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Research Article

Aortic Dissection that Presented to a Tertiary Hospital's ED in Dubai, UAE: A Descriptive Study with Literature Review

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Abstract

Objectives: Aortic dissection is a life-threatening condition, with a high mortality rate. It can be classified into Stanford type A or type B. This study reports the clinical presentation, risk factors, systolic blood pressure, and the mortality rate of patients with confirmed aortic dissection on computed tomography (CT) imaging. Mortality rate on weekends, weekdays, daytime, and night-time were also reported.

Methods: A retrospective review of electronic health records of all patients requiring CT aortogram in the emergency department (ED) between 2013 and 2022 were examined. Patients with confirmed acute aortic dissection on CT were included. Presenting symptoms, demographics, and mortality rate were described and reported for type A and type B aortic dissection.

Results: Of 315 patients, 65 had confirmed acute aortic dissection on CT imaging. The mean age at presentation was 50.6 years and the majority of the cohort were male (83%). Chest pain was the most common symptom (43%). A history of hypertension was present in 65% of the subjects. D-dimer was elevated in 95% of the patients. The overall in-hospital mortality was 18.5%, with a mortality rate of 40% in type A aortic dissection.

Conclusion: Aortic dissection can occur with various symptoms, and therefore, requires a high index of suspicion. Chest X-ray has a low sensitivity in detecting aortic dissection and should not be used to rule out aortic dissection. D-dimer can be used as a diagnostic assay in ruling out aortic dissection. Type A aortic dissection has the highest mortality rate and hence necessitates prompt intervention.

Keywords: mortality rate, aortic dissection, demographics, risk factors, UAE

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1. Introduction

Acute aortic dissection is a life-threatening condition that occurs as a result of an intimal tear in the aorta. Symptoms of aortic dissection, most commonly chest pain, shortness of breath, back pain, or diaphoresis, are non-specific and can mimic other life-threatening emergencies such as acute coronary syndrome or pulmonary embolism. Aortic dissection is commonly associated with risk factors such as advanced age, hypertension, and aortic aneurysm, with hypertension having an attributable risk of 54% [1]. The in-hospital mortality rate of aortic dissection is around 27% and can be higher depending on the classification of aortic dissection and the type of intervention done [2, 3]. Based on the anatomical location of the dissection, two systems of classification are commonly used: Stanford and DeBakey classification. Stanford A is a dissection that involves the ascending aorta, proximal to the brachiocephalic artery, whereas Stanford B is a dissection that only involves the descending aorta, distal to the left subclavian artery [4]. Stanford A is more common and has a higher mortality rate than type B (22.0% vs. 13.9%) [5]. Depending on the time from symptom onset, aortic dissection can be classified as acute or chronic, with acute presenting within 14 days from symptom onset. In this paper, we describe the clinical findings and outcomes of a series of patients who presented with acute aortic dissection in a tertiary hospital.

2. Methods

The search was done using ICD-10 codes corresponding to “aortic dissection”. Medical records from January 2013 to December 2021 were retrospectively reviewed, and each medical record was searched such that patients who underwent computed tomography (CT) aortogram in the emergency department (ED) were retrieved. Patients who did not undergo CT aortogram, as well as those who had other diagnoses on CT aortogram were excluded. For all patients, demographic data such as age at presentation, sex (defined as biological sex), past medical history, vital signs at presentation, signs and symptoms, as well as D-dimer levels were collected from their charts. Mortality, defined as in-hospital mortality that occurred during admission for aortic dissection, was also recorded.

