Original Research Article

Sex Differences in Systolic Heart Failure in Patients with Acute ST-Elevation Myocardial Infarction Undergoing Primary Percutaneous Intervention

Abstract

**Aims:** Sex differences are the biological and physiological differences in the cardiovascular system resulting from different gene expressions due to sex chromosomes. Some well-documented sex differences in ST-elevation myocardial infarction (STEMI) include that women are older and have more comorbidities when compared to men. To determine sex-specific differences in systolic heart failure in patients with acute STEMI undergoing primary percutaneous coronary intervention (PCI) and follow up after 3 months duration for major adverse cardiovascular events (MACE) and conventional echocardiographic study.

**Study design:** This prospective cohort study.

**Place and Duration of Study:** Department of Cardiology, Faculty of Medicine, Benha University, AlQalyubia, Egypt between the period from October 2023 to October 2024.

**Methods:** We included 116 adult patients with systolic heart failure following STEMI undergoing primary PCI. The subjects were divided into two equal groups: male (58 cases) and female (58 cases).

**Results:** Females exhibited higher NT-proBNP levels than males (*P* < *0.001*). Females exhibited significantly lower left ventricular ejection fraction (LVEF) compared to males (*P* = *0.02*). Readmission with acute heart failure at three months was significantly higher in females compared to males (*P* => *0.001*). Cardiovascular death and acute heart failure at three months were significantly higher in females compared to males (*P* = *0.031*). Females showed significantly higher MACE compared to males (*P*= *0.016*).

**Conclusions:** Female patients with systolic heart failure following ST-elevation myocardial infarction who undergo primary PCI have a higher risk of cardiovascular mortality within the first three months compared to males. The observed difference in mortality suggests that female patients may require different clinical approaches and closer follow-up to improve outcomes.

*Keywords***:** *Sex Differences, Systolic Heart Failure, Acute ST-Elevation Myocardial Infarction, Percutaneous Coronary Intervention*

# Introduction:

Acute coronary syndromes (ACS) encompass a spectrum of clinical presentations, predominantly differentiated based on the presenting electrocardiogram as either ST-segment elevation myocardial infarction (STEMI) or non-ST-segment elevation ACS (NSTEACS) **(Collet, Thiele, 2021)**.

Primary percutaneous coronary intervention (PCI) is the preferred reperfusion strategy in patients with STEMI within 12 h of symptom onset, provided it can be performed expeditiously (i.e., 120 min from STEMI diagnosis by an experienced team. Primary PCI is superior to fibrinolysis in reducing mortality, reinfarction, or stroke **(Jortveit, Pripp, 2022)**.

Heart Failure (HF) is a syndrome that can be defined clinically by a collection of symptoms (dyspnea, fatigue, exertional intolerance) and signs (edema, gallop, rales) that are attributable to a cardiac disorder. HF may also be defined hemodynamically as an inability to provide adequate cardiac output to the body at rest, with exertion, or only in elevated cardiac filling pressures **(Hunt, Abraham, 2009)**.

Preserved left ventricular ejection fraction exceeds 50% of its total blood volume. Reduced left ventricular ejection fraction (LVEF) equals or less than 40%, i.e., those with a significant reduction in LV systolic function. This is designated as heart failure with reduced ejection fraction (HFrEF). Patients with a LVEF between 41% and 49% have mildly reduced LV systolic function, i.e., HFmrEF.

We aimed to determine sex-specific differences in systolic heart failure in patients with acute STEMI undergoing primary PCI and follow up after 3 months duration for major adverse cardiovascular events (MACE) and conventional echocardio picic study.

1. **Material and Methods:**

This prospective cohort study was carried out on 116 adult patients with systolic heart failure (with ejection fraction less than 50%) following ST-elevation myocardial infarction undergoing primary PCI during the period from October 2023 to October 2024. An informed written consent from all patients or first-degree relatives before participation was obtained.

**Inclusion criteria were** both male and female genders, ages older than 18 years old, undergoing primary PCI due to ST-elevation myocardial infarction, and with LVEF less than 50%

**Exclusion criteria were** asevere chronic renal and liver failure, atrial fibrillation, complete or incomplete bundle branch block, moderate-severe valvular pathology, moderate to severe anaemia, thyroid dysfunction, pulmonary hypertension or pulmonary embolism, active cancer, and chronic lung disease.

* 1. **Patient grouping:**

**(Male Group):** 58 male patients with systolic heart failure following ST-elevation myocardial infarction undergoing primary PCI.

**(Female Group):** 58 female patients with systolic heart failure following ST-elevation myocardial infarction undergoing primary PCI.

All patients were subjected to the following: History Taking, Clinical Examination, Echocardiography, and N-terminal pro-b-type natriuretic peptide (NT-proBNP) Measurement.

