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Article

The Effect of Onset Time on In-Hospital Mortality in Patients with Acute Type A Aortic Dissection of Different Gender: A Retrospective Cohort Study

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Abstract

Background: Although the research on gender in acute type A aortic dissection (AAAD) patients has increased in recent years, the results are still controversial. The effect of time of onset on in-hospital mortality in patients with AAAD of different gender is unclear. The purpose of this study was to investigate the effect of onset time on in-hospital mortality of patients with AAAD of different gender. **Methods**: In this retrospective observational study, patients with AAAD were selected from June 2013 to March 2020. Patients' information was extracted from electronic medical records. Based on the onset time, the patients were categorized into four groups: group one (00:00–05:59), group two (6:00–11:59), group three (12:00–17:59), and group four (18:00–23:59). **Results**: A total of 760 subjects were included in our study. There were 591 (77.8%) males and 169 (22.2%) females. In male patients, 79 cases died, in female patients, 19 cases died ($p < 0.05$). We conducted subgroup analysis according to gender, univariate Cox regression analysis of male patients showed that compared with the patients at onset time of 0:00–5:59, patients at onset time of 12:00–17:59 and 18:00–23:59 were associated with an increased risk of in-hospital mortality. Multivariate Cox regression analysis of male patients showed that the onset time of 18:00–23:59 remained as the significant risk factor of in-hospital mortality of male patients hazard ratio (HR) = 4.396 ($p < 0.05$). **Conclusions**: This analysis demonstrated that in-hospital mortality of AAAD patients was similar in different genders. In male patients, the onset time of 18:00–23:59 was significantly associated with an increased risk of in-hospital mortality.

Keywords

acute type A aortic dissection; onset time; gender; in-hospital mortality

Introduction

Acute type A aortic dissection (AAAD) involves the ascending aorta and is a life-threatening disease. The prognosis of untreated AAAD patients is extremely poor, with an increase of mortality rate of 1%–2% every hour and a two-week mortality rate as high as 70% [1]. It was reported that the mortality rate of AAAD patients was as high as 27% [2]. Hospital mortality is a key indicator to measure the severity of the disease. Therefore, it is important to determine the risk factors of in-hospital mortality for disease triage. In the past decades, the effect of gender on aortic dissection (AD) patients has been extensively studied, but the results are still controversial. Studies have shown that female have more in-hospital complications and worse outcomes after AAAD surgery [3,4]. Chang *et al.*'s [5] study on patients with AD also showed that female have a higher 30-day mortality compared to male. But in the study of Friedrich and Rylski, female were not associated with worse early and long-term outcomes [6,7]. Compared with female, male appear to be more likely to develop AAAD at a young age and have a higher mortality after surgery. Female have mild symptoms during onset and have a higher survival rate after surgery [8]. The potential pathways for gender differences in AD have not been fully explored and remain challenging.

Previous large studies have reported that temporal rhythm has a great influence on the occurrence of AD. These periodic changes led to the occurrence of AD with obvious chronobiological patterns [9], but only Mehta *et al.* [10] explored that, in-hospital mortality was similar among aortic dissections occurring in the 4 time periods (midnight to 6 AM, 6 AM to noon, noon to 6 PM, 6 PM to midnight), and no other similar studies have been reported. The male to female ratio of AD patients is estimated to be between 1.5 and 2:1 [1,11]. The European Society of Cardiology (ESC) guidelines emphasize the urgent need for more epidemiological studies to assess potential gender differences

[12]. Meanwhile, we are not aware of any comparative studies that have revealed gender differences in correlation between AD onset time and outcome, which may reveal important biological mechanisms. Therefore, this study was divided into groups according to gender and onset time to further explore the impact of onset time on the in-hospital mortality of AAAD patients of different genders.

