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Gender Differences in Type a Acute Aortic Dissection

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ABSTRACT

Background: Females usually have a higher risk in cardiac surgery than males. Type A acute aortic dissection can occur in both males and females, but there are not enough studies about gender difference in clinical features and surgical outcome. **Objective:** This study aimed to evaluate the clinical data and surgical outcome difference between males and females with type A acute aortic dissection. **Patients and Methods:** This was a comparative retrospective study that took place between January 2014 and May 2021, in 7 centres in Egypt and Saudi Arabia. We had 427 patients presented to us and were operated for type A acute ascending aortic dissection, of them 291 (68.15%) were males and 136 (31.85%) were females where group 1 consisted of males, while group 2 included the female patients. We compared their clinical features, in hospital course and outcome and follow up in the first six-month post-surgery.

Results: There was no statistically significant difference between both groups regarding operative data. There were statistically significant longer duration of mechanical ventilation > 48 h (27.94% vs 6.19%, P < 0.001), intensive care unit (ICU) was 8.1 ± 4.2 vs 2.7 ± 1.15 (P < 0.001), hospital stay was 17.2 ± 8.1% vs 12.6 ± 4.8 (P < 0.001) and reoperation for bleeding was 7.35% vs 1.37% (P < 0.001) in females more than males. Also hospital mortality was statistically significant higher in females than in males (5.88% vs 1.03%, P < 0.001). Regarding other post-operative morbidities and six months follow up, there were no statistically significant difference between both groups.

Conclusions: Type A aortic dissection occurred more frequently in males than females. Females presented to us were older, had more comorbidities and mortality than males and the surgical outcomes was better in males than in females.

Keywords: Type A acute aortic dissection, Gender, Morbidity, Mortality.

INTRODUCTION

In cardiac surgery particularly in coronary artery surgery females have a higher rate of short and long-term mortality [(1-5)]. As females have smaller body mass index with short stature and have longer life span than males so they may present at older age, with more comorbidities like diabetes mellitus (DM), anaemia and atherosclerotic disease [(6-8)].Type A acute aortic dissection is a life threating situation with top emergency that have a very bad outcome and high rate of mortality in both males and females without surgery, which may reach up to 50% [(9,10)]. There are few studies that were done to compare the outcome of surgery of Type A acute aortic dissection in both males and females, so we aimed to compare the clinical data and surgical outcome difference between both gender group. The aim of this study was to evaluate the clinical data and surgical outcome difference between males and females with type A acute aortic dissection.

PATIENTS AND METHODS

This is a comparative retrospective study that took place between January 2014 and May 2021, in 7 centres in the Egypt and Saudi Arabia. We had 427 patients that were operated for type A acute ascending aortic dissection, of them 291 (68.15%) were males and 136 (31.85%) were females. We compared their clinical features, in hospital course and outcome and follow up in the first six-month post-surgery.

Pre-Operative Assessment:

All our patients had:

- Full detailed history and clinical examination with emphasis on associated comorbidities.
- Routine full laboratory investigations including CBC, liver and kidney function tests and coagulation profile with emphasis on the presence of anaemia, DM and impaired kidney and liver functions.
- Chest X-ray posteroanterior and lateral view.
- Transthoracic echo for EF, aortic valve affection and any other valvular or cardiac abnormality.
- CT chest with contrast for proper assessment of the size of the ascending aorta and site, extent, and degree of the dissection.
- TEE was done preoperative for proper assessment of the ascending aortic dissection, aortic valve affection and associated cardiac abnormality also was done intra- and post-operative for assessment of the aortic conduit, aortic valve, and cardiac condition.

Type of Anaesthesia used:

All patients were performed under general anaesthesia and transferred to the ICU post-operatively on mechanical ventilation.

Operative Technique:

Median sternotomy was used in all patients. Arterial cannulation was done through one of femoral artery, axillary artery or distal ascending aorta. The aim of surgery was to exclude the intimal tear if it was limited in the ascending aorta only, it was replaced, if it involved the arch replacement of the arch or hemi arch was done with circulatory arrest at temperature of 25–27°C with antegrade or retrograde cerebral perfusion (Figure 1).

