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Analysis of Risk Factors for Delirium in Elderly Patients with Stanford-type B Aortic Dissection

Rong Wang[1]†, Baoyi Yang[1]†, Na Wang[2]*, Qi Tang[1]

[1]Intensive Care Unit, Shiyan Taihe Hospital, Hubei University of Medicine, Shiyan 442000, Hubei Province, China
[2]Nursing Department, Shiyan Taihe Hospital, Hubei University of Medicine, Shiyan 442000, Hubei Province, China
†These authors contributed equally to this work and share first authorship.

Corresponding author: Na Wang, 245917803@qq.com

Abstract: *Objective:* To investigate the incidence of delirium in elderly patients with Stanford-type B aortic dissection and analyze its risk factors. *Methods:* A convenience sample of 767 elderly patients with Stanford-type B aortic dissection admitted to the ICU from January 2020 to December 2023 was selected. Data were collected using a delirium-related questionnaire and the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). *Results:* The incidence of delirium in elderly Stanford B aortic dissection patients was 23.73%. Logistic regression analysis showed that gender, length of stay in the ICU, and duration of sedative drug use were independent risk factors for delirium in elderly patients ($P < 0.05$). The model likelihood ratio test $\chi^2 = 28.462$, $P < 0.001$; Hosmer-Lemeshow goodness-of-fit test $\chi^2 = 0.715$, $P = 0.878$. *Conclusion:* The incidence of delirium in elderly patients with Stanford-type B aortic dissection is relatively low. Medical staff should conduct adequate and effective preoperative assessment according to the condition of elderly Stanford-type B aortic dissection patients, and use analgesic and sedative drugs reasonably to create a good treatment environment for patients, thereby minimizing the incidence of delirium in elderly patients with Stanford-type B aortic dissection as much as possible.

Keywords: Elderly; Aortic dissection; Delirium; Risk factors

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1. Introduction

Aortic dissection (AD) is a relatively common critical illness in cardiovascular surgery [1]. Its onset is sudden, and the etiology is still unclear. Often caused by multiple factors such as hypertension, atherosclerosis, and cystic medial degeneration. If not treated in time, it will seriously threaten the lives of patients [2]. According to the Stanford classification, AD is divided into Type A and Type B. Stanford-type A AD has a more dangerous course, and almost all cases require complex surgeries with a higher incidence of postoperative complications. Currently, domestic and international scholars have conducted extensive research on it. For Stanford-type B AD, with the increasing number

of hypertensive patients, its incidence rate is also rising, but research on it is relatively limited. Delirium is a common complication in AD patients, often manifested as confusion in thinking, decreased clarity of consciousness, and even cognitive function damage [3]. Due to a series of changes in the brain during aging [4], the elderly population is at a higher risk of delirium. The occurrence of delirium in the elderly prolongs the length of hospital stay, increases hospitalization costs, and increases the incidence of perioperative complications and mortality [5,6], thereby increasing the burden on patients' families and society. Some studies have pointed out that understanding the risk factors for delirium and actively taking relevant intervention measures can effectively prevent the occurrence of delirium to a certain extent [7-8]. Currently, there are few reports on delirium in elderly patients with Stanford-type B AD. This study aims to explore the occurrence and related risk factors of delirium in elderly patients with Stanford-type B AD, hoping to lay a foundation for the prevention and treatment of delirium in this patient population.

2. Subjects and methods

2.1. Research subjects

From January 2020 to December 2023, a convenience sample of 767 elderly patients with Stanford-type B aortic dissection admitted to the ICU was selected. Inclusion criteria: (1) Age ≥ 60 years old; (2) Confirmed as Stanford-type B AD by aortic computed tomography angiography (CTA) and/or echocardiography; (3) Underwent endovascular aortic repair; (4) Previously in good health, without a history of neurological or psychiatric diseases, and with normal communication ability; (5) Informed consent and voluntary participation in this study. Exclusion criteria: (1) With a history of neurological or psychiatric diseases; (2) Unable to complete the study due to changes in the condition during the research process; (3) Those who are treated in the ICU for less than 24 hours.

2.2. Research tools

2.2.1. Delirium-related data questionnaire

Designed by the researcher after consulting relevant materials and experts. It includes two parts: general information about patients and clinically relevant information. The content consists of 15 factors such as the patient's gender, age, educational level, body mass index (BMI), Acute Physiology and Chronic Health Evaluation (APACHE II) score, smoking history (smoking within 3 months before surgery), drinking history (drinking within 3 months before surgery), history of hypertension and diabetes, length of stay in the ICU (days), duration of analgesic drug use (hours), duration of sedative drug use (hours), patient's operation time (hours), postoperative mechanical ventilation time (hours), and limb restraint time (hours).

2.2.2. Confusion Assessment Method for the Intensive Care Unit (CAM-ICU)

The CAM-ICU was used as a diagnostic tool for delirium. Its diagnostic criteria include four items: (1) Sudden change or fluctuation in the state of consciousness; (2) Attention disorder; (3) Confusion in thinking; (4) Change in the level of consciousness. If both (1) and (2) are positive, and either (3) or (4) is positive, then delirium is diagnosed. The sensitivity of this scale in diagnosing delirium in ICU patients is 93–100%, and the specificity is 98–100% [5].