Materials and Methods

Study Population

We performed a retrospective cohort study. The study participants were recruited from June 2013 to March 2020 at the cardiac surgery department of Fujian Medical University Union Hospital. All patients (age $\geq$18 years) had a confirmed clinical diagnosis of AAAD by computed tomography angiography or magnetic resonance angiography, and intervals carried out from clinical onset to diagnosis occurred within 14 days. We excluded those patients if (1) the onset time was unclear; (2) had traumatic dissection; (3) had a history of a malignant tumor; and (4) had right coronary artery dissection. The study was approved by the Fujian Medical University Union Hospital (2019KY019). The study was in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Data Collection

The researcher extracted the relevant information from the electronic medical record of the study hospital. The following data were extracted from the system. (1) Patients' general characteristics: age, gender, height, weight, and previous medical history (hypertension, diabetes, smoking, and drinking). (2) Patients' clinical data: the specific time of onset, blood pressure and heart rate at admission, and symptoms (e.g., headache/dizziness, chest/back pain, profuse sweating, nausea, vomiting, shock, syncope, dyspnea). (3) Patients' laboratory results were recorded from the electronic medical record. (4) Intraoperative clinical data: surgical intervention, the cardiopulmonary bypass time (CPB), aortic cross-clamp time, and operation time. The patient records were monitored till they were discharged from the hospital or died.

The main outcome was death in the hospital. According to the electronic medical record to record the time of death until the patient died or was discharged. Smokers are defined as those who have smoked for 6 months or more. In our study, we divided patients into four groups using standard 6-hour spans of 24 h periods according to the exact time of symptom onset (group one: 00:00–05:59; group two: 06:00–11:59; group three: 12:00–17:59; group four: 18:00–23:59).

Statistical Analysis

Analyses were performed with SPSS 24.0 (IBM Corp., Armonk, NY, USA). Continuous variables were presented using mean $\pm$ standard deviation (SD) or median and interquartile ranges (IQR) according to whether or not they follow Gaussian distribution. Analysis of variance or χ^2 tests or Kruskal-Wallis rank-sum tests were used to compare the baseline characteristics between the two groups. Univariate Cox regression analysis was performed to determine the potential risk factors of in-hospital mortality, and a backward multivariate Cox regression analysis was performed to determine the significant risk factors of in-hospital mortality. Kaplan Meier method was used for survival analysis among the four groups. A p value < 0.05 was considered statistically significant.

Results

From June 2013 to March 2020, 812 patients with AAAD were admitted to Fujian Medical University Union Hospital. 52 patients were excluded because of the following reasons. 43 patients had unclear onset time of AAAD, 1 patient had AAAD due to taking strong acid, 2 patients due to traumatic dissection, 5 patients had comorbidity of cancer, and 1 patient had right coronary artery dissection. A total of 760 patients met our research criteria and was included in the final data analysis (Fig. 1).

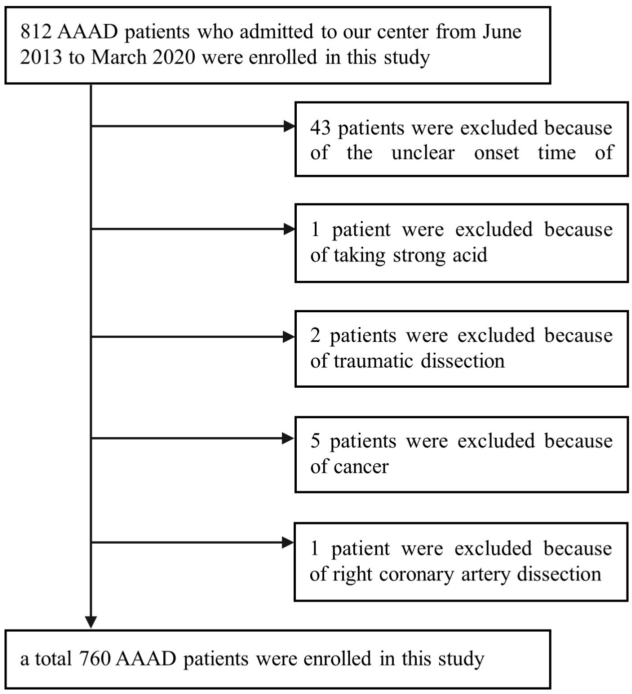

Fig. 1. Patient flow chart of the cohort. AAAD, acute type A aortic dissection.