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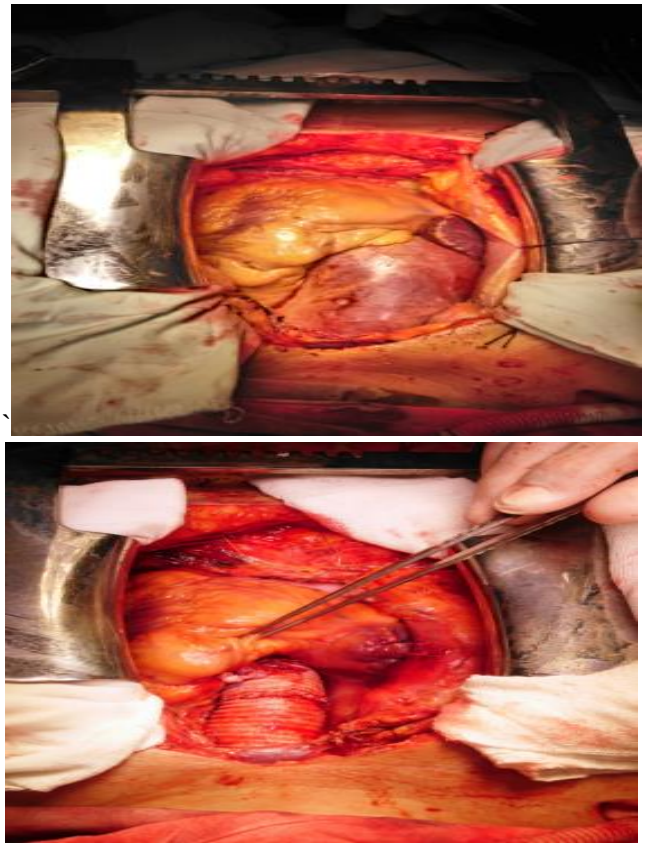

Figure (1): Preoperative and postoperative case of acute type A aortic dissection.

Ethical consent: An approval of the study was obtained from Cairo University Academic and Ethical Committee. Every patient signed an informed written consent for acceptance of participation in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

Results were collected, tabulated, and statistically analysed using Microsoft Excel software. Data were then analysed in Statistical Package for Social Sciences (SPSS version 20) software. Data were expressed as mean and SD for continuous variables, and as percentages for categorical variables. Chi- squared test (χ^2) was used to test for significance and p value of $\leq$ 0.05 was considered significant. Student's t test was used for continuous variables.

RESULTS

Patients' demographic and baseline clinical data were collected for each group. Females were significantly older than males and had significantly higher body mass index than males. Diabetes mellitus, anaemia, dyslipidaemia and hypertension were significantly higher in females more than males. Smoking and chronic obstructive pulmonary disease (COPD) were significantly higher in males more than in females. All our patients had been operated in both groups' males and females. There was no statistically significant difference between both groups regarding preoperative clinical conditions (Table 1).

Table (1): Demographic and preoperative clinical condition of both groups

Variable	Group 1: Males 291 (68.15%)	Group 2: Females 136 (31.85%)	P value
Age: Range (years) Mean ± SD	38-79 59.4 ± 12.06	49-84 68.2 ± 8.32	<0.001
Weight: Range (kg) Mean ± SD	68-110 88.27 ± 9.1	69-121 98.31 ± 10.25	<0.001
Height: Range (cm) Mean ± SD	167-185 174.15 ± 3.7	159-178 164.26 ± 4.1	<0.001
Body mass index (kg/m^2) Range Mean ± SD	24.7-32.4 28.31 ± 3.41	25.2-37.3 31.71 ± 4.1	<0.001
Smoking	113 (38.83%)	9 (6.62%)	<0.001
Chronic obstructive pulmonary Dis. (COPD)	42 (14.43%)	5 (3.68%)	<0.001
Anemia	14 (4.81%)	35 (25.74%)	<0.001
Diabetes mellitus (DM)	24 (8.25%)	41 (30.15%)	<0.001
Hypertension (HTN)	31 (10.65%)	59 (43.38%)	<0.001
Dyslipidaemia	19 (6.53%)	47 (34.59%)	<0.001
Ischemic heart disease (IHD)	9 (3.09 %)	5 (3.676 %)	0.64
Chronic kidney disease (CKD)	12 (4.124%)	6 (4.41%))	0.51
Liver impairment	2 (0.687%)	1 (0.735%)	0.14
Shock	42 (14.43%)	21 (15.44%)	0.84
Organ malperfusion	20 (6.87%)	10 (7.35%)	0.72
Tamponade	13 (4.467)	6 (4.412)	0.69
Pleural effusion	43 (14,777%)	21 (15.44%)	0.46
Aortic regurge	34 (11.68%)	18 (13.235%)	0.53

There was no statistically significant difference between both groups regarding operative data (Table 2).