3. Results

A total of 315 patients were retrieved. Sixty-five patients with confirmed aortic dissection on CT aortogram were included in this descriptive case series. Among the 65 patients included, the majority were male (n = 54, 83%). The overall mean age of presentation was 50.6 ± 12 years. A majority of the patients were above 50 years of age (53%); however, a significant proportion (17%) were younger than 40 years. The mean ± standard deviation (SD) age of presentation in type A and type B aortic dissection was 47.6 ± 12.1 years and 53.1 ± 12.4 years, respectively. Thirty patients (46.2%) presented with type A aortic dissection,

whereas 35 patients (53.8%) presented with type B aortic dissection. The overall in-hospital mortality rate in our study population was 18.5% (40% in type A and 0% in type B). 11 out of 12 (91.7%) of the deceased patients were males, and 75% were over the age of 50 years (Table **1**).

Table 1: Risk factors, presenting signs and symptoms, imaging, D-dimer, and mortality in type A vs. Type B aortic dissection.

	Total n = 65	**Stanford A n = 30**	**Stanford B n = 35**
Biological risk factors			
Age (years), mean	50.6 ± 12	47.6 ± 12.1	53.1 ± 12.4
Male	54 (83%)	26 (86.7%)	28 (80%)
Female	11 (17%)	4 (13.3%)	7 (20%)
Modifiable risk factors			
Hypertension	42 (65%)	18 (60%)	24 (68.6%)
Diabetes	6 (9%)	2 (6.7%)	4 (11.4%)
Coronary heart disease	6 (9%)	4 (13.3%)	2 (5.7%)
Obesity	12 (18%)	6 (20%)	6 (17.1%)
Presenting signs and symptoms			
Chest pain	28 (43.1%)	12 (40%)	16 (45.7%)
Abdominal pain	16 (24.6%)	3 (10%)	13 (37.1%)
Limb weakness or numbness	11 (16.9%)	7 (23.3%)	4 (11.4%)
Cardiac arrest	4 (6.2%)	4 (13.3%)	0 (0%)
Chest X-ray	n = 62	n = 29	n = 33
Widened mediastinum or abnormal aortic contour	32 (51.6%)	11 (37.9%)	21 (63.6%)
D-dimer (ng/ml), median	4345 (IQR 9693)	9600 (IQR 17660)	3670 (IQR 4295)
Mortality	12 (18.5%)	12 (40%)	0 (0%)

3.1. Signs and Symptoms

Chest pain was the most common presenting symptom overall (n/N = 28/65, 43%) and 68% of these patients described the chest pain as radiating to the back. In patients with type A dissection, chest pain was the most common symptom present in 12 out of 30 (40%). Chest pain was also present in 16 (46%) of those with type B aortic dissection. Abdominal pain was present in 25% of the patients, making it the second most common presenting symptom. Out of the 16 patients who presented with abdominal pain, 13 (81%) patients had type B aortic dissection, whereas only 3 (19%) patients had type A aortic dissection. Unilateral or bilateral limb weakness or numbness was present in 11 (17%) patients, 7 (64%) had type A aortic dissection. Shortness of breath was found in 11 (17%) patients, followed by back pain (16%), and vomiting 11%. Four (6%) patients presented with cardiac arrest. After achieving a return of spontaneous

circulation (ROSC), CT imaging was done, which revealed that all 4 (100%) had type A aortic dissection. Of those, 3 (75%) were deceased later (Table **1**).

3.2. Modifiable Risk Factors

Forty-two out of 65 (65%) patients were previously diagnosed with hypertension. Six (9%) patients had a history of diabetes, of which 5 (8%) had both hypertension and diabetes. 32% of the patients did not have a history of diabetes or hypertension, while 6 (9%) patients had a history of coronary artery disease. Obesity, defined as a BMI ≥ 30, was prevalent in 12 (18%) of the patients.

3.3. Blood Pressure and Heart Rate on Presentation

Four patients presented with cardiac arrest. 45\61 (73%) patients had an initial systolic blood pressure ≥ 130 mmHg, where 15 (24.6%) of these patients had a SBP ≥180 mmHg. On the other hand, 5 (8%) patients had a systolic blood pressure of ≤100 mmHg. In our analysis, the mortality rate among those with a SBP of 130-179 mmHg was 4 out of 30 (13.3%), SBP ≥ 180 mmHg was 1/15 (6.7%) and SBP ≤ 100 mmHg was 2 out of 5 (40%). The mean heart rate in our study population was 78 ± 22.3 beats per minute. 24/61 (39.3%) patients had a heart rate of more than 80 bpm, wherein 1 was later deceased (Table **2**, Figure **1**).

