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## Gender–Differences in aortic dissection

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### ABSTRACT

**Objectives:** Aortic dissection is a truly emergency in daily practice, and for gender factor, we want to compare the epidemiology, biomarkers, symptoms and outcome. **Methods:** A retrospective review six–year AD cases in a northern Taiwan medical center from January, 1, 2005 to December, 31, 2010. by gathering data of 134 AD patients including gender, age, episodes of time, season, vital signs, symptoms (chest pain, chest tightness (CP/CT), abdominal pain, neurological symptoms), Stanford classifications, and outcome. Comparisons are made by gender of AD groups. 85 cases with complete data are strictly enrolled into our study. We used student t test and one way ANOVA for statistical analyses, and significance was set at a P value less than 0.05 (2–tailed). **Results:** There are 64 male and 21 female enrolled into our study with the mean  $\pm$  standard deviation (SD) of age is (64.1 $\pm$ 14.0) years old. In AD patients with female gender are older than male AD patients (71.5 vs. 61.6 years old,  $P$  value $<$ 0.01). In symptoms of presentation, female AD patients have more neurologic symptoms than male AD patients (38.1% vs. 12.5%,  $P$  $<$ 0.01). Female AD patients have longer hospital stay and higher mortality rate than male AD patients (16.8 vs. 13.4 d; 38.1% vs. 18.8%,  $P$ =0.39;  $P$ =0.07). **Conclusion:** Female AD patients are ten–year older in age than male, and have more common neurologic symptoms in presentations, and female AD patient have 2–fold mortality rate than male AD patients.

## 1. Introduction

Aortic dissection (AD) is one of the cardiovascular emergencies in the emergency department (ED). We all know early diagnosis and aggressive management of aortic dissection leads to better outcome. There are some articles describing worse prognosis of AD patients, such as elderly, female, hypotension, neurologic presentations, type A dissection, probable extravasation (pericardial effusion, pleural effusion), visible intimal flap in echocardiography and acute renal deterioration[1–4]. For gender factor, we want to know the reason why the female

AD patients had worse outcome than male AD patients[1,2]. We made a retrospective review six–year AD patients in a medical center at northern Taiwan to find out the etiologies and gender difference in aortic dissections.

## 2. Materials and methods

A retrospective review six–year AD cases in a northern Taiwan medical center from January, 1, 2005 to December, 31, 2010. by gathering data of 134 AD patients including gender, age, episodes of time, season, vital signs (heart rate and systolic blood pressure/diastolic blood pressure at triage), symptoms (chest pain, chest tightness (CP/CT), abdominal pain, neurological symptoms), mediastinal width (MW), D–dimer, Stanford classifications, and outcome. Comparisons are made by gender of AD groups. To prevent from data bias, 49 cases are excluded (2 out–of–hospital cardiac arrest, 9 transferred from

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other hospital, 36 admitted via outpatient department, 2 transferred to other hospital). 85 cases with complete data are strictly enrolled into our study. We defined daytime is 7:00 a.m. to 19:00 p.m., and the night time is 19:00 p.m. to next day of 7:00 a.m. Months in seasons of spring are (March, April, May); summer (June, July, August); autumn (September, October, November) and winter (December, January, February). Hypertension was defined as systolic blood pressure >140 mmHg. There are four image tools used to diagnose AD: retrograde angiography; ultrasound, including transesophageal TEE; computerized tomogram (CT) scanning; and magnetic resonance imaging (MRI). CT is relative less invasive and more popular nowadays.

We retrospectively reviewed picture archiving and communication system (PACS, EBM technology) and measured the mediastinal width. About the symptoms, chest pain and chest tightness (CP/CT) are all chest symptoms, and limb weakness, headache, syncope, convulsion are classified into cases having neurological symptoms. Mortality cases are defined as in-hospital mortality without survival to discharge. The normal range of D-dimer is within 500 ng/mL. We analyzed data by commercial statistical software (SPSS for Windows, version 11.0, SPSS Ltd., Chicago, IL). We used student *t* test and one way ANOVA for statistical analyses, and significance was set at a *P* value less than 0.05 (2-tailed).

### 3. Results

There are 64 male and 21 female enrolled into our study with a ratio of M:F = 3:1. The mean  $\pm$  standard deviation (SD) of age is (64.1  $\pm$  14.0) years old with range of 33 to 88 years old. Episodes at night time are common than daytime (56.5% vs. 43.5%) and winter (34.1%) in season is also most commonly seen in aortic dissection (AD). Female AD patients have relative lower SBP (systolic blood pressure) at triage than that of male AD patients without reaching statistical significance (128 mmHg vs. 149 mmHg, *P*=0.07).