* 1. **Killip Classification:**

The Killip classification was used to stratify the severity of heart failure in patients following acute STEMI based on clinical signs observed during admission **(Mello, Oliveira, 2014, Del Buono, Montone, 2021)**.

* 1. **Echocardiographic study**

A baseline upon admission and 3 months follow-up echocardiographic study was done according to the latest guidelines to assess LVEF, left ventricular end-diastolic volume (LVEDV), and left ventricular end-systolic volume (LVESV) **(Hsich, Grau-Sepulveda, 2012)**.

* 1. **N-terminal pro-B-type natriuretic peptide (NT-proBNP) Measurement:**

NT-proBNP levels were measured for all patients upon admission to assess the severity of heart failure. Blood samples were collected in the emergency department within the first 24 hours after admission, prior to any intervention. Serum NT-proBNP concentrations were determined using an automated electrochemiluminescence immunoassay (ECLIA) on a Cobas e411 analyzer (Roche Diagnostics), following the manufacturer’s instructions. The results were expressed in picograms per millilitre (pg/mL). A higher NT-proBNP level was considered indicative of more severe heart failure. Reference ranges were based on age and gender-specific cut-offs, with elevated levels defined as >300 pg/mL for patients under 50 years and >900 pg/mL for those over 50 years **(Sarak and Karadeniz, 2019)**.

* 1. **Study Interventions:**

Patients with STEMI complicated by acute HF require urgent and coordinated management of both conditions. All patients received standard medical treatment according to the latest STEMI and heart failure guidelines **(Ibanez, James, 2018)**. Including dual antiplatelet therapy, statins, Beta-blockers, ACE inhibitors or ARBs, diuretics when needed, and spironolactone when indicated. All patients received the same drugs, excluding patients who received different drugs or doses. All patients underwent primary PCI within the window.

* 1. **Follow-Up:**

Three months follow-up was done for both echocardiographic data and for detection of MACE,defined asnon-fatal stroke, non-fatal myocardial infarction, rehospitalization due to acute heart failure and cardiovascular death **(Okkonen, Havulinna, 2021)**.

Statistical analysis:

Data management and statistical analysis were done using SPSS version 28 (IBM, Armonk, New York, United States). Quantitative data were assessed for normality using the Shapiro-Wilk test and direct data visualization methods. According to normality, quantitative data were summarized as means and standard deviations and compared using the independent t-test. Categorical data were summarized as numbers and percentages and compared using the Chi-square. Multivariate logistic regression analysis was done to predict cardiovascular mortality. All statistical tests were two-sided. *P* values less than .05 were considered significant.

# Results:

Males and females exhibited significant differences in several variables. Females were older than males, with a mean age of 64.5 ± 5.2 years compared to 56.4 ± 5.3 years (*P* < 0.001). A higher proportion of females had a family history of coronary artery disease (CAD) (*P* < 0.001) and diabetes (*P* < 0.001). Similarly, hypertension was more prevalent in females (*P* < 0.001). Current smoking was significantly more common in males (*P* < 0.001). Prior stable angina was also more frequent in females (*P* = .04). Other variables, including hypercholesterolemia, prior myocardial infarction, prior PCI, prior CABG, peripheral artery disease, and prior stroke, were not significant (*P* = 1.0). Females had a lower admission heart rate than males (*P* = .03). Killip class distribution also differed significantly; males were more likely to present in Killip I, while females had higher rates of Killip II and Killip III. Additionally, females exhibited higher NT-proBNP levels than males (*P* < 0.001). Other variables were insignificant, including systolic blood pressure, serum creatinine, and the STEMI type at admission. **Table 1**