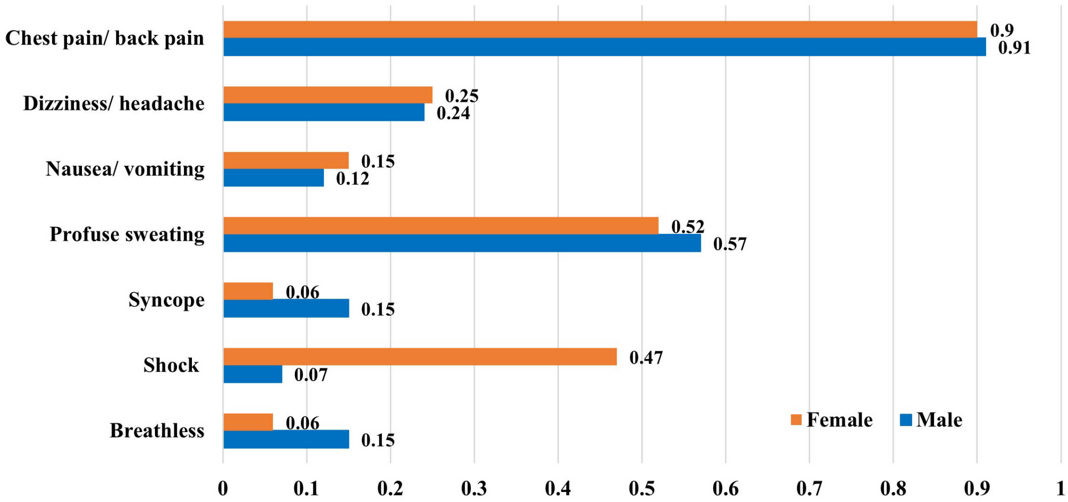

Fig. 2. Comparison of clinical symptoms between different genders (%).

Table 1 shows the clinical data according to gender. Among the 760 patients, 591 cases were male and 169 cases were female. The age of males was (51.80 ± 11.53) years old, the age of females was (57.02 ± 11.23) years old, and the difference between the two groups was statistically significant ($p < 0.001$). There were significant differences in body mass index (BMI), smoker, drink, diabetes mellitus, systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate, white blood cell (WBC), neutrophil, and macrophage between the two groups ($p < 0.05$). There were no significant differences in hypertension, Marfan syndrome, previous cardiac surgery, lymphocyte, platelets, surgery, operating time, cardiopulmonary bypass (CPB) time, and aortic cross-clamp time between the two groups ($p > 0.05$). There were 122 (20.6%) male patients and 30 (17.8%) female patients with the onset time in 0:00–5:59, 141 (23.9%) male patients and 41 (24.3%) female patients with the onset time in 6:00–11:59, 210 (35.5%) male patients and 59 (34.9%) female patients with the onset time in 12:00–17:59, 118 (20.0%) male patients and 39 (23.1%) female patients with the onset time in 18:00–23:59, and no statistically significant difference between the two groups in the four periods of onset time ($p = 0.756$).

There were no significant differences in symptoms, including headache, dizziness, chest and back pain, nausea and vomiting, dyspnea, and shock between the different gender ($p > 0.05$) (Fig. 2). AAAD patients were divided into four groups according to the onset time. Kaplan-Meier survival curve showed that male patients with onset at 18:00–23:59 had the lowest survival rate, and the difference between the four groups was statistically significant ($\chi^2 = 13.340$, $p = 0.004$), as shown in Fig. 3.

Table 2 shows the results of the Cox regression analysis of in-hospital mortality in AAAD patients. Univariate Cox regression analysis showed that age increased the risk of in-hospital death (hazard ratio (HR), 1.025; 95% CI, 1.007 to 1.043; $p = 0.006$). Compared to the onset time of 0:00–5:59, the HR of the in-hospital mortality risk for patients with onset time of 12:00–17:59 was 2.531 (95% CI, 1.228 to 5.217; $p = 0.012$); and the risk of in-hospital mortality was 3.422 (95% CI, 1.642 to 7.210; $p = 0.001$) for patients with onset time of 18:00–23:59. Other factors associated with in-hospital mortality included operation time (HR, 1.005; 95% CI, 1.003 to 1.008; $p < 0.001$), CPB time (HR, 1.008; 95% CI, 1.006 to 1.010; $p < 0.001$), and aortic occlusion time (HR, 1.007; 95% CI, 1.004 to 1.010; $p < 0.001$). In addition, surgery significantly reduced the risk of in-hospital mortality (HR, 0.071; 95% CI, 0.046 to 0.111; $p < 0.001$). Subgroup analysis was performed according to gender. Cox regression univariate analysis showed that the older the male or female, the higher the risk of in-hospital death; in male patients, compared with the onset time of 0:00–5:59, the onset time of 12:00–17:59 and 18:00–23:59 were related to the increased risk of in-hospital death, but there was no such trend in female patients.