2.3. Data collection and delirium assessment

All members of the research team received professional training on delirium-related knowledge, and only those

who passed the assessment were allowed to participate in this study. The researcher extracted the general and clinical-related information of patients with delirium from the medical records, such as the doctor's progress records and relevant nursing records in the electronic medical record system. The diagnosis of delirium was mainly completed by the attending doctors in the research team in strict accordance with the assessment standards and procedures, and recorded in the progress of the disease.

2.4. Statistical methods

SPSS 25.0 was used for data analysis. Examples, percentages, and mean ± standard deviation (SD) were used for statistical description. *t*-tests, chi-square tests, and other methods were used for statistical analysis, and binary logistic regression was used for regression analysis. $P < 0.05$ was considered statistically significant.

3. Results

3.1. Incidence of delirium in elderly patients with Stanford-type B AD

Among the 767 research subjects, 182 patients developed delirium, with an incidence rate of 23.73%.

3.2. Univariate Analysis of Delirium in Elderly Patients with Stanford-type B AD

The 767 research subjects were divided into a delirium group and a non-delirium group based on whether delirium occurred or not. The comparison of general information between the two groups is shown in **Table 1**. As can be seen from **Table 1**, there were seven factors, including the patient's gender, age, drinking history, length of stay in the ICU, duration of analgesic drug use, duration of sedative drug use, and postoperative mechanical ventilation time, that had statistically significant differences in the occurrence of delirium in elderly patients with Stanford-type B AD ($P < 0.05$).

Table 1. Analysis of general data of research subjects [*n*(%)]

Items	Delirium group (*n* = 182)	Non-delirium group (*n* = 585)	t/χ^2 Value	*P* Value
Gender			1.646	0.199
Male	127 (69.78)	378 (64.62)		
Female	55 (30.22)	207 (35.38)		
Age (years)			11.569	0.001
60–70	146 (80.22)	392 (67.01)		
> 70	36 (19.78)	193 (32.99)		
Educational Level			2.903	0.088
Junior high school and below	140 (76.92)	412 (70.43)		
High school and above	42 (23.08)	173 (29.57)		
Body Mass Index	20.48 ± 3.67	21.05 ± 3.42	0.875	0.348
APACHEII score	20.22 ± 4.41	21.57 ± 5.27	0.976	0.475
Smoking history			0.898	0.343
Yes	120 (65.93)	363 (62.05)		
No	62 (34.07)	222 (37.95)		

Table 1 (Continued)

Items	Delirium group (n = 182)	Non-delirium group (n = 585)	t/χ^2 Value	P Value
Drinking history			2.436	0.119
Yes	117 (64.29)	338 (57.78)		
No	65(35.71)	247(42.22)		
Hypertension history			3.037	0.081
Yes	108 (59.34)	304 (51.97)		
No	74 (40.66)	281 (48.03)		
Diabetes history			0.168	0.682
Yes	58 (31.87)	196 (33.50)		
No	124 (68.13)	389 (66.50)		
ICU treatment duration (d)	5.37 ± 1.28	3.12 ± 1.02	3.468	0.021
Analgesic drug use duration (h)	68.72 ± 15.14	45.24 ± 12.87	2.677	0.036
Sedative drug use duration (h)	82.42 ± 23.85	28.95 ± 10.16	4.325	0.025
Operation time (h)	3.06 ± 1.48	3.15 ± 1.37	1.276	0.582
Post-operative mechanical ventilation time (h)	4.54 ± 1.22	2.98 ± 0.87	2.206	0.035
Limb restraint time (h)	5.98 ± 1.37	4.69 ± 1.17	0.972	0.586

3.3. Logistic regression analysis of delirium in elderly patients with Stanford-type B AD

Taking the occurrence of delirium as the dependent variable, and the factors with statistical significance in the univariate analysis as independent variables. The assignment methods of independent variables are shown in **Table 2**. The forward stepwise Wald χ^2 method was used for Logistic regression analysis (an entry = 0.05, an exit = 0.10), and $P < 0.05$ was considered as a statistically significant difference. The results showed that gender, drinking, time of delirium diagnosis, and sedative drug use duration were independent risk factors affecting the occurrence of delirium in elderly patients with Stanford-type B AD. The model likelihood ratio test $\chi^2 = 28.462$, $P < 0.001$, indicating that the regression model was meaningful; the Hosmer-Lemeshow goodness-of-fit test $\chi^2 = 0.715$, $P = 0.878$, indicating that the model fits well.