There is only 10.6% AD cases having diabetes mellitus. Theirs is 88.4% of AD patients experienced severe chest pain or/and abdominal pain. Chest pain and chest tightness (CP/CT) are the most common symptom presented than abdominal pain and neurological symptoms (67.1% vs. 29.4% vs. 18.8%). General data and comparisons by gender are shown in Table 1. The subtypes of neurologic presentations and methods of surgical interventions are shown in Table 2. Stanford type A AD are more commonly seen in female than male AD patients (76.2% vs. 40.6%, *P*=0.12). In AD patients with female gender are older than male AD patients (71.5 vs. 61.6 years old, *P* value=0.003) (Figure 1). In symptoms of presentation, female AD patients have more commonly seen of neurologic symptoms than male AD patients (38.1% vs. 12.5%, *P*<0.01),

**Table 1.**

Basic data and comparisons by gender of enrolled 85 aortic dissection cases.

	All (85)	Male (64)	Female (21)	<i>P</i> value
Age (y/o)	64.1 $\pm$ 14.0	61.6 $\pm$ 14.0	71.5 $\pm$ 12.8	<0.01*
Daytime	(37) 43.5%	(25) 39.1%	(12) 57.1%	0.68
Night	(48) 56.5%	(39) 60.9%	(9) 42.9%	0.73
Spring	(25) 29.4%	(22) 34.4%	(3) 14.3%	0.13
Summer	(17) 20.0%	(11) 17.2%	(6) 28.6%	0.66
Autumn	(14) 16.5%	(10) 15.6%	(4) 19.0%	0.76
Winter	(29) 34.1%	(21) 32.8%	(8) 38.1%	0.76
Systolic blood pressure (mmHg)	144 $\pm$ 45	149 $\pm$ 45	128 $\pm$ 43	0.07
Diastolic blood pressure (mmHg)	77 $\pm$ 21	76 $\pm$ 19	79 $\pm$ 25	0.70
Mediastinal width (cm)	9.5 $\pm$ 1.8	9.6 $\pm$ 1.8	9.4 $\pm$ 2.1	0.55
Troponin I > 0.5 ng/mL	(1) 1.4%	(0) 0.0%	(1) 5.9%	0.22
CKMB > 10 U/L	(7) 9.2%	(3) 5.4%	(4) 20.0%	0.22
D-dimer > 500 ng/mL	(47) 96.0%	(34) 94.4%	(13) 100%	0.99
Diabetes	(9) 10.6%	(6) 9.4%	(3) 14.3%	0.41
Chest pain/tightness	(57) 67.1%	(46) 71.9%	(11) 52.4%	0.08
Abdominal pain	(25) 29.4%	(17) 26.6%	(8) 38.1%	0.29
Neurologic symptoms	(16) 18.8%	(8) 12.5%	(8) 38.1%	<0.01*
Stanford A	(42) 49.4%	(26) 40.6%	(16) 76.2%	0.12
Stanford B	(43) 50.6%	(33) 51.6%	(10) 47.6%	0.86
Surgical intervention	(34) 39.5%	(27) 42.2%	(7) 33.3%	0.59
Hospital stay	14.3 $\pm$ 14.6	13.4 $\pm$ 12.6	16.8 $\pm$ 19.6	0.39
Mortality	(20) 23.5%	(12) 18.8%	(8) 38.1%	0.07

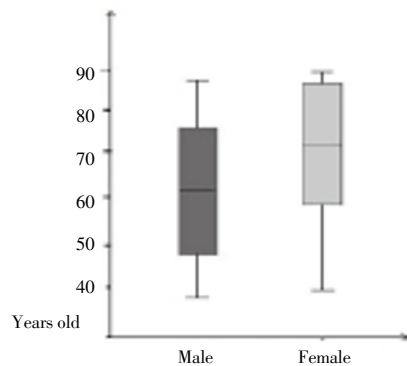
( ) = *n*.

**Table 2.**

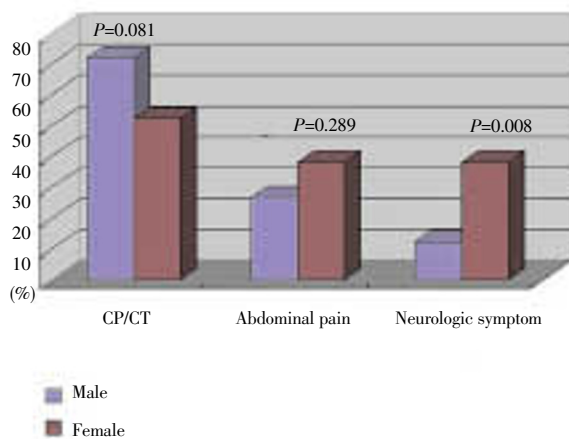
List of the subtypes of neurologic symptoms and methods of surgical interventions of AD patients.

