Gender Differences in Patients with Left Ventricular Thrombus Following Myocardial Infarction

Heba M El-Naggar, Alaa A Abdel-Gaber*, Yehia T Kishk, Tarek AN Ahmed.
Department of Cardiovascular Medicine, Assiut University Heart Hospital, Assiut, Egypt.
***Corresponding author:** Alaa Abdel-Rahman Abdel-Gaber
***E-mail:** alaaabdelrahman300@aun.edu.eg*

Abstract:

Background: Gender disparities in cardiovascular disease are widely investigated. Data about gender variabilities in left ventricular (LV) thrombus following acute myocardial infarction (AMI) are still underreported.

Purpose: The study evaluated gender differences in LV thrombus formed after AMI.

Methods: We performed a retrospective analysis of patients with LV thrombus following anterior wall myocardial infarction and studied gender-specific associations regarding morphologic characteristics of the thrombus and clinical outcomes.

This retrospective study was held at Assiut University Heart Hospital. A total of 109 patients with LV thrombus were identified during the period from 2020 to 2022.

Results: One hundred nine patients with LV thrombus were included (12 females and 97 males). Female patients were significantly (p=0.048) older compared to males, with significantly (p=0.042) higher rates of dyslipidaemia (42%) than males (15.5%). Females had significantly (p=0.004) higher mean heart rate and higher Killip class (58%) at presentation compared to males (18.5%).

Females had significantly (p=0.040) larger LV thrombus size, more frequent mobile LV thrombus (42%) in comparison with males (10%) (P=0.003), and a significantly earlier detection time compared to males (p=0.037). They had significantly (p=0.003) higher mortality rates (33.3% vs. 3.1%) as well as higher rates of MACE, stroke, and HF than males. However, there was no significant association between bleeding complications and gender (p=0.225).

Conclusion: Compared to male patients, female patients with AMI are at a higher risk of developing a dangerous LV thrombus with potentially dangerous complications.

Keywords: Left ventricular thrombus, acute myocardial infarction, in-hospital outcomes, gender differences.

Introduction:

Left ventricular (LV) thrombus is a well-known ST-segment elevation myocardial infarction (STEMI) complication. It is associated with a high risk of catastrophic consequences, such as stroke and death (1).

Sex-specific differences in cardiovascular diseases (CVD) are widely documented (2). While some studies demonstrate that males are more likely to develop CVD and experience catastrophic outcomes (3), other studies report a higher incidence of CVD in females (4).

However, data about gender differences in LV thrombus characteristics and clinical outcomes are still scarce. Therefore, the present study evaluated the differences between male and female patients regarding LV thrombus characteristics and clinical outcomes and investigated the gender-specific associations of LV thrombus morphological patterns, behavior, and clinical concerns.

Patients and Methods

We retrospectively investigated patients with LV thrombus after AMI at Assiut University Heart Hospital from 2020 to 2022. Gender was selected and compared based on demographic data, clinical data, thrombus morphologic characteristics, and major adverse cardiac events, which were also studied comparatively in male and female patients. From our reports, 109 patients had LV thrombus detected in this period following an AMI, with 12 females and 97 males.

Demographic data, cardiovascular risk factors, clinical outcomes, and echocardiographic data were obtained from the electronic and medical files. Follow-up resolution of ST-segment one and a half hours after coronary revascularization was also reported and compared in both genders.

The diagnosis of an LV thrombus was established by 2D transthoracic echocardiography, which was performed using a GE ultrasound (VividS5) machine. An LV thrombus was detected as an echo-dense mass in the left ventricular apex, separate from the endocardium and adjacent to an area of hypokinetic or akinetic myocardium seen in at least two echo views (5). Different shapes of LV thrombus were identified as mural, rounded, or protuberant, and LV thrombus size and degree of mobility were assessed comparatively between males and females. LV ejection fraction (EF) and the degree of LV diastolic dysfunction were also identified and compared in both genders.

The time of detection of LV thrombus during routine echocardiographic follow-ups after AMI and its complete resolution were recorded. Patients received either warfarin or new oral anticoagulants (NOACs).

All patients enrolled in the study were assessed for in-hospital major adverse cardiovascular events (MACE), including death, heart failure, reinfarction, and stroke. Bleeding events were also identified.