Table 2. Assignment methods of independent variables

Items	Assignment methods
Gender	Male = 1, Female = 2
Age	60–70 years old = 1, > 70 years old = 2
Drinking history	Yes = 1, No = 2
ICU treatment duration (d)	Input actual value
Analgesic drug use duration (h)	Input actual value
Sedative drug use duration (h)	Input actual value
Post-operative mechanical ventilation time (h)	Input actual value

Table 3. Logistic regression analysis of delirium in elderly patients with Stanford-type B AD

Items	B value	SD	*P* value	OR value	95% CI
Constant	-6.258	1.386	0.001	0.618	
Gender	0.486	0.878	0.008	4.025	1.182–6.378
ICU treatment duration (d)	0.674	0.723	0.004	5.174	2.336–8.891
Sedative drug use duration (h)	0.882	0.746	0.000	5.878	1.078–7.364

4. Discussion

4.1. Analysis of the occurrence of delirium in elderly patients with Stanford-type B AD

The results of this study showed that the incidence of delirium in elderly patients with Stanford-type B AD was 23.73%, which is essentially consistent with the result of 20.8% reported by Shen *et al.* [9], lower than the result of 30.0% obtained by Wu *et al.* [10] in their study on elderly postoperative patients in the ICU, and also lower than the result of 30.67% reported by Wu *et al.* [11] in their study on patients with Stanford-type A AD.

The reason for this may be that, compared to Stanford-type A AD, the condition of patients with Stanford-type B AD may not be as complex and dangerous. Most of them do not need long-term surgery under general anesthesia and deep hypothermic circulatory arrest. Instead, they generally undergo endovascular repair of thoracic aortic dissection under interventional guidance. This surgery is less invasive and has fewer postoperative complications. The duration of treatment in the ICU for these patients is also relatively shorter [12,13]. Therefore, the incidence of postoperative delirium in patients with Stanford-type B AD is lower than that in patients with Stanford-type A AD.

4.2. Analysis of risk factors for delirium in elderly patients with Stanford-type B AD

Logistic regression analysis shows that gender, alcohol consumption, duration of treatment in the ICU, duration of analgesic drug use, and duration of sedative drug use are independent risk factors affecting the occurrence of delirium in elderly patients with Stanford-type B AD.

4.3. Gender

Research indicates that male patients are more prone to postoperative delirium than female patients [14]. The incidence of Stanford-type B AD is higher in males than in females, with a ratio that can reach 2.00 to 3.00:1.00 [15]. Therefore, the incidence of delirium is also relatively higher. In this study, the ratio of male to female patients was approximately 1.50:1.00, and among the patients who developed delirium, the ratio of male to female patients was even higher, around 3.50:1.00, which also confirms previous studies. The reason for this may be that among the male patients selected in this study, a relatively higher proportion had bad living habits such as smoking and alcohol consumption. Moreover, male patients may experience greater stress in their daily life and work. Under the influence of these psychological and social factors, the incidence of Stanford-type B AD may increase, thereby increasing the incidence of delirium in patients with Stanford-type B AD.

4.4. Duration of treatment in the ICU

Some studies have pointed out that a long duration of treatment in the ICU is an independent risk factor for the occurrence of delirium in critically ill patients. The results of this study also show that the longer the duration of treatment in the ICU, the higher the incidence of delirium in elderly patients with Stanford-type B AD. The reason

for this may be related to the closed management model of the ICU. At present, due to various reasons, most ICUs in China, restrict family members from visiting patients, which will cause separation anxiety in patients, increasing the risk of delirium. In addition, research has shown that frequent changes of beds, lack of time orientation tools such as clocks or watches, physical restraints, or a "passive immobilization" state due to treatment are closely related to the occurrence of delirium [16]. Due to the stimulation of sound and light in the ICU, coupled with the fact that most patients with Stanford-type B AD need to be on absolute bed rest and cannot get out of bed to move around, these factors can easily lead to changes in the patient's sleep schedules and disruption of their biological rhythms, thereby causing delirium.

4.5. Use of sedative drugs

Elderly patients, due to reasons such as cellular aging, degenerative changes in brain tissue, degeneration of neural regulation functions, aging and decline of systems and organs, poor stress resistance, and slow drug metabolism rates, are themselves a high-risk group for delirium. In addition, some sedative drugs have the effect of reducing cerebral blood flow and central anticholinergic action, which can affect the conduction of pain signals and reduce the reactivity to internal and external environmental stimuli [17]. At the same time, sedative drugs themselves also have side effects such as hallucinations and delusions. Withdrawal symptoms similar to delirium may occur when the drug dosage changes or is interrupted, which all promote the occurrence of delirium to a certain extent [12]. Therefore, the incidence of delirium in elderly patients who use sedative drugs for a long time and in large quantities is relatively high.

5. Conclusion

In summary, the incidence of delirium in elderly patients with Stanford-type B AD is relatively low, which may be related to factors such as gender, duration of treatment in the ICU, and duration of sedative drug use. Therefore, medical staff should conduct a full and effective assessment of elderly patients with Stanford-type B AD before surgery according to their conditions, and use analgesic and sedative drugs reasonably. They should also create a good treatment environment for patients to minimize the incidence of delirium in elderly patients with Stanford-type B AD as much as possible. Due to the limited sample size collected in this study and the limitations of clinical work, the discussion has certain limitations. In the future, more large-sample, multi-center, and prospective studies are still needed for verification.

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