Multivariate Cox regression analysis of male patients found that after adjusting for age, blood biochemical indicators, operation time, and other factors, compared with the onset time of 0:00–5:59, the onset time of 18:00–23:59 remained as a significant risk factor for in-hospital mortality in male patients (HR, 4.396; 95% CI, 1.602 to 12.068; $p = 0.004$). Multivariate Cox regression analysis of male patients found that age significantly increased the risk of in-hospital mortality in female patients (HR, 1.156; 95% CI, 1.039 to 1.286; $p = 0.008$), but different onset time did not effect on the risk of in-hospital mortality (Table 3).

Table 1. Clinical data according to gender.

Variable	Male (N = 591)	Female (N = 169)	p value
Demographics			
Age (years)	51.80 ± 11.53	57.02 ± 11.23	<0.001
BMI (kg/m^2)	25.22 ± 4.00	23.97 ± 3.44	0.002
Smoker	338 (57.2)	23 (13.6)	<0.001
Drinker	238 (40.3)	15 (8.9)	<0.001
Hypertension	453 (76.6)	126 (74.6)	0.573
Marfan syndrome	15 (2.5)	6 (3.6)	0.479
Diabetes mellitus	14 (2.4)	9 (5.3)	0.048
Previous cardiac surgery	19 (3.2)	6 (3.6)	0.829
SBP (mmHg)	142.58 ± 30.33	136.07 ± 28.97	0.013
DBP (mmHg)	76.18 ± 16.94	73.06 ± 16.56	0.034
Heart rate (beats/min)	82.31 ± 16.98	78.18 ± 16.39	0.005
Onset time			0.756
0:00–5:59	122 (20.6)	30 (17.8)	
6:00–11:59	141 (23.9)	41 (24.3)	
12:00–17:59	210 (35.5)	59 (34.9)	
18:00–23:59	118 (20.0)	39 (23.1)	
Blood biochemistry			
WBC (×10^9/L)	13.05 ± 4.18	11.71 ± 3.82	<0.001
Neutrophil (×10^9/L)	11.05 ± 4.06	10.00 ± 3.69	0.003
Lymphocyte (×10^9/L)	1.05 ± 0.51	0.97 ± 0.55	0.120
Macrophage (×10^9/L)	0.84 ± 0.45	0.60 ± 0.34	<0.001
Platelets (×10^9/L)	176.00 ± 65.54	181.53 ± 67.70	0.331
Surgical procedures			
Surgery	553 (93.6)	159 (94.1)	0.809
Operating time (min)	322.38 ± 87.81	334.37 ± 88.07	0.131
CPB (min)	166.48 ± 65.65	168.87 ± 76.82	0.699
Aortic cross-clamp time (min)	79.75 ± 49.10	81.36 ± 54.14	0.726
Clinical outcome			
Mechanical ventilation	56.0 (27.5, 115.0)	54.0 (31.0, 110.63)	0.875
ICU day	6.02 (3.80,10.29)	6.0 (4.0, 10.13)	0.993
In hospital day	20.0 (15.0, 27.0)	20.0 (14.0, 26.0)	0.361
Survival	512 (86.6)	150 (88.8)	0.467

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; WBC, white blood cell; CPB, cardiopulmonary bypass; MV, mechanical ventilation; ICU, intensive care unit. Data of continuous variables with normal distribution are shown as mean (SD), data of non-normal distribution are displayed as interquartile range, and data of binary variables are shown as absolute numbers (percentages).