Table (2): Operative data

Variable	Group 1: Males 291 (68.15%)	Group 2: Females 136 (31.85%)	P value
Ascending replacement	274 (94.16%)	128 (94.12%)	0.72
Associated procedures			
Aortic root replacement	117 (40.21%)	58 (42.65%)	0.26
Aortic valve surgery	126 (43.3%)	63 (46.32%)	0.19
Coronary anastomosis	31 (10.65%)	15 (11.03%)	0.14
Arch replacement	17 (5.84%)	8 (5.88%)	0.14
Operation time (min)	178-268	181-271	0.55
Mean ± SD	231 ± 11.4	237 ± 12.1	
CPB time(min)	114-158	116-162	0.27
Mean ± SD	128 ± 9.30	131 ± 9.7	
Cross clamp time(min)	91-132	93-138	0.12
Mean ± SD	105 ± 8.7	109 ± 9.2	
Circulatory arrest time(min)	19-32	20-31	0.24
Mean ± SD	26 ± 1.8	25 ± 1.7	

Postoperative data showed statistically significant longer duration of mechanical ventilation, intensive care unit, hospital stay and reoperation for bleeding in females more than in males. Also, hospital mortality was statistically significantly higher in females than in males. Regarding other post-operative morbidities there were no statistically significant difference between both groups (Table 3).

Table (3): Inpatient outcome, morbidity, and mortality

Variable	Group 1: Males 291 (68.15%)	Group 2: Females 136 (31.85%)	P value
Prolonged Mechanical ventilation time (>48 h)	18 (6.19%)	38 (27.94%)	<0.001
Intensive care unit stay(days)	1-6	1-17	<0.001
Mean ± SD	2.7 ± 1.15	8.1 ± 4.2	
Hospital stays(days)	7-18	7-34	<0.001
Mean ± SD	12.6 ± 4.8	17.2 ± 8.1	
Reoperation for bleeding	4 (1.37%)	10 (7.35%)	<0.001
Renal impairment	12 (4.12%)	7 (5.147%)	0.21
Haemodialysis	19 (6.53%)	10 (7.35%)	0.14
Myocardial infarction	6 (2.06%)	5 (3.676%)	0.17
Organ ischemia	7 (2.41%)	4 (2.94%)	0.24
Stroke	6 (2.06%)	3 (2.2%)	0.21
Inotropic support	54 (18.56%)	28 (20.588%)	0.22
Sepsis	9 (3.09%)	5 (3.676%)	0.08
Multiple organ failure	5 (1.72%)	3 (2.2%)	0.12
Pneumonia	25 (8.59%)	14 (10.29%)	0.48
Mediastinitis	2 (0.68%)	2 (1.47%)	0.36
Superficial wound infection	6 (2.06%)	5 (3.676%)	0.41
Tamponade	4 (1.37%)	3 (2.2%)	0.25
Pleural effusion	12 (4.12%)	7 (5.147%)	0.46
Aortic regurgitation (>mod)	0	0	
Mortality	3 (1.03%)	8 (5.88%)	<0.001

All patients were followed up for six months (161 ±18 days) for morbidity and mortality by CXR, ECHO and CT chest with contrast and there was no difference between both groups.

DISCUSSION

Type A aortic dissection has a high surgical mortality for both men and women, with an average mortality rate between 8% to 26% [11-14]. This refers to the surgical difficulty and its related complications such as respiratory complications that may end to respiratory failure, brain insults, organ malperfusion that may lead to organ failure and inflammatory response [15, 16]. Generally, in cardiac surgery female gender itself is a risk factor like that in coronary and valve surgery [17–19] but regarding acute type A aortic dissection, there are very limited studies about the gender-related clinical data and surgical outcome. One of these studies, was International Registry of Acute Aortic Dissection (IRAD), which is the biggest study discussing the full clinical details of acute aortic dissection was done in 12 international referral centres in 6 countries between January 1996 and December 1998 [9]. Sub analysis of IRAD was done in 2004 for gender related differences.