		Total	Male	Female
Neurologic symptoms	Dizzy and fainting	5	2	3
	Altered mental status (AMS)	4	2	2
	Syncope and collapse	4	2	2
	Convulsion	1	1	0
	Left limb weakness	1	0	1
	Right limb paralysis	1	1	0
	Total	16	8	8
Surgical intervention	Aortic arch grafting with aortic valvuloplasty	29	22	7
	Resection of vessel with replacement	2	2	0
	Endovascular aortic grafting	1	1	0
	Descending thoracic aorta grafting	1	1	0
	Exploratory laparotomy	1	1	0
	Total	34	27	7

and the comparisons of gender in AD patients of symptoms presentations are shown in (Figure 2). In time of episodes, seasonal variations, hospital stay, and mortality rate are no significant difference by gender. Female AD patients have longer hospital stay and higher mortality rate than male AD patients (16.8 vs. 13.4 d; 38.1% vs. 18.8%,  $P=0.39$ ;  $P=0.07$ ).



**Figure 1.** In aortic dissection patients with female gender are older than male aortic dissection patients (71.5 vs. 61.6 years old,  $P$  value = 0.003)



**Figure 2.** Comparisons of symptoms presentations by gender in aortic dissection patients.

#### 4. Discussion

Aortic dissection (AD) is a truly emergent condition in the ED involving the elderly. The mean age of female AD patients is 71.5 years old older than male patients (61.6 years old). And owing to the older age, it contributes 2-fold mortality rate than male AD ones[5].

For the circadian and seasonal variation, AD is commonly seen in the morning and winter[6,7], and in our study, female AD patients are commonly seen in the morning (57.1%) and winter (38.1%). However, male AD patients are not, they happened more commonly at night (60.9%) and spring (34.4%), but no differences in circadian and seasonal distribution were observed among the gender groups.

Another study from Japan reported most of AD episodes in the winter reaching 39% of cases[8]. Hypertension is one of the major etiologies of aortic dissections, but hypertension was noted only in 75% of AD patients at triage[9]. Hypotension is a warning sign of poor outcome in AD patients[3]. In blood pressure of AD patients, there is no significant difference in gender factor.

Although the mediastinal width in male AD patients are 0.2 cm wider than female ones, it did not reach clinical significance (9.6 cm vs. 9.4 cm). In biomarkers, D-dimer is sensitive to diagnose aortic dissection, but it is also no statistical difference in gender factor[10]. Diabetes is relatively low incidence in aortic dissection and it accounted for 10.6% of AD patients in our study.

In presentation of symptoms, chest pain and/or chest tightness (CP/CT) is the major and typical one than abdominal pain and neurologic symptoms (67.1% vs. 29.4% and 18.8%). Female AD patients showed atypical presentation than male AD patients to have more common

abdominal pain and neurologic symptoms (38.1% vs. 26.6% and 38.1% vs. 12.5%). Especially, the female patients had 3-fold neurologic symptoms presentation than male AD ones. This is an also link to higher mortality rate (2-fold) in the female AD patients than male<sup>[3]</sup>.

In classification of AD, Stanford type A accounted for 76.2% in female AD patients and 40.6% in male AD patients. Although there is no significant statistical difference in gender to anatomical type, it is relative dangerous and tough to manage in the female patients owing to have type A more than type B (76.2% vs. 47.6%).

There are 42.4% of male AD patients and 33.3% of female AD patient undergone surgical intervention and female AD patients have longer hospital stay than male patients without reaching statistical analysis difference (16.8 vs. 13.4 d).

There are many articles reported about the diagnosis, surgical intervention, risk factors of mortality, and outcome. For the prognosis, in the newest report of Dr. Su in the year of 2012 describing elderly, hypotension and neurologic symptoms are 2, 3.7 and 2.3-fold risk of mortality in AD patients<sup>3</sup>. Nevertheless, there are articles described female AD patients had worse outcome than male ones<sup>[2,11]</sup>.

In the year of 2007, Dr. Hung reported the female AD patient's odds ratio to mortality is 21.0 and elderly aged above 70 is 6.4<sup>[1]</sup>. In the year of 2004, another large cases number study by Dr. Nienaber concluded elderly, altered mental status and female are high risk to mortality in aortic dissection<sup>[2]</sup>.

According to the conclusion of year 2012 by Dr. Su, elderly and presentations of neurologic symptoms are risk factors to mortality, we can explain the reason why female AD patients are worse outcome than male ones by this study<sup>[3]</sup>; we found female AD patients are older in age than male ones (71.5 vs. 61.6 years old) and more common presentations of neurologic symptoms (38.1% vs. 12.5%). So female AD patients are 2-fold risk of mortality than male ones in our study.

Our analysis highlights the importance of gender-related differences in AD with regard to clinical characteristics, presentations, and outcomes. Female AD patients are older in age, and have more common neurologic symptoms in presentations. Important diagnostic implications may help taking care of aortic dissection in women to improve their outcomes.

## Conflict of interest statement

The authors declare that there are no conflicts of interest.

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