Discussion

This study is the first to retrospectively analyze the relationship between the onset time and hospital mortality in patients with AAAD of different genders, which has a certain value for the clinical management and risk stratification of AAAD. The main findings of this study among patients with AAAD: (1) the in-hospital mortality of AAAD patients of different genders was similar; (2) we conduct subgroup analyses according to gender, the Cox regression analysis found that in male patients, compared with the onset time of 0:00–5:59, 18:00–23:59 was related to the increased risk of in-hospital mortality, but this trend did not show in female patients; (3) females are older than males, and aging the older the female patients, the higher the risk of death; (4) multivariate analysis showed that CPB time increased the risk of death in male patients during hospitalization.

Previous studies have shown that female patients with AAAD have a poorer clinical prognosis than males [6]. According to the IRAD database, Nienaber *et al.* [4] reported that among patients undergoing surgery and conservative treatment, the in-hospital mortality rate was as high as 38% in females and 27% in males (p = 0.002), and in this report, in-hospital mortality after surgery for AAAD was 32% *vs.* 22% in female and male, respectively (p =

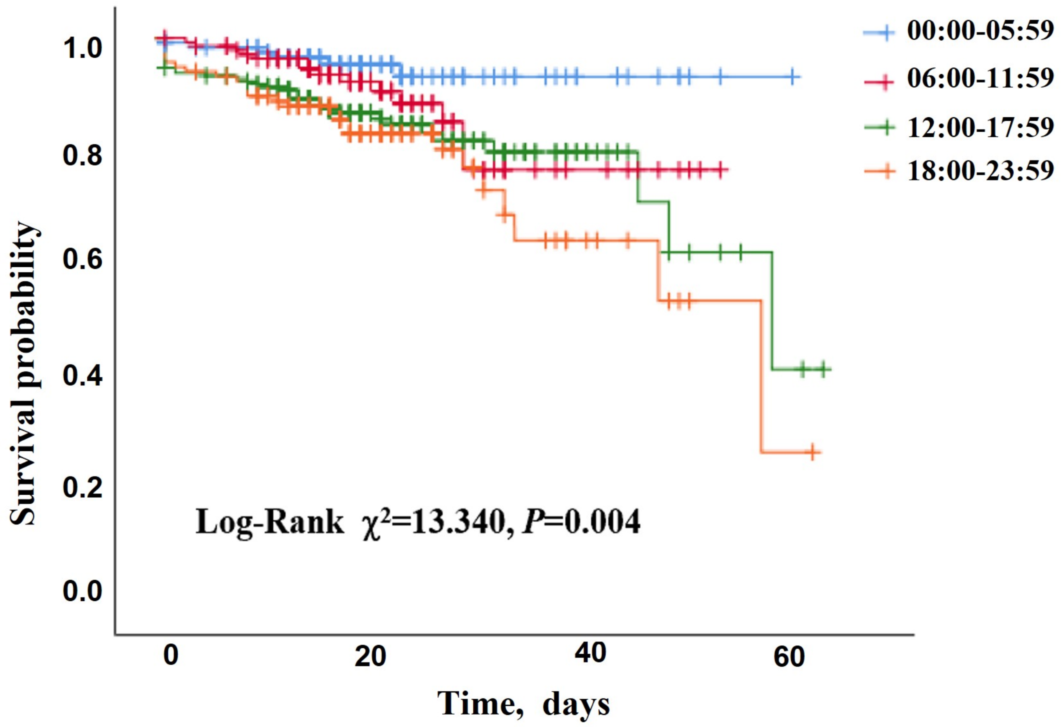

Fig. 3. Kaplan-Meier survival of in-hospital mortality in male patients with different onset time group.