In our study we had 427 patients of them 291 (68.15%) were males and 136 (31.85%) were females, females were significantly older than males (68.2 ± 8.32 years vs 59.4 ± 12.06 years, P < 0.001) and had significantly higher body mass index (31.71 ± 4.1 vs 28.31 ± 3.41, P < 0.001), diabetes mellitus (30.15% vs 8.25%, P < 0.001), anaemia (25.74% vs 4.81%, P < 0.001), dyslipidaemia (34.59% vs 6.53%, P < 0.001) and hypertension (43.38% vs 10.65%, P < 0.001) incidence more than males. Smoking (38.83% vs 6.62%, P < 0.001) and chronic obstructive pulmonary disease (COPD) (14.43% vs 3.68%, P < 0.001) were significantly higher in males more than in females. All our patients had been operated in both groups' males and females.

In IRAD there were 464 patients (mean age was 63 years and 65.3% were males) 62.3% of them had type A dissection. Females were older and more often had later presentation than men (P0.008), with higher rate of preoperative complications like pleural and pericardial effusion, tamponade, rupture, disturbed conscious level and less pulse deficit and operation ratio than males. **Suzuki *et al.*** [20] reported that male to female ratio who had surgery for acute Type A dissection was close to 1:1. In other studies, it was approximately 2:1 [21–23]. Almost all patients in **Suzuki *et al.*** [20] were immediately operated, except for patient with unsuccessful resuscitation. Females were significantly older (72.6 vs 63.0; P < 0.001) and had smaller body mass index (22.2 vs 24.3) and body surface area (1.46 vs 1.91 m^2, P < 0.001) than male patients. Smoking was more in males than female patients (71% vs 10%, P < 0.001). There were no other significant differences in patients' preoperative data. **Friedrich *et al.*** [24] with 368 patients (male 65.8% vs. female 34.2%) who had surgery for acute aortic dissection type A, where females were older than males (70.7 years vs. 60.6 years, p < 0.001). Males were smokers than females (27.6% vs. 16.0%, p = 0.015).

In our study we had no statistically significant difference between both groups regarding operative data. Also, in **Suzuki *et al.*** [20], operative mortality was similar between the groups (8.2% vs 8.9%; P = 0.80). **Friedrich *et al.*** [24] had intra-operatively, more complex procedures and longer cardiopulmonary bypass (CPB) in males than in females' group (171 min vs. 149 min, p = 0.001) and cross-clamping times (94 min vs. 85 min, p = 0.018).

We had statistically significant longer duration of mechanical ventilation (> 48 h) (27.94% vs 6.19%; P < 0.001), intensive care unit (8.1 ± 4.2 vs 2.7 ± 1.15, P < 0.001), hospital stay (17.2 ± 8.1% vs 12.6 ± 4.8; P < 0.001) and reoperation for bleeding (7.35% vs 1.37%; P < 0.001) in females more than in males. Also, hospital mortality was statistically significant higher in females than in males (5.88% vs 1.03%; P < 0.001). Regarding other post-operative morbidities and six months follow up there were no statistically significant difference between both groups. In the **Hagan *et al.*** [9] study, surgical outcome was worse in females than in males. In type A dissection, females had a higher surgical mortality of 32% versus 22% in males (P 0.013) although they have the same circumstances as same delay, surgical technique, and hemodynamics. Females had shorter duration of ICU, ventilator support and postoperative hospital stay that may be due to higher smoker rate in males (71%) than in females (10%) and suggesting that females have tendency to have faster recovery than males. **Suzuki *et al.*** [20] reported that intensive care unit stay (median 54 vs 64 h; P = 0.03) and mechanical ventilator duration (34 vs 43 h; P = 0.02) were significantly shorter in females' group. There was no significant difference between short-term and long-term (10 years) mortality in both groups. Male patients had higher reoperation rate related to aortic dissection. **Friedrich *et al.*** [24] had similar survival in both groups with a 30-day mortality 19.0% in the female and 16.5% in the male group (p = 0.545). Follow-up time was 5.2 years in average and there was no difference in the survival rate between both groups.

Conclusion:

Type A aortic dissection occurred more frequently in males than females. Females presented to us were older, had more comorbidities and mortality than males and the surgical outcomes were better in males than in females.

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