction: Nursing satisfaction is assessed using a questionnaire filled out by patients regarding their satisfaction with the nursing staff during the period of receiving care. The total score is 100, with a cutoff of 60. The satisfaction levels are categorized as satisfied (81-100 points), fairly satisfied (61-80 points), and dissatisfied (0-60 points).

Comparison: Comparison of ICU monitoring time, hospitalization time, and duration of delirium between two patient groups.

Incidence rate of delirium-related safety incidents (falls, injuries, unplanned extubations, etc.).

Quality of care: Evaluated using a self-made scale with a Cronbach's α coefficient of 0.83 and a validity chronic venous insufficiency (CVI) of 0.87. It includes four dimensions: basic nursing, professional skills, health education, and ward management. Each dimension is scored out of 100, with higher scores indicating higher quality.

Statistical analysis

SPSS 20.0 statistical software was used. Count data is presented as percentages and the number of cases. Between-group comparisons were conducted using the chi-square test. Metric data is presented as $\bar{x} \pm s$ (mean \pm standard deviation), and between-group comparisons were conducted using the *t* test. A significance level of $P < .05$ was used to determine statistical significance.

RESULTS

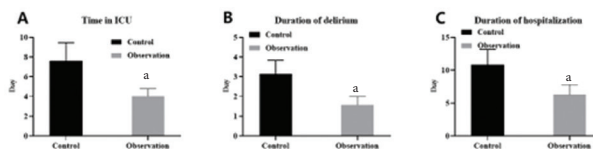
Comparison of ICU monitoring time, hospitalization time, and duration of delirium between two patient groups.

As shown in Figure 1, the observation group exhibited significantly shorter durations for ICU monitoring, hospitalization, and delirium compared to the control group. Statistical analysis revealed significant differences between the two groups ($P < .05$).

Comparison of nursing satisfaction between the two groups of patients.

As shown in Table 1, Compared to the control group, the satisfaction level of patients in the observation group is significantly higher than that of the control group. The difference between the two groups is statistically significant ($P < .001$).

Figure 1. Comparison of recovery times. A) Comparison of ICU monitoring time, B) Comparison of duration of delirium, C) Comparison of hospitalization time.

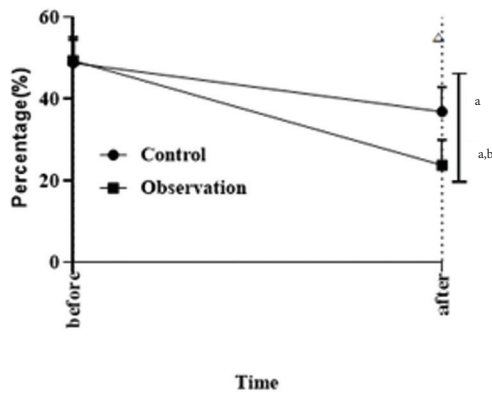


^a $P < .05$ compared to the control group.

Table 1. Comparison of nursing satisfaction between the two groups of patients.

Group	n	Not satisfied	Fairly satisfied	Satisfied	Satisfaction level
Observation group	160	14 (8.75%)	74 (46.25)	72 (45.00)	146 (91.25%)
Control group	160	46 (28.75)	67 (41.88)	47 (29.37)	114 (71.25%)
χ^2/t					6.443
P value					<.001

Figure 2. Comparison of the incidence rate of delirium between the two groups of patients.

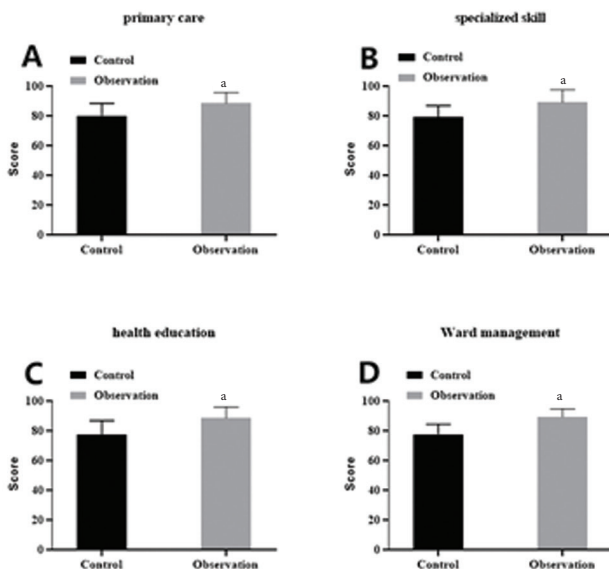


^a $P < .05$ compared to before nursing intervention.
^b $P < .05$ compared to the control group

Table 2. Comparison of delirium-related safety incidents between the two groups of patients.

Group	n	Circulatory disturbances	Injury	Escape from restraint devices	Unplanned extubation	Rate of adverse events (%)
Observation group	160	6	7	2	1	16 (10.00%)
Control group	160	14	11	5	2	32 (18.13%)
χ^2/t						4.651
P value						.012

Figure 3. Comparison of nursing quality between the two groups. A) Comparison of primary care, B) Comparison of professional skills, C) Comparison of health education, D) Comparison of ward management.



^a $P < .05$ compared to the control group.

Comparison of the incidence rate of delirium between the two groups of patients.

