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Original Article

Gender variations in acute aortic dissection: insights from a retrospective cohort analysis

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Abstract

Objectives: Aortic dissection is a life-threatening cardiovascular condition, and this study aims to explore gender-related differences in clinical characteristics, treatment outcomes, and complications.

Methods: We conducted a retrospective cohort study analyzing medical records of 74 patients diagnosed with symptomatic aortic aneurysms at Afshar and Shahid Sadoughi Hospitals in Yazd from 2017 to 2023. We categorized patients by gender and collected the data on demographics, clinical presentations, comorbidities, treatment strategies, complications, and mortality.

Results: The study included 54 males and 20 females. Females were older at presentation (mean age 64.3 years) and had a higher prevalence of diabetes mellitus (45.0% vs. 14.8%, P=0.011). The time from symptom onset to admission was significantly longer for females (4.0 vs. 2.4 hours, P=0.039). Treatment strategies were similar across sexes. Complication rates, such as heart failure and cardiac tamponade, were higher in females (P=0.057), although overall mortality rates were similar (37.0% in males vs. 45.0% in females, P=0.933). Cox regression analysis showed age as a significant risk factor for mortality (HR 1.03, 95% CI 1.01-1.05, P=0.003).

Conclusions: Clinical presentations and treatment approaches for aortic dissection are generally similar between sexes, but differences in age at presentation and comorbidities are noteworthy. These findings underscore the importance of considering sex-specific factors in the management and prognosis of aortic dissection to improve patient outcomes.

Keywords: Aortic dissection, Gender variations, Mortality, Complications, Cardiovascular disease

Introduction

Aortic dissection is a critical and frequently fatal cardiovascular event characterized by the separation of the layers of the aortic wall [1]. This life-threatening condition can lead to significant morbidity and mortality, making it an essential focus of clinical research and healthcare management [2]. The complexity of aortic dissection necessitates a thorough understanding of the factors that influence both its presentation and outcomes to enhance patient care and improve survival rates [3]. Among these influential factors, sex differences have garnered increasing attention in recent years, prompting a need for a deeper exploration into how these differences manifest in clinical settings [4]. Research has demonstrated that men and women may experience aortic dissection differently across several

dimensions [5, 6]. For instance, studies indicate that women typically present at an older age compared to men [7]. Additionally, women are more likely to have a higher prevalence of comorbid conditions such as hypertension [8]. These differences in age and underlying health can significantly impact the clinical presentation of aortic dissection, influencing the types of symptoms reported and the urgency with which treatment is initiated [9]. Furthermore, variations in treatment responses and outcomes between sexes complicate the clinical landscape, necessitating appropriate management strategies [10]. Despite a growing body of evidence highlighting these disparities, many studies on aortic dissection have not adequately addressed the impact of sex on clinical outcomes [4]. This oversight may contribute to suboptimal treatment approaches and disparities in the quality of care received by male and female patients. Consequently, it is imperative to conduct comprehensive studies that systematically examine the sex-related differences in clinical characteristics, treatment modalities, complications, and mortality rates associated with aortic dissection. By elucidating these differences, we can significantly enhance our understanding of the disease and its multifaceted nature. This knowledge is crucial for informing clinical guidelines and ultimately improving the prognosis for all patients affected by this life-threatening condition. The primary objectives of this study were to compare the clinical characteristics and outcomes—specifically in-hospital and follow-up mortality rates—as well as complications associated with aortic dissection between male and female patients. By analyzing these differences, this research aims to provide valuable insights into any sex-related disparities in the management and prognosis of aortic dissection. Addressing these gaps in the literature will lay a foundation for future investigations into sex-specific approaches to managing aortic dissection, thereby advancing the field of cardiovascular health.

Materials and Methods

Study Design

This study employed a retrospective cohort design to analyze medical records and follow-up data of patients diagnosed with aortic dissection referred to Afshar and Shahid Sadoughi Hospitals in Yazd from 2017 to 2023.