Table 2: Frequency distribution of systolic blood pressure and heart rate.

Vital signs		**Frequency (%)**
Systolic blood pressure	≤ 100 mmHg	5/61 (8.2%)
	130-179 mmHg	30/61 (49.2)
	≥ 180 mmHg	15/61 (24.6%)
Heart rate	≤ 60 bpm	9/61 (14.8%)
	60-99 bpm	48/61 (78.7%)
	≥ 100 bpm	4/61 (6.6%)

3.4. Chest X-ray

Among the patients in our study, 51.6% (32/62) patients had a positive finding of widened mediastinum or abnormal aortic contour on presentation, while 48.4% (28\64) had unremarkable findings on chest X-rays. Three patients did not undergo X-ray imaging on presentation. 37.9% (11/29) of type A aortic dissection patients had positive chest X-ray findings of a widened mediastinum or abnormal aortic contour on presentation. These positive chest X-ray findings were present in 63.6% (21/33) of those with type B aortic dissection (Table **1**).

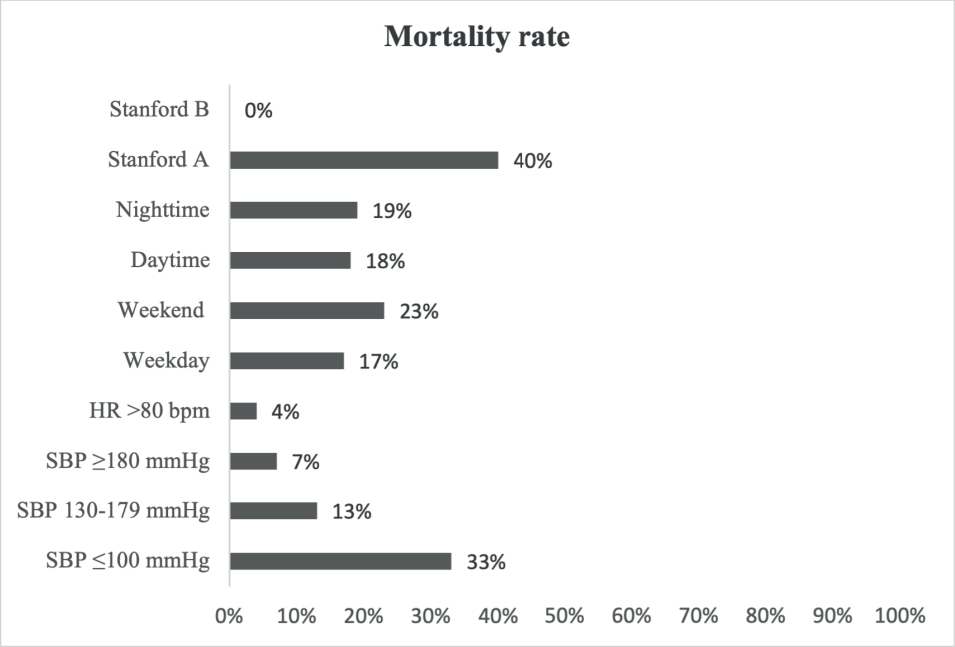

Figure 1: Mortality rates for Stanford A vs. Stanford B, daytime vs. nighttime, weekend vs. weekday, systolic blood pressure categories, and heart rate >80 bpm.