Patients signed informed consent to participate in our study. Assiut Faculty of Medicine approved the study (IRB number: 17101015).

Statistical Analysis

Data were verified, coded by the researcher, and analyzed using IBM-SPSS 21.0 (IBM-SPSS Inc., Chicago, IL, USA). Descriptive statistics: Means, standard deviations, and percentages were calculated. Test of significance: Chi-square/Fisher's exact test was used to compare the distribution of frequencies among different groups as appropriate. The test of normality, Shapiro-Wilk, was used to test the normality of continuous variables; for continuous variables with two categories, an independent sample t-test was calculated to test the differences in mean between groups. A significant p-value was considered when it was equal to or less than 0.05.

Results:

Our study included 109 LV thrombus patients, 12 females, and 97 males. It showed a higher incidence of LV thrombus in males (88.9%) than in females (11.0%).

Demographic data of the studied groups:

Female patients were significantly ($p=0.048$) older (65.6 ± 10.2 years) than males (58.8 ± 11.8 years). Dyslipidaemia was also significantly higher among females (42%) than among males (15.5%). However, there was no significant difference between the two groups regarding family history of CAD, diabetes mellitus, and hypertension **(Table 1).**

Baseline clinical and echocardiographic data among the studied groups:

Female patients had a significantly higher mean heart rate at presentation than males (**Table** 2). Additionally, there was also a significant association between gender and Killip classification, i.e., Female patients also had a significantly higher Killip class (III, IV) (58%) compared to males (18.5%). On the other hand, there was no significant difference between males and females regarding the mean chest pain duration or the

extent of ST-segment resolution **(Table 2)**. Regarding the echocardiographic data of the studied patients, both groups had comparable EF and diastolic dysfunction at presentation **(Table 2).**

LV thrombus characteristics among the studied groups:

Females had a significantly larger LV thrombus size (3.2 ± 0.3 cm) than males (1.9 ± 0.2 cm). There was a significantly earlier detection time of LV thrombus among females (3.2 ± 0.3 months) compared to males (7.2 ± 0.5 months). However, both genders had similar shapes of LV thrombus. Also, there was no gender association with LV thrombus resolution rate **(Table 3)**. Conversely, females had a significantly more frequent mobile LV thrombus (42%) compared to males (10%) **(Table 3)**.

Clinical outcomes among the studied groups:

Females had significantly higher mortality rates (33.3%) than males (3.1%). Similarly, females had significantly higher rates of MACE, stroke, and HF (66.7%, 33.3%, and 66.7%) than males (16.5%, 8.2%, and 11.3%) **(Figure 1).**

Remarkably, females had a significantly higher percentage of usage of warfarin as an anticoagulant (83%) than males (46%), while males used NOACS more frequently (54%) than females (17%) **(Table 4)**. However, anticoagulant treatment with either warfarin or NOACs showed no significant difference in bleeding complications between the two groups. **(Table 4).**

Figures:

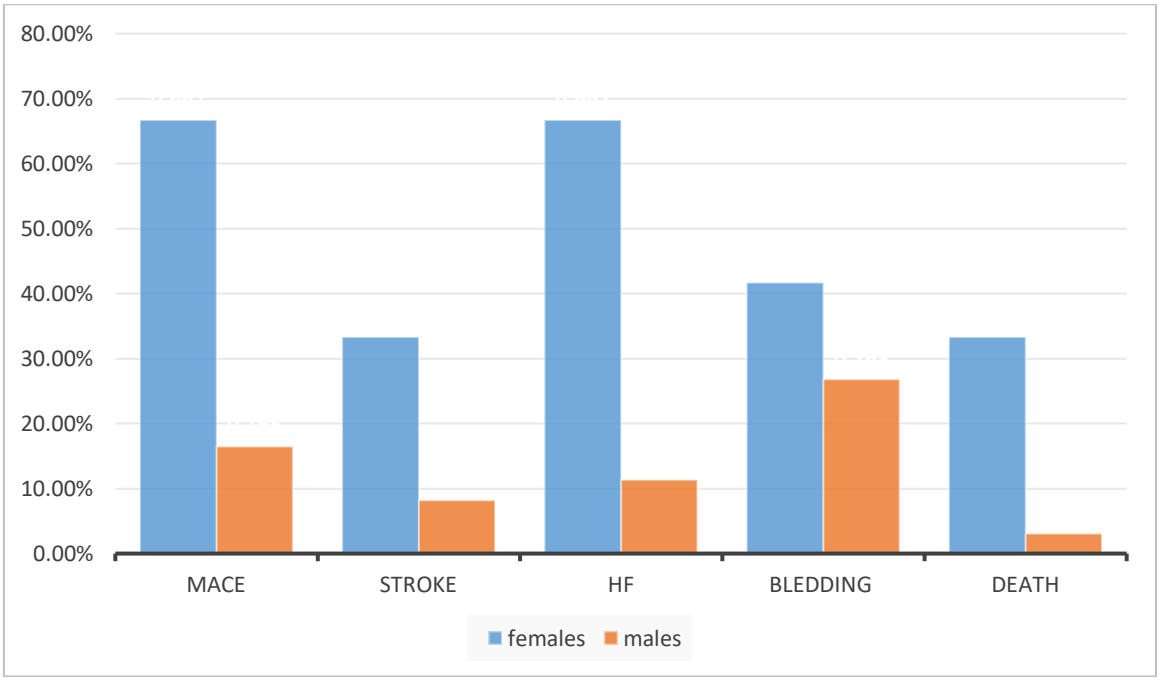

Figure 1. Clinical outcomes among the studied groups
MACE: major adverse cardiac events**, HF:** heart failure**.**

Tables

Table 1. Demographic data of the studied groups

	Female (n=12)	Male (n=97)	P-value
Age/years	65.58 ± 10.2	58.75 ± 11.8	**= 0.048***
Dyslipidemia	5 (41.7%)	15 (15.5%)	**= 0.042****
Family History	2 (16.7%)	15 (15.5%)	= 0.593**
Diabetes Mellitus	5 (41.7%)	34 (35.1%)	= 0.412**
Hypertension	5 (41.7%)	37 (38.1%)	= 0.523**

***An independent t-test was used to compare differences in means between groups.

**Fisher's exact test was used to compare differences in frequency between groups.

Table 2. Clinical and echocardiographic data of the studied groups

	Female (n=12)	Male (n=97)	P-value
Duration of Chest Pain/hour	30.01 ± 6.5	35.37 ± 2.7	= 0.462*
HR at Presentation	101.25 ± 18.8	90.01 ± 11.5	= 0.004*
Killip Classification			= 0.038**
• **Killip-I**	3 (25%)	58 (59.8%)	
• **Killip-II**	2 (16.7%)	21 (21.6%)	
• **Killip-III**	3 (25%)	7 (7.2%)	
• **Killip-IV**	4 (33.3%)	11 (11.3%)	
Degree of ST-Segment Resolution			= 0.085**
• **No Resolution**	4 (33.3%)	24 (24.7%)	
• **Partial Resolution**	8 (66.7%)	54 (55.7%)	
• **Complete Resolution**	0 (0%)	19 (19.6%)	
EF at Presentation	36.75 ± 7.1	35.72 ± 6.7	= 0.639*
Degree of Diastolic Dysfunction			= 0.444**
• **DD-I**	4 (33.3%)	51 (52.6%)	
• **DD-II**	7 (58.3%)	41 (42.3%)	
• **DD-III**	1 (8.3%)	5 (5.2%)	

*An independent t-test was used to compare differences in means between groups.
**The Chi-square test was used to compare differences in frequency between groups.
HR: heart rate**, EF:** Ejection fraction**, DD:** diastolic dysfunction.

Table 3. Thrombus Characteristics of the studied groups

	Female (n=12)	Male (n=97)	P-value
LV thrombus Size/cm	3.24 ± 0.3	1.86 ± 0.2	= 0.040*
LV thrombus Detection Time/months	3.23 ± 0.3	7.20 ± 0.5	= 0.037*
LV thrombus Resolution	8 (66.7%)	81 (83.5%)	= 0.152**
LV thrombus Shape			= 0.544**
• **Rounded**	4 (33.3%)	35 (36.1%)	
• **Protuberant**	7 (58.3%)	43 (44.3%)	
• **Mural**	1 (8.3%)	19 (16.9%)	
LV thrombus Mobility			
• **Immobile**	7 (58.3%)	87 (89.7%)	= 0.003**
• **Mobile**	5 (41.7%)	10 (10.3%)	

*An independent t-test was used to compare differences in means between groups. **The Chi-square test was used to compare differences in frequency between groups. **LV:** Left ventricular.