Study Population

The study focused on patients with confirmed aortic dissection who underwent diagnostic testing and treatment at designated cardiac referral hospitals during the specified timeframe. Patients were excluded from the study if they had incomplete medical records, experienced out-of-hospital cardiac arrest, or if their diagnosis was made post-mortem through autopsy.

Data Collection

A thorough retrospective analysis was conducted using data extracted from medical records, including demographic information such as age, sex, and other relevant clinical factors. The clinical presentation of each patient was documented to provide insights into the symptoms and manifestations of aortic aneurysms at the time of diagnosis. Diagnostic imaging findings played a crucial role in this study. CT scans of the aorta were carefully reviewed by an imaging specialist trained in CT interpretation. This review aimed to confirm the accuracy of initial diagnoses and ensure the reliable inclusion of patients in the study cohort. Regarding treatment, researchers documented the various methods used in managing symptomatic aortic aneurysms, including surgical interventions, endovascular procedures, and other therapeutic approaches. The data collected on treatment modalities facilitated an assessment of clinical practices and their potential impact on patient outcomes. Additionally, any post-treatment complications that arose during the follow-up period were recorded. These complications could result from specific treatments or stem from the natural progression of aortic aneurysms. By documenting and analyzing these complications, the study aimed to explore potential associations between the occurrence of complications and subsequent mortality rates. To evaluate mortality outcomes, information from the death certificates of patients who died during the one-year follow-up period was utilized. The cause of death listed on the death certificates served as a reliable criterion for assessing mortality within the study population, ensuring consistency and objectivity in outcome determination and allowing for comparisons across patients.

Statistical Analysis

Statistical analyses were conducted using SPSS version 26. Descriptive statistics summarized the demographic and clinical characteristics of the study population. To compare differences between sexes, we used chi-square tests and Fisher's exact tests for categorical variables, while independent t-tests were applied for continuous variables. Cox regression analysis was conducted to evaluate hazard rates, and survival analysis was assessed using the log-rank test.

A p-value of less than 0.05 was considered statistically significant, indicating meaningful differences between the groups.

Ethical Considerations

This study adhered to ethical guidelines and received approval from the institutional review board (IR.SSU.MEDICINE.REC.1402.264). Strict measures were implemented to maintain patient confidentiality and privacy throughout the research. To ensure anonymity, patient data were appropriately anonymized during the analysis and reporting processes.

Results

The study consisted of 74 patients, comprising 54 males and 20 females. Demographic characteristics revealed that the mean age for males was 56.9 years (±17.8), while females had a higher mean age of 64.3 years (±19.0); however, this difference was not statistically significant (p = 0.121). In terms of clinical presentation, the distribution of symptoms, such as acute pulmonary edema, shock, and cardiac arrest, did not show significant differences between genders. Similarly, the prevalence of dyspnea and syncope was comparable across both groups, indicating similar acute presentations. Analysis of risk factors demonstrated that systemic hypertension was common in both groups, with rates of 63.0% in males and 75.0% in females. Notably, diabetes mellitus (DM) was significantly more prevalent in females (45.0%) compared to males (14.8%), with this difference reaching statistical significance (p = 0.011). There were no significant differences in echocardiographic findings and left ventricular ejection fraction (LVEF) between genders (p = 0.612). However, the time from symptom onset to admission was significantly longer for females, averaging 4.0 hours compared to 2.4 hours for males (p = 0.039). Treatment strategies, including medical and surgical interventions, did not differ significantly between genders, with a relatively balanced distribution of treatment modalities. Complication rates, including heart failure and cardiac tamponade, were higher in females, although this did not reach statistical significance (P=0.057). Overall, the complication profiles were comparable between genders. Mortality rates were also similar, with in-hospital mortality at 37.0% for males and 45.0% for females (P=0.933). The detailed information is presented in Table 1.