**Table 1. General characteristics and baseline clinical characteristics according to gender**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Males (n = 58)** | **Females (n = 58)** | **P-value** |
| **Age (years)** | 56.4 ± 5.3 | 64.5 ±5.2 | <0.001\* |
| **Family history of CAD** | 9 (15.5) | 37 (63.8) | <0.001\* |
| **Diabetes** | 8 (13.8) | 36 (62.1) | <0.001\* |
| **Hypertension** | 38 (65.5) | 53 (91.4) | <0.001\* |
| **Hypercholesterolemia** | 23 (39.7) | 30 (51.7) | 0.192 |
| **Current smokers** | 32 (55.2) | 4 (6.9) | <0.001\* |
| **Prior stable angina** | 26 (44.8) | 37 (63.8) | 0.04\* |
| **Prior myocardial infarction** | 17 (29.3) | 12 (20.7) | 0.284 |
| **Prior PCI** | 6 (10.3) | 4 (6.9) | 0.508 |
| **Prior CABG** | 0 (0) | 1 (1.7) | 1.0 |
| **Peripheral artery disease** | 2 (3.4) | 2 (3.4) | 1.0 |
| **Prior stroke** | 4 (6.9) | 3 (5.2) | 1.0 |
| **Clinical characteristics** |
| **Admission SBP (mm Hg)** | 130 ±16 | 135 ±12 | 0.058 |
| **Admission heart rate (beats/min)** | 86 ±11 | 82 ±10 | 0.034\* |
| **Admission serum creatinine (mg/dL)** | 1.2 ±0.4 | 1.2 ±0.3 | 0.41 |
| **Killip Class** |  |  |  |
| Killip I | 43 (74.1) | 20 (34.5) | <0.001\* |
| Killip II | 15 (25.9) | 28 (48.3) |
| Killip III | 0 (0.0) | 10 (17.2) |
| **Type of STEMI** |  |  |  |
| Anterior | 19 (32.8) | 15 (25.9) | 0.948 |
| Anterior-inferior | 2 (3.4) | 3 (5.2) |
| Antro-lateral | 2 (3.4) | 2 (3.4) |
| Inferior | 23 (39.7) | 24 (41.4) |
| Lateral | 6 (10.3) | 9 (15.5) |
| Septal | 2 (3.4) | 3 (5.2) |
| Posterior | 4 (6.8) | 2 (3.4) |
| **NT-proBNP (pg/mL)** | 730(350 – 2041) | 1303.5 (350 – 3373) | <0.001\* |

*Data are represented as Mean + SD, Range or frequency (%), Median (IQR), CAD: Coronary artery disease; PCI: Percutaneous coronary intervention; CABG: Coronary artery bypass graft. SBP: Systolic blood pressure; SD: Standard deviation; STEMI: ST elevation myocardial infarction; NT-proBNP: N-terminal pro b-type natriuretic peptide. \*: significant P value*

Females exhibited significantly lower LVEF (40.8 ±5.9) than males (43 ±4), with a *P* value of 0.02. No significant differences were found between males and females in left ventricular end-diastolic volume, left ventricular end-systolic volume, left atrial diameter, tricuspid annular plane systolic excursion, or pulmonary artery systolic pressure (*P* = .41, *P* = .27, *P* = .83, *P* = .57, and *P* = .42 respectively). **Table 2**

**Table 2. Baseline Echocardiography findings according to gender**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Males (n = 58)** | **Females (n = 58)** | **P-value** |
| **LVEF (%)** | 43 ±4 | 40.8 ±5.9 | 0.02\* |
| **LVEDV** **(mL)** | 5.4 ±0.6 | 5.5 ±0.7 | 0.407 |
| **LVESV (mL)** | 3.8 ±0.5 | 4 ±0.6 | 0.273 |
| **LA Diameter (cm)** | 3.9 ±0.5 | 3.9 ±0.5 | 0.833 |
| **TAPSE**  | 18.3 ±2.2 | 18 ±2.7 | 0.565 |
| **PASP (mmHg)** | 19.3 ±1.5 | 19.5 ±1.2 | 0.418 |

*Data are represented as Mean + SD, LVEF: Left ventricular ejection fraction; SD: Standard deviation; LVEDV: Left ventricular end-diastolic volume; LVESV: Left ventricular end-systolic volume; LA: Left atrial; TAPSE: Tricuspid annular plane systolic excursion; PASP: Pulmonary artery systolic pressure. \*: significant P value*

**In hospital outcome**

No in-hospital MACEs were reported in both genders.

**Three-month follow-up for MACE and Echocardiography:**

**Echocardiography:** No significant differences were observed between males and females in left ventricular ejection fraction, left ventricular end-diastolic volume, left ventricular end-systolic volume, left atrial diameter, tricuspid annular plane systolic excursion, or pulmonary artery systolic pressure (*P* = .47, *P* = .47, *P* = .25, *P* = .49, *P* = .91 and *P* = .21 respectively). **Table 3**

**Table 3. Three-month Echocardiography findings according to gender**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Males (n = 58)** | **Females (n = 58)** | **P-value** |
| **LVEF%** | 43.8 ±4.6 | 43.1 ±4.7 | 0.465 |
| **LVEDV (mL)** | 5.4 ±0.6 | 5.5 ±0.7 | 0.467 |
| **LVESV (mL)** | 3.9 ±0.5 | 4 ±0.6 | 0.249 |
| **LA Diameter (cm)** | 4 ±0.5 | 4 ±0.5 | 0.491 |
| **TAPSE (mm)** | 18.3 ±2.3 | 18.4 ±2.8 | 0.906 |
| **PASP** | 19.5 ±1.5 | 19.8 ±1.2 | 0.211 |

*Data are represented as Mean ±SD, LVEF: Left ventricular ejection fraction; LVEDV: Left ventricular end-diastolic volume; LVESV: Left ventricular end-systolic volume; LA: Left atrial; TAPSE: Tricuspid annular plane systolic excursion; PASP: Pulmonary artery systolic pressure.*

Cardiovascular death and readmission with acute heart failure at three months were significantly higher in females compared to males (*P* = .03, *P*<0.001, respectively). Non-fatal stroke and non-fatal myocardial infarction showed no significant differences between males and females (*P* = 1.0 and *P* = .47, respectively).