0.013). In our study, 79 males (13.4%) and 19 females (11.2%) died of AAAD patients during hospitalization ($p = 0.467$). After surgery, 55 males (9.9%) and 13 females (8.2%) died, which was consistent with the results registered in Germany. The German Registry for Acute Aortic Dissection Type A (GERAADA) reported that 23.0% of male and 16.3% of female deaths, with no significant difference in 30-day hospital mortality between the two groups ($p = 0.177$) [7]. In their study, the age of female patients was significantly older than that of male patients (65.5 $\pm$ 12.7 years *vs.* 59.2 $\pm$ 13.3 years, $p < 0.001$). Similarly, our results showed that females were older than males (57.02 $\pm$ 11.23 years *vs.* 51.8 $\pm$ 11.53 years, $p < 0.001$), but the average age of onset of AD reported by us was younger than that in European and American countries, which was consistent with previous studies. Ovarian estrogen has a protective effect on women's cardiovascular system and can reduce the risk of hypertension [13]. Hypertension is an important risk factor for AD. The decrease of estrogen after menopause will increased vascular fragility and promote the occurrence of hypertension [14].

A multiethnic study conducted by Mehta *et al.* [10] from the USA, which found that the clinical outcomes of AAD patients were found to be similar at the four different periods of the 24 h, but the study did not stratify by gender. The results of Zhang *et al.* [15] showed that the peak incidence of AD (type A and type B) was between 13:00–18:00, and there was no statistical difference in the onset time of different genders ($p = 0.45$), our results were similar ($p = 0.736$). As we all know, the research results of female patients with AD are mostly based on male [7,16]. Therefore, we conducted a stratified analysis by gender, and multivariate Cox regression analysis showed that compared with the onset time of 0:00–5:59, the onset time of 18:00–23:59 was associated with increased risk of in-hospital mortality in male patients, but this trend did not appear in female patients. In society and family, males play an important role. Chinese males are more likely to participate in social activities at night when they finish work at 17:00. Social activities and entertainment are significantly more than females, and the form of social communication and social entertainment is mainly potluck. This will inevitably consume too much tobacco, alcohol, high fat, high cholesterol, and high-calorie diet. Nicotine in cigarettes can lead to abnormal glucose and fat metabolism, accelerate the deposition of blood lipids in the vascular wall, harden the blood vessels, cause continuous contraction of small arteries, and increased cardiovascular morbidity and mortality [17,18]. The conclusion that an unhealthy lifestyle increases cardiovascular disease and mortality is very clear [19].

Maintaining a normal Circadian rhythm of blood pressure plays a very important role in protecting the heart, brain and other important target organs [20,21]. In studies based on population and hypertension, for every 5% increase in nocturnal SBP relative to daytime SBP, the risk of cardiovascular events increased by 20% [22]. Studies have shown that nighttime blood pressure fluctuation has a greater impact on target organs than daytime blood pressure level, and

Table 2. Predictors of in-hospital mortality by univariate Cox regression analysis.