Table 1. Comparison of Characteristics by Gender in Aortic Dissection Patients

Variable	Male (n=54)	Female (n=20)	Total (n=74)	P value
Age (yr)	56.9±17.8	64.3±19.0	58.9±18.3	0.121
Refer type (n, %)				
Direct	17(31.5)	8(40.0)	49(66.2)	0.583
Indirect(transferred)	37(68.5)	12(60.0)	25(33.8)	
Location (n, %)				
Thoracic -type A	35(64.8)	11(55.0)	46(66.2)	0.755
Thoracic- type B	10(18.5)	5(25.0)	15(20.3)	
Abdominal	9(16.7)	4(20.0)	13(17.6)	
Risk factor (n, %)				
Trauma	2(3.7)	2(10.0)	4(5.4)	0.294
Systemic hypertension	34(63.0)	15(75.0)	49(66.2)	0.413
DM	8(14.8)	9(45.0)	17(23.0)	0.011
CAD	10(18.5)	3(15.0)	13(17.6)	0.754
Positive FH	6(11.1)	3(15.0)	9(12.2)	0.696
Prior CABG	3(5.6)	2(10.0)	5(6.8)	0.607
Prior MVR	1(1.9)	0(0.0)	1(1.4)	1.000
Prior AVR	3(5.6)	1(5.0)	4(5.4)	0.314
Prior aneurysm surgery	1(1.9)	0(0.0)	1(1.4)	1.000
Prior dissection surgery	3(5.6)	1(5.0)	4(5.4)	1.000

Table 1. Comparison of Characteristics by Gender in Aortic Dissection Patients

Prior dissection	3(5.6)	1(5.0)	4(5.4)	1.000
Prior aneurysm	2(3.7)	2(10.0)	4(5.4)	0.294
Marfan syndrome	8(14.8)	2(10.0)	10(13.5)	0.719
Aortic Coarctation	2(3.7)	0(0.0)	2(2.7)	1.000
Presentation (n, %)				
Acute pulmonary edema	1(1.9)	1(5.0)	2(2.7)	0.470
Shock	14(25.9)	2(10.0)	16(21.6)	0.207
Cardiac arrest	2(3.7)	1(5.0)	3(4.1)	1.000
Symptom&sign (n, %)				
Chest pain	40(74.1)	15(75.0)	55(74.3)	1.000
Interscapular pain	22(40.7)	8(40.0)	30(40.5)	1.000
Abdominal pain	12(22.2)	4(20.0)	16(21.6)	1.000
Dyspnea	14(25.9)	7(35.0)	21(28.4)	0.563
PND	4(7.4)	0(0.0)	4(5.4)	0.569
Presyncope	3(5.6)	3(15.0)	6(8.1)	0.334
Syncope	3(5.6)	3(15.0)	6(8.1)	0.334
Palpitation	0(0.0)	1(5.0)	1(1.4)	0.270
Asymmetric pulse	24(44.4)	8(40.0)	32(43.2)	0.796
Asymmetric BP	21(38.9)	5(25.0)	26(35.1)	0.291
AI murmur	19(35.2)	6(30.0)	25(33.8)	0.786
Blood pressure (mmHg)				
Systolic	117.1±30.6	110.4±36.0	116.8±29.3	0.428
Diastolic	69.0±18.2	69.1±22.7	69.9±17.8	0.982
ECG findings (n, %)				
Normal	6(11.1)	0(0.0)	6(8.1)	
Sinus tachycardia	18(33.3)	6(30.0)	24(32.4)	
Sinus bradycardia	4(7.4)	0(0.0)	4(5.4)	
LVH	10(18.5)	5(25.0)	15(20.3)	
ST depression	8(14.8)	4(20.0)	12(16.2)	0.435
ST elevation	6(11.1)	0(0.0)	6(8.1)	
Nonspecific ST-T	1(1.9)	2(10.0)	3(4.1)	
changes	2(3.7)	0(0.0)	2(2.7)	
LBBB	1(1.9)	1(5.0)	2(2.7)	
RBBB				
Chest radiography (n, %)				
Normal	16(29.6)	3(15.0)	19(25.7)	0.245
Mediastinum widening	25(46.3)	7(35.0)	32(43.2)	0.438
Cardiomegaly	7(13.0)	3(15.0)	10(13.5)	1.000
Pleural effusion	9(16.7)	4(20.0)	13(17.6)	1.000
Echocardiography finding (n, %)				
Aortic insufficiency(mild)	8(14.8)	7(35.0)	15(20.3)	
Aortic	11(20.4)	6(30.0)	17(23.0)	0.123
insufficiency(moderate)	23(42.6)	5(25.0)	28(37.8)	
Aortic	8(14.8)	4(20.0)	12(16.2)	0.724
insufficiency(severe)	12(22.2)	5(25.0)	17(23.0)	1.000
Bicuspid aortic valve				
Pericardial effusion				
LVEF (%)	48.6±6.3	47.8±7.0	48.3±6.4	0.612