As shown in Figure 2, before the nursing intervention, there was no significant difference in the incidence rate of delirium between the two patient groups ($P > .05$). However, after the nursing intervention, the observation group exhibited a significantly lower incidence rate of delirium

compared to the control group, and this difference was statistically significant ($P < .05$).

Comparison of the occurrence of delirium-related safety incidents between the two groups of patients.

As shown in Table 2, after the nursing intervention, the incidence rates of blood circulation disorders, patient injuries, self-removal of restraints, and unplanned extubations were significantly lower in the observation group compared to the control group. The differences between the two groups were statistically significant ($P = .012$).

Comparison of nursing quality between the two groups.

As shown in Figure 3, compared to the control group, the observation group had significantly higher nursing quality scores in the four dimensions: primary care, professional skills, health education, and ward management. The differences between the two groups were statistically significant ($P < .05$).

DISCUSSION

Postoperative delirium often manifests as acute and transient confusion, but some patients may gradually develop into chronic cognitive dysfunction, ultimately leading to an increased mortality rate.^{7,8} Therefore, early identification and treatment of postoperative delirium are crucial. Although postoperative delirium is relatively common in clinical practice, its exact pathogenesis remains unclear, leading to symptomatic treatment using medications. Recent literature reports have indicated that nursing interventions can effectively reduce the occurrence of postoperative delirium and other complications.⁹ The shared decision-making model among healthcare professionals and patients is a clinical management approach that has gained popularity in recent years and has experienced rapid development in Western developed countries.¹⁰ However, it is used less frequently in the postoperative care of patients with Type A aortic dissection. Our research group conducted a statistical analysis of the influencing factors of postoperative delirium in patients with Type A aortic dissection and constructed a delirium prediction model. The delirium risk prediction scoring model for patients with Type A aortic dissection developed in this study is easy to use and shows good application effectiveness. It takes a nursing perspective of intervening only when patients have relevant symptoms,¹¹ Shift towards planned, graded management with focused nursing care quality, starting before the onset of delirium symptoms in patients.

Patients with severe Type A aortic coarctation have a rapid progression of disease and patients are at high risk of death.¹² For such patients, it is necessary to timely implement comprehensive treatment measures, while also providing quality medical services from a nursing perspective to better promote patient recovery. To improve the quality of nursing work, it is also important to carry out proper nursing management.¹³ In this study, we conducted research using a

novel nursing management model based on a delirium prediction model with a graded management approach. The results of this experiment showed that the occurrence rate of adverse clinical nursing events in the observation group, which applied the graded management based on the delirium prediction model, was 10.00%, significantly lower than the control group's rate of 20.00%. There was also a difference in the satisfaction level of nursing work between the two groups, with the total satisfaction rate in the control group at 71.25%, significantly lower than the observation group's rate of 91.25%. These results confirm that the application of the graded management based on the delirium prediction model is significantly effective in the clinical nursing of severely ill patients with Type A aortic dissection. Analyzing the reasons behind these findings may be due to the effective integration and rational allocation of existing nursing resources based on the actual needs of patients through the implementation of graded nursing management.¹⁴ Centered around the patient, nursing management is classified based on the severity of the patient's condition, aiming to help patients adapt to their psychological and physical states, eliminate feelings of helplessness, experience happiness, enhance self-confidence, meet physiological and psychological health needs during the treatment process, and improve the coordination of disease management.¹⁵

In terms of specific nursing management, a detailed graded management system has been established based on the clinical conditions and nursing needs of critically ill patients in the ICU. Different patients are categorized to ensure the smooth implementation of subsequent nursing work. At the same time, rational allocation of nursing resources within the department has been carried out to guarantee the work efficiency and quality of different nursing staff, while maximizing the utilization of various existing nursing resources. Additionally, several findings from this study reveal that the occurrence rate and duration of postoperative delirium in the observation group were superior to those in the control group. This indicates that the graded management established based on the delirium prediction model can effectively reduce the occurrence of postoperative delirium in patients through risk control, which is consistent with existing research findings.^{16,17}

Furthermore, in the graded nursing management established based on the delirium prediction model, there is also an emphasis on supervision and assessment. Through close monitoring and regular assessments, the clinical nursing outcomes are effectively grasped, while nursing staff members are encouraged to better fulfill their nursing tasks, ensuring the quality of clinical nursing work. As a result, the corresponding clinical nursing work exhibits higher quality, increases efficiency, and effectively prevents the occurrence of adverse events, thereby providing patients with an ideal nursing experience.

However, due to the short period of this study, we were unable to assess the prognosis of the patients. At the same time, the management model used in this study was developed by us,

and there are no authoritative guidelines in the clinic that can provide us with reference, so there is still room for optimization and improvement in the specific management content. In the follow-up study, we also need to conduct a more in-depth and comprehensive analysis of the above limitations.

CONCLUSION

In summary, the graded management based on the delirium prediction model can effectively reduce the incidence of postoperative delirium in patients with Type A aortic dissection, while improving patient satisfaction and the quality of nursing care. It is worthy of promotion and application in clinical practice.

CONFLICTS OF INTEREST

The authors report no conflict of interest.

FUNDING

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AUTHOR CONTRIBUTIONS

Ping Feng designed the study, Hao Zhang wrote and revised the manuscript, Qiuyu Wang collected and analyzed data, and Hao Zhang and Qiuyu Wang made equal contributions to this work. All authors read and approved the final submitted manuscript.

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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