3.5. Weekend Effect

In our patient population, 32 patients presented during the daytime (8 am to 8 pm), whereas 33 patients presented during the night (8 pm to 8 am). The mortality rate among those presenting during the daytime and night-time was 18% and 19%, respectively. On the other hand, 52 patients presented during weekdays, with a mortality rate of 17%. A total of 13 patients presented during the weekend (Friday 12:00 am to Saturday 11:59 pm), with a mortality rate of 23% during weekends (Table **3**, Figure **1**).

Table 3: Mortality rate based on the systolic blood pressure at the time of presentation, and the presentation day and time.

	Mortality rate (%)
Systolic blood pressure and heart rate	
Systolic BP ≤ 100 mmHg	33%
Systolic BP 130-179 mmHg	13%
Systolic BP ≥ 180 mmHg	7%
Heart rate > 80 bpm	4%
Presentation day and time	
Weekday	17%
Weekend	23%
Daytime	18%
Nighttime	19%

3.6. D-dimer

Out of the 65 patients in our analysis, records of D-dimer values were found for 40 patients, only. Among the 40 patients, 38 patients had D-dimer levels of more than 500 ng/ml (95%). On the other hand, D-dimer levels were found to be more than 2000 ng/ml in 32 patients (80%). All the deceased patients had a D-dimer value of more than 2000 ng/ml, and 2 had a D-dimer value of ≥ 20,000 ng/ml. The median Stanford A D-dimer was 9600 ng/ml (IQR 17,660), and the median D-dimer level for Stanford B was 3670 ng/ml (IQR 4295). The overall median D-dimer was 4345 (IQR 9693) (Table **1**).

4. Discussion

This paper reports the demographic, clinical, and biological characteristics of a series of 65 patients with Stanford type A and type B dissection. The findings from the demographic reported in our paper echo those from previous studies. Aortic dissection is associated with multiple biological risk factors, such as advanced age of more than 65 years, gender, and congenital disorders like Marfan's syndrome or bicuspid aortic valve [1]. Acute aortic dissection is more common in males than in females, with males presenting around half to two-thirds of the population [6-8]. Women usually present at an older age than men and have a high chance of in-hospital mortality [9, 10]. Advanced age is also a risk factor for aortic dissection, with type A patients generally being younger than type B [1, 11].

Regarding modifiable risk factors, in this paper, we report that 65% of the subjects had a previous history of hypertension (Table **1**). Hypertension, smoking, dyslipidemia, inflammatory vessel disease, and some drugs like cocaine have been associated with aortic dissection [3, 7, 12]. Hypertension is the most prevalent risk factor associated with aortic dissection [13]. A history of hypertension was present in as many as 76% of the patients in the International Registry of Acute Aortic Dissection (IRAD) study [14]. Given that the IRAD study population predominantly consists of individuals of white ethnicity (86.4%), it is vital to recognize that risk factors and outcomes may vary when considering other demographic groups. A limitation of this study was that it used a retrospective review of electronic health records, which may not include all relevant modifiable risk factors. This is because the main aim of documenting information in both paper and electronic records is to support clinical practice, rather than for research purposes. Additionally, we report that 32% of patients did not have diabetes or hypertension. However, it is unknown whether such patients had the pre-existing condition without access to healthcare to detect it, or if such patients were aware of their condition but noncompliant with follow-up or medications.

Hypertension remains an important risk factor for aortic dissection, with a positive dose-dependent risk [15]. Another study found the mortality rate in type A aortic dissection to be higher in those with a high SBP ≥ 180 mmHg and in those with SBP ≤ 100 mmHg (26.3%, and 29.9%, respectively) [16]. A heart rate of > 80 bpm has been associated with an approximately three-fold higher long-term mortality [17].