	Total		Male		Female	
	HR (95% CI)	*p* value	HR 95% CI	*p* value	HR (95% CI)	*p* value
Demographics						
Age (years)	1.025 (1.007–1.043)	0.006	1.020 (1.000–1.040)	0.045	1.068 (1.014–1.124)	0.012
BMI (kg/m^2)	0.960 (0.895–1.031)	0.262	0.976 (0.907–1.051)	0.522	0.952 (0.788–1.149)	0.606
Smoker	0.836 (0.561–1.246)	0.379	0.897 (0.575–1.400)	0.663	0.038 (0.023–9.474)	0.246
Drinker	0.643 (0.410–1.008)	0.054	0.665 (0.415–1.063)	0.088	0.042 (0.013–2.375)	0.356
Hypertension	0.906 (0.560–1.465)	0.687	0.902 (0.531–1.534)	0.704	1.149 (0.397–3.483)	0.806
Marfan syndrome	1.031 (0.253–4.194)	0.966	1.467 (0.359–6.004)	0.594	1.127 (0.723–6.192)	0.593
Diabetes mellitus	0.327 (0.046–2.347)	0.266	0.470 (0.039–5.621)	0.322	1.113 (0.148–8.374)	0.917
Previous cardiac surgery	0.730 (0.180–2.963)	0.659	0.446 (0.062–3.207)	0.422	1.790 (0.238–13.472)	0.572
SBP (mmHg)	0.997 (0.990–1.004)	0.388	0.997 (0.989–1.004)	0.401	0.997 (0.981–1.012)	0.675
DBP (mmHg)	0.999 (0.987–1.011)	0.884	1.001 (0.988–1.014)	0.874	0.998 (0.971–1.026)	0.998
Heart rate (beats/min)	0.995 (0.983–1.007)	0.431	0.997 (0.984–1.011)	0.686	0.995 (0.966–1.024)	0.709
Onset time						
0:00–5:59	Reference		Reference		Reference	
6:00–11:59	1.980 (0.894–4.383)	0.092	2.205 (0.847–5.742)	0.105	1.502 (0.355–6.358)	0.580
12:00–17:59	2.531 (1.228–5.217)	0.012	3.228 (1.355–7.692)	0.008	1.165 (0.290–4.678)	0.830
18:00–23:59	3.422 (1.642–7.210)	0.001	4.289 (1.759–10.458)	0.001	1.588 (0.377–6.693)	0.529
Blood biochemistry						
WBC (×10^9/L)	1.011 (0.967–1.056)	0.644	1.004 (0.955–1.057)	0.865	1.087 (0.989–1.195)	0.084
Neutrophil (×10^9/L)	1.018 (0.973–1.065)	0.445	1.019 (0.968–1.072)	0.474	1.076 (0.965–1.199)	0.186
Lymphocyte (×10^9/L)	0.902 (0.592–1.377)	0.634	0.597 (0.359–0.992)	0.046	1.791 (1.149–2.792)	0.010
Macrophage (×10^9/L)	0.824 (0.518–1.310)	0.413	0.749 (0.450–1.247)	0.266	1.434 (0.367–5.608)	0.605
Platelets (×10^9/L)	0.996 (0.993–0.999)	0.011	0.996 (0.992–0.999)	0.021	0.995 (0.988–1.002)	0.198
Surgical procedures						
Surgery	0.071 (0.046–0.111)	<0.001	0.080 (0.049–0.132)	<0.001	0.043 (0.015–0.126)	<0.001
Operating time (min)	1.005 (1.003–1.008)	<0.001	1.005 (1.003–1.008)	<0.001	1.006 (1.001–1.011)	0.024
CPB (min)	1.008 (1.006–1.010)	<0.001	1.008 (1.006–1.011)	<0.001	1.007 (1.003–1.011)	<0.001
Aortic cross-clamp time (min)	1.007 (1.004–1.010)	<0.001	1.006 (1.002–1.010)	0.002	1.008 (1.003–1.014)	0.003

HR, hazard ratio; CI, confidence interval; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; WBC, white blood cell; CPB, cardiopulmonary bypass.

the increase of nocturnal blood pressure level is closely related to high sodium intake, and has a greater impact on cardiovascular disease and death [23]. Chinese men's nocturnal life after 17:00 is likely to affect the normal circadian regulation of blood pressure, further promoting the development of AD, making it more serious and worse prognosis.

Experimental studies have reported that there are gender differences in the morphology, peptide and electrical activity of the suprachiasmatic nucleus between rodents and humans [24]. However, whether these differences affect the function of patients' circadian systems, leading to gender differences between onset time and clinical outcomes, is unclear. Biological gender appears to mitigate the circadian rhythm effects of neutrophils during myocardial infarction (MI). Female mice given an MI during their wake time have greater neutrophil infiltration into infarcted hearts, and worse outcomes, as compared to female mice when MI was induced during their sleep time [25]. In the study of Aziz *et al.* [26], MI in female and male, the neutrophilic response is different, and their research team found that different neutrophilic response phenotypes are displayed in male and female mice, and there are differences in cardiovascular pathophysiology between female and male. Studies reported that *CLOCK* gene, a key clock gene, has a genetic variability in female compared to male. Gene polymorphism may be one of the reasons for the different effects of circadian rhythm on gender [27,28]. Future research is needed to consider gender when examining the relationship between onset time and outcome. In the study by Peng Hui *et al.* [29], it was found that patients with nocturnal onset had higher levels of inflammatory markers (C-reactive protein (CRP) and neutrophils) compared to other times of the day. This suggests that reperfusion enhances the infiltration of inflammatory cells and may translate into adverse remodeling and decreased cardiac function beyond the initial ischemic injury. Meanwhile, the anti-inflammatory and antioxidant effects of estrogen and progesterone have been demonstrated in previous studies, partially counteracting the inflammatory response [30].