Table 4. Clinical outcomes and antithrombotic therapy of the studied groups

	Female (n=12)	Male (n=97)	P-value
Outcome			
• MACE	8 (66.7%)	16 (16.5%)	< 0.001*
• Stroke	4 (33.3%)	8 (8.2%)	= 0.026*
• HF	8 (66.7%)	11 (11.3%)	< 0.001*
• Bleeding	5 (41.7%)	26 (26.8%)	= 0.225*
• Death	4 (33.3%)	3 (3.1%)	= 0.003*
Type of Anticoagulant			= 0.016*
• Warfarin	10 (83.3%)	45 (46.4%)	
• NOACs	2 (16.7%)	52 (53.6%)	

*The Chi-square test was used to compare differences in frequency between groups.

MACE: major adverse cardiac events**, HF:** heart failure**, NOACs:** direct oral anticoagulants**.**

Discussion

The presence of a specific gender association with the incidence and characteristics of LV thrombus in AMI patients is still understudied.

A higher frequency of LV thrombus in males compared to females was demonstrated in our study, consistent with another cross-sectional study reported by Jadoon et al. (6). However, Albaeni et al. (2020) reported a significantly decreased risk of LV thrombus development in females both in the univariate and multivariate analyses [AOR 0.65, 95% CI (0.51-0.83)] (2). Additionally, male gender was independently associated with LV thrombus in a large retrospective study performed by Zhou et al. [odds ratio (OR) = 1.73, 95% confidence interval (CI): 1.25–2.37, *P* = 0.001] (7).

Cardiovascular risks vary greatly among males and females. Although women have a lower incidence of CVD than men, especially in pre-menopausal age, they have a greater mortality rate and a worse prognosis following acute cardiovascular events. The risk of CVD in women is frequently underestimated due to the misconception that women are more 'protected' against CVD than men. Neglecting CVD in women and lower rates of interventional procedures lead to worse outcomes compared to males (8, 9).

Clinical trials have discovered that females with CAD are often older and have a greater expression of cardiovascular risk factors than males (10). This was consistent with our study, which demonstrated that female patients with LV thrombus tend to be older than males. The history of dyslipidemia was significantly higher in the female gender. However, both genders demonstrated a comparable incidence of diabetes mellitus, hypertension, and a family history of CAD.

Regarding baseline clinical characteristics, both genders had comparable mean chest pain duration and extent of ST-segment resolution after revascularization. This was in line with Dey et al. (11). However, prolonged ischemic time was observed in females with STEMI due to atypical presentation in a 5-year retrospective study (12). In our study, female patients with LV thrombus demonstrated a significantly higher HR and worse Killip class at presentation time than males.

Our study demonstrated no specific gender association with echocardiographic parameters. Both genders showed comparable EF at presentation and the degree of diastolic dysfunction.

Data about possible gender association with LV thrombus phenotypic characteristics, e.g., shape, size, and mobility, is sparse. Interestingly, our study showed that females had a significantly larger LV thrombus and shorter detection time than males. Additionally, mobile LV thrombi were significantly more frequent in females than males. Conversely, no difference in the shapes of LV thrombus was observed between males and females.

LV thrombus following AMI is associated with an increased risk of MACE, HF, embolic complications, and death. In our study, the adverse events were significantly more frequent in females with LV thrombus than in males. This was probably also driven by the increased incidence of cardiovascular complications in females with CAD (2, 13).

For the treatment of LV thrombus post-MI, it was noted that warfarin usage was significantly higher in females, while NOACs were used more significantly in males. There was no significant difference between males and females regarding bleeding complications. No data in the literature studied the gender association with the use of specific anticoagulants or their clinical implications.

Limitations:

This was a retrospective study. The coagulation profiles of the patients were not recorded and compared between both groups, as the increased risk of systemic embolization in females could be attributed

to the hypercoagulable state in females and the thrombus behavior.

Conclusions:

Female patients with AMI are associated with larger and more mobile LV thrombus and more frequent cardiovascular events than males. This may warrant more critical cardiovascular prevention, early diagnosis, and treatment.

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