Table 1. Comparison of Characteristics by Gender in Aortic Dissection Patients

PASP (mmHg)	22.2±7.2	20.0±7.1	21.6±7.2	0.248
Aneurysm size(mm)	61.4±11.8	57.4±11.7	60.3±11.8	0.200
Diagnostic modality (n, %)	21(39.9)	8(40.0)	29(39.2)	0.400
TTE	2(3.7)	0(0.0)	2(2.7)	
TEE	25(46.3)	11(55.0)	36(48.6)	
CTA	5(9.3)	0(0.0)	5(6.8)	
Aortography	1(1.9)	0(0.0)	1(1.4)	
Sonography	0(0.0)	1(5.0)	1(1.4)	
Intraoperative				
Coronary angiography result (n, %)	8(14.8)	31(15.0)	11(14.9)	0.985
Normal	2(3.7)	0(0.0)	2(2.7)	
Single vessel disease	4(7.4)	1(5.0)	5(6.8)	
Two vessel disease	4(7.4)	2(10.0)	6(8.1)	
Three vessel disease	36(66.7)	14(70.0)	50(67.6)	
Not performed				
Treatment strategy (n, %)				
Medical	16(29.6)	9(45.0)	25(33.8)	0.438
Surgical	32(59.3)	9(45.0)	41(55.4)	
Endovascular	6(11.1)	2(10.0)	8(10.8)	
Time gap				
Symptom onset to admission (hr)	2.4±2.0	4.0±6.9	3.0±4.0	0.039
Admission to diagnose (hr)	3.0±5.86	25.5±75	9.0±39.8	0.030
Diagnosis to initial medical treatment (hr)	101.1±417.9	25.0±32.6	80±358.1	0.421
Medical treatment to repairment (hr)	3.73±2.8	3.4±3.5	3.6±2.9	0.676
ICU stay(day)	6.1±6.3	6.5±6.0	6.2±6.2	0.812
In hospital stay(day)	8.4±8.0	8.9±6.4	8.5±7.6	0.811
Complication (n, %)				
Peripheral ischemia	5(9.3)	0(0.0)	5(6.8)	0.057
CVA	1(1.9)	0(0.0)	1(1.4)	
MI	5(9.3)	0(0.0)	5(6.8)	
Heart failure	9(16.7)	5(20.0)	14(18.9)	
Cardiac tamponade	8(14.8)	1(5.0)	9(12.2)	
AKI	4(7.4)	3(15.0)	7(9.5)	
Bleeding	9(16.7)	6(30.0)	15(20.3)	
Mortality (n, %)				
In-hospital	20(37.0)	9.0(45.0)	29(39.2)	0.933
Follow up	7.0(13.0)	2.0(10.0)	9.0(12.2)	