Table 3. Predictors of in-hospital mortality by multivariate Cox regression analysis.

	Male		Female	
	HR (95% CI)	*p* value	HR (95% CI)	*p* value
Age	0.986 (0.962–1.010)	0.246	1.156 (1.039–1.286)	0.008
Smoker	NA	NA	NA	0.977
Onset time				
0:00–5:59	Reference		Reference	
6:00–11:59	2.314 (0.779–6.872)	0.131	0.955 (0.145–6.271)	0.962
12:00–17:59	2.574 (0.951–6.963)	0.063	0.752 (0.105–5.374)	0.776
18:00–23:59	4.396 (1.602–12.068)	0.004	0.842 (0.089–7.976)	0.881
WBC	NA	NA	1.117 (0.975–1.279)	0.110
Lymphocyte	0.445 (0.231–0.850)	0.015	4.175 (1.084–16.079)	0.038
Platelets	0.997 (0.993–1.001)	0.137	0.989 (0.979–1.000)	0.045
Operating time	1.000 (0.995–1.005)	0.926	1.000 (0.990–1.011)	0.948
CPB	1.008 (1.002–1.014)	0.011	1.007 (0.994–1.021)	0.948
Aortic cross-clamp time	1.001 (0.995–1.006)	0.814	1.003 (0.991–1.015)	0.608

HR, hazard ratio; CI, confidence interval; WBC, white blood cell; CPB, cardiopulmonary bypass; NA, not applicable.

These results provide new perspectives for the prevention and management of AD. Chinese people have the habit of taking a lunch break at noon. With an increase in physical activity and a significant upward trend in blood pressure in the afternoon. At the same time, after finishing work at 17:00, men will participate in more social activities, such as smoking, drinking, high-fat and high-salt diet, and work stress release, these factors may lead to dramatic changes in blood pressure, leading to the occurrence of AD [9,15]. It is suggested that clinical medical staff should understand and recognize the possible role of onset time in AD pathology, and provide scientific basis for time therapeutics and time nursing of AD patients. Taking antihypertensive or anticoagulant drugs at evening can better match daily physiological oscillation, and significantly reduce the incidence rate and mortality of AD [31,32]. These factors may benefit people with risk factors for AD, such as high blood pressure or atherosclerosis. In addition, managers should pay more attention to the distribution of medical resources and the quality of night care during this period, strictly monitor changes in patient conditions, identify high-risk patients early, and provide reasonable medical care interventions in a timely manner, which will significantly improve the survival rate of AD patients.

Limitations

There are some limitations to this study. First, our study is a retrospective cohort study, and the data may be biased. Second, we included patients recorded in the medical system and patients who died before admission were not included. Third, this is a single-center study design, and our findings need to be validated in a multicenter study. Finally, the allocation of nighttime medical resources and the decline in nursing quality may lead to a certain bias in the results. Therefore, it is necessary to further investigate in a larger population to explore the impact of onset time on the clinical outcomes of AAAD patients of different gender.

Conclusions

This analysis demonstrated that in-hospital mortality of AAAD patients was similar in different genders. Onset time in the 18:00–23:59 may be a factor that increases the risk of in-hospital death from AAAD of males. But this trend was not observed in female patients. These results may contribute to the clinical management and risk stratification of AD.

Abbreviations

AAAD, Acute type A aortic dissection; ESC, The European Society of Cardiology; CPB, Cardiopulmonary bypass time; HR, Hazard ratio.

Availability of Data and Materials

Full data set available from the corresponding author. However, reanalysis of the full data need to be approved by Fujian Medical University Union Hospital.

Author Contributions

Study design, YP and HN; methodology, YP, YL and LC; investigation, QP, LL and SL; data curation, QP and LL; writing-original draft paper, YP and HN; writing-review and editing, YL and LC; supervision, YL and LC. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

Ethics Approval and Consent to Participate

The study was approved by the Fujian Medical University Union Hospital (2019KY019). The study was in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study was a retrospective study and did not require an informed consent form.

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Conflict of Interest

The authors declare no conflict of interest.

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