Timely diagnosis of acute aortic dissection remains challenging given the nonspecific symptoms and signs at presentation. Diagnostic modalities such as chest X-ray (CXR) and computed tomography (CT) are often used to aid with diagnosis. Aortic dissection is typically associated with a widened mediastinum on chest X-ray, with a study linking a lack of widened mediastinum to delayed diagnosis of aortic dissection [18]. In this paper, we reported 48.4% of patients with an unremarkable chest X-ray. This reiterates the importance of not relying solely on this modality to rule out acute aortic dissection in the emergency setting. The sensitivity of abnormal chest X-rays in diagnosing aortic dissection has been estimated to be around 67% [19]. In the IRAD study, the absence of a widened mediastinum or abnormal aortic contour on chest X-ray was reported in more than 20% of the patients with confirmed aortic dissection [14].

Generally, admissions and surgeries done during weekends have been linked with a higher likelihood of death and worse outcomes [20, 21]. This could be due to the nature of staffing and an overall reduction in the quality of care during the weekends. One study done on patients with acute type A aortic dissection showed no difference in 30-day mortality between patients operated during weekends vs. weekdays. However, night-time surgery predicated a higher 30-day mortality [22].

In our study population, aortic dissection was classified according to the Stanford classification, as interpreted on CT aortogram imaging. Stanford type A is the most common type of aortic dissection, present in 67% of aortic dissection patients, often requiring surgical intervention [14, 23]. The overall mortality rate was higher in type A aortic dissection patients than those in type B, 34.9 vs. 14.9%, respectively [14]. A study reported a decrease in the overall mortality rate of type A over the past decade from 31% to 22%, mainly due to a reduction in surgical mortality [23].

D-dimer has been suggested in the literature as a useful assay in diagnosing and outcome prediction of aortic dissection. One study suggested that a D-dimer cut-off value of 500 ng/ml within the first 6 hours of presentation had a sensitivity of 95.7% and specificity of 61.3% in detecting aortic dissection [24]. A meta-analysis has shown the pooled sensitivity of D-dimer to be 0.96 and pooled specificity to be 0.70, with an increased sensitivity in D-dimer cut-off value of $\leq$ 500 ng/ml [25]. D-dimer levels were found to be significantly higher in patients with Stanford type A aortic dissection, than in those with type B aortic dissection. D-dimer levels were also found to be higher in patients who died than in those who survived both types of aortic dissection [26].

Despite the limitations in data collection from previous records and the retrospective nature of this review, till date, no similar studies providing insight into patients with aortic dissection have been published in the United Arab Emirates or the Gulf region. Future directions should focus on establishing prospectively maintained databases such as the IRAD, and forming collaborations with Middle Eastern countries to bolster its position as a repository of aortic dissection by providing comprehensive and diverse insight.

5. Conclusion

Aortic dissection, particularly Stanford A aortic dissection, is a catastrophic condition with a high mortality rate. It can present with various symptoms ranging from chest pain to stroke-like symptoms, therefore a low diagnostic threshold should be kept for patients with risk factors of aortic dissection such as hypertension or advanced age. D-dimer is a useful assay but should not be used alone in ruling out aortic dissection.

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Informed Consent and Statement of Ethics

Dubai Health Hospitals obtained general informed consent from all patients upon registration to use their de-identified data for education and research.

Ethical Approval

Institutional review board (IRB) approval was obtained from The Dubai Scientific Research Ethics Committee (DSREC), code DSREC/RRP/2022/35. Date: 27/12/2022.

Conflict of Interest

The authors declare that there are no conflicts of interest.

Artificial Intelligence (AI) Disclosure Statement

AI-unassisted work.

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Author Contributions

Ivyan Kambal – Guarantor (conceptualization, methodology and investigation, visualization, analysis, data collection, paper writing, draft, and editing). Esra AlHamadani- Data acquisition, conceptualization, paper editing, and data collection. Sania Zia- Study design, data collection, paper editing, and review. Rand Aboelkher- Data collection and paper review. Firas AlNajjar- Supervision. All authors added critically important intellectual data and contributed equally to the creation of this manuscript; each fulfilled the criteria as established by the ICMJE.

Data Sharing Statement

The data supporting the findings of this study are not publicly available due to the information they contain that could compromise the privacy of research participants; however, are available upon reasonable request.

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