CVA: Cerebrovascular Accident, MI: Myocardial Infarction, AKI: Acute Kidney Injury, MVR: Mitral Valve Replacement, AVR: Aortic Valve Replacement, CABG: Coronary Artery Bypass Grafting, DM: Diabetes Mellitus, CAD: Coronary Artery Disease, FH: Family History, TTE: Transthoracic Echocardiography, TEE: Transesophageal Echocardiography, CTA: Computed Tomography Angiography, LBBB: Left Bundle Branch Block, RBBB: Right Bundle Branch Block, PASP: Pulmonary Artery Systolic Pressure, LVEF; Left Ventricular Ejection Fraction, PND: Paroxysmal Nocturnal Dyspnea, AI: Aortic Insufficiency

The Cox proportional hazards model showed that for each additional year of age, there was a significant increase of 3% in the risk of the outcome (HR 1.03, 95% CI 1.01-1.05, p = 0.003). Several complications of aortic dissection, including peripheral ischemia, cerebrovascular accident, heart failure, cardiac tamponade, and bleeding, were identified as significant risk factors see Table 2.

Table 2. Cox Regression Analysis of Variables Associated with Mortality Following Aortic Dissection in the Study Population

Variable	B	SE	Hazard ratio	95% CI	P value
Age (per year)	0.032	0.011	1.03	1.01-1.05	0.003
Peripheral ischemia	2.612	0.854	13.6	2.5-72.7	0.002
CVA	3.111	1.271	22.4	1.9-270.7	0.014
Heart failure	1.860	795	6.4	1.4-30.5	0.019
Cardiac tamponade	2.270	830	9.7	1.9-49.2	0.006
AkI	1.587	0.915	4.9	0.8-29.4	0.083
Bleeding	2.088	0.776	8.1	1.8-36.9	0.007

The survival analysis did not reveal a significant difference in mortality between males and females with aortic dissection (p = 0.700). Both groups exhibited a rapid initial decline in survival, followed by a gradual decline over the 12.5-month follow-up period see Figure 1.

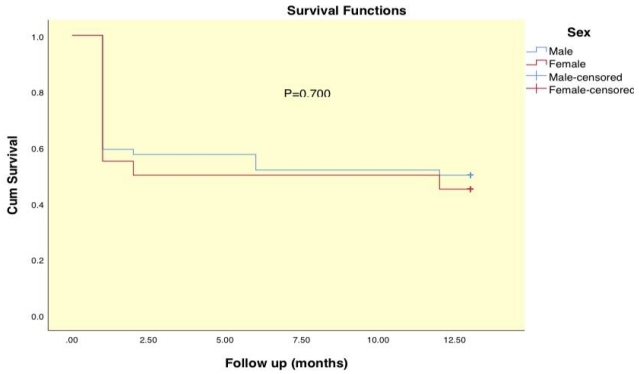

Figure 1. Kaplan-Meier Survival Curves for Aortic Dissection Patients by Sex

Discussion

Aortic dissection is a critical cardiovascular event characterized by the tearing of the aortic wall, leading to significant morbidity and mortality. This study aimed to explore the differences in clinical characteristics, treatment outcomes, and complications of aortic dissection between male and female patients. Our findings reveal both similarities and notable differences that enhance the understanding of how sex may influence the presentation and management of this condition.

Demographic and Clinical Characteristics

The studyincluded 74 patients, with a predominance of males (54%) compared to females (27%). The incidence of aortic dissection significantly increases with age, particularly in individuals over 60, due to degenerative changes and elevated risk factors such as hypertension. In our study, the mean age for males was significantly lower than that for females, suggesting that aortic dissection may present at an older age in women. This observation aligns with existing literature indicating that females often experience cardiovascular events later in life, possibly due to hormonal differences and variations in risk factor profiles [11, 12]. The analysis revealed that while systemic hypertension was prevalent in both sexes, diabetes mellitus (DM) was significantly more common among females. This finding underscores the importance of considering comorbidities in the management of aortic dissection, as DM can complicate both clinical presentation and outcomes. The higher prevalence of DM among women may contribute to their older age at presentation and the severity of comorbid conditions. The relationship between diabetes mellitus and aortic dissection remains incompletely understood, with some studies suggesting that diabetes may lower the risk of dissection [13-15].

Clinical Presentation and Timing of Admission

Interestingly, the distribution of acute symptoms such as dyspnea, syncope, shock, and pulmonary edema did not significantly differ between the sexes. This finding suggests that the clinical manifestations of aortic dissection may be similar across genders, potentially complicating diagnosis and delaying treatment [16]. However, the longer time from symptom onset to admission for females (averaging 4.0 hours compared to 2.4 hours for males) raises critical concerns. Delays in presentation may be attributed to various factors, including differences in symptom recognition, healthcare-seeking behavior, and social determinants of health, all of which could exacerbate outcomes in female patients [17, 18].

Treatment Strategies and Complications

Regarding treatment modalities, the study found no significant differences between genders in terms of surgical and medical interventions. This consistency suggests that clinical decision-making is uniform across sexes in acute settings. However, the higher rates of complications such as heart failure and cardiac tamponade in females—though not reaching statistical significance—warrant further investigation. These complications could reflect underlying physiological differences or variations in responses to treatment that remain inadequately understood. Previous studies have indicated differing complication rates between males and females in aortic dissection, with cardiac tamponade being more frequent in females and neurologic complications occurring more often in males [4, 7, 19].

Mortality Outcomes

Mortality rates were similar for both sexes, with in-hospital mortality of 37.0% for males and 45.0% for females. Despite differences in clinical characteristics and complications, this similarity suggests that factors beyond immediate clinical presentation—such as underlying health status and post-discharge care—may influence outcomes. Research on the relationship between gender and mortality due to aortic dissection has produced conflicting findings. Some studies indicate that female patients experience higher mortality rates compared to their male counterparts, potentially due to differences in age at presentation, comorbidities, and physiological responses to treatment. Conversely, other studies suggest that mortality rates are similar between genders, highlighting the role of factors such as healthcare access and treatment options [20, 21]. In this study, survival analysis showed no significant difference in mortality between male and female patients with aortic dissection. Both groups experienced a rapid initial decline in survival, followed by a gradual decrease over the 12.5-month follow-up period. This indicates that, while immediate mortality rates may not vary by sex, long-term outcomes could be affected by factors like adherence to follow-up care, psychosocial support, and lifestyle changes after discharge. The Cox proportional hazards model found that increasing age was significantly linked to higher mortality risk, underscoring the importance of careful monitoring

and management of older patients, especially females, who may have more comorbid conditions. Previous research shows that aging is associated with increased mortality in cases of aortic dissection, mainly due to the cumulative effects of vascular changes and higher prevalence of comorbidities. Older patients often present with more atypical symptoms and greater physiological compromise, which can complicate treatment and worsen outcomes. Additionally, delays in diagnosis and intervention among older adults may also contribute to higher mortality rates [22, 23].

Limitations

The limitations of this study include its retrospective design, which may introduce selection bias and limit the generalizability of the findings. Additionally, the relatively small sample size may not adequately capture the full spectrum of clinical characteristics associated with aortic dissection across different demographics. Furthermore, reliance on medical records for data acquisition could lead to incomplete or inconsistent information regarding patient comorbidities and treatment outcomes. Lastly, the study may not account for all confounding variables, such as lifestyle factors and genetic predispositions, which could influence the relationship between sex and aortic dissection.

Conclusion

Our study highlights important differences in the characteristics and outcomes of aortic dissection between male and female patients. While certain clinical presentations and treatment approaches are similar, significant differences in age at presentation, prevalence of comorbidities, and potential complications must be acknowledged. Future research should focus on the underlying mechanisms contributing to these differences and explore targeted interventions that consider sex-specific factors in the management of aortic dissection. Understanding these nuances can lead to improved patient outcomes and more personalized care strategies.

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Conflicts of Interest

The authors declare there is no conflict of interest.

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