Females showed significantly **higher MACE** than males (60.3% vs. 37.9%), with a P-value of 0.016. **Figure 1**

|  |  |
| --- | --- |
|  |  |
| (A) | (B) |

**Fig. 1. Three-month outcome (A) Cardiovascular mortality and (B) MACE according to gender**

*MACE: major adverse cardiovascular events*

Multivariate logistic regression analysis was done to predict MACE. Gender was a significant predictor, with females having a higher odds ratio for MACE than males (OR: 7.4, 95% CI: 1.835 - 29.849, *P* = .01); other variables, including age, family history of coronary artery disease, diabetes, hypertension, smoking status, and hypercholesterolemia (*P* = 0.35), were not statistically significant predictors (*P* = .01, *P* = .32, *P* = .903, *P* = 0.97 and *P* = .19 respectively). **Table 4**

**Table 4. Multivariate logistic regression analysis to predict mortality**

|  |  |  |
| --- | --- | --- |
|  | **OR (95% CI)** | **P-value** |
| **Age (years)** | 0.939 (0.87 - 1.012) | 0.099 |
| **Female gender** | 7.4 (1.835 - 29.849) | **0.005\*** |
| **Family history of CAD (%)** | 0.619 (0.241 - 1.59) | 0.319 |
| **Diabetes (%)** | 0.945 (0.379 - 2.352) | 0.903 |
| **Hypertension (%)** | 1.02 (0.38 - 2.737) | 0.969 |
| **Current smokers (%)** | 1.961 (0.724 - 5.309) | 0.185 |
| **Hypercholesterolemia (%)** | 1.453 (0.667 - 3.168) | 0.347 |

*OR: Odds ratio; CI: Confidence interval; CAD: Coronary artery disease, \*: significant P value*

# DISCUSSION:

ACS are categorized based on ECG findings into STEMI and non-ST-segment elevation ACS (NSTE-ACS). The study aims to determine sex-specific differences in systolic heart failure in patients with acute ST-elevation myocardial infarction undergoing primary PCI and follow-up after 3 months for MACE and conventional echocardiographic study.

In our study, males and females exhibited significant differences in several variables. Females were older than males, with a mean age of 64.5 ± 5.2 years compared to 56.4 ± 5.3 years (*P* < 0.001). A higher proportion of females had a family history of coronary artery disease (CAD) (*P* < 0.001) and diabetes (*P* < 0.001). Similarly, hypertension was more prevalent in females (*P* < 0.001). Current smoking was significantly more common in males (*P* < 0.001). Prior stable angina was also more frequent in females (*P* = .04). Other variables, including hypercholesterolemia (*P* = .19), prior myocardial infarction (*P* = .28), prior PCI (*P* = .51), prior CABG (*P* = 1.0), peripheral artery disease (*P* = 1.0), and prior stroke (*P* = 1.0), were not significant.

Women tend to experience cardiovascular events at an older age due to the protective effects of estrogen prior to menopause **(Ryczkowska, Adach, 2023)**. A higher prevalence of family history of CAD, diabetes, and hypertension in females suggests a more significant burden of predisposing risk factors **(Garcia, Mulvagh, 2016)**. Conversely, current smoking was significantly more common in males, reflecting gender-based differences in lifestyle behaviours **(Branstetter, Blosnich, 2012)**.

The study by Savage et al. who aimed to assess sex differences in treatment and outcomes in STEMI patients treated with primary PCI, including 1244 patients treated with primary PCI found a significantly higher smoking history among males compared to females (64.9% vs 55.1%, *P* value=0.002), while contrasting our results, they found no significant differences regarding risk factors as diabetes, hypertension, dyslipidemia, and history of CAD.

In contrast, a study by Cenko et al. was performed to assess and examine sex-specific differences in 30-day mortality in patients with ACS and acute HF at the time of presentation, including a total of 87,812 patients, 30,922 (35.2%) were women and found lack of significant differences in age, family history of coronary artery disease (CAD), diabetes, hypertension, and hypercholesterolemia between men and women. These differences may be attributed to the differences in population and methodology. While parallel to our results regarding smoking, they found a relatively similar percentage of current smokers.

Females had a lower admission heart rate than males (82 ± 10 vs. 86 ± 11 beats/min, *P* = .03). Killip class distribution also differed significantly; males were more likely to present in Killip I (*P* < 0.001), while females had higher rates of Killip II and Killip III. Additionally, females exhibited higher NT-proBNP levels than males (*P* < 0.001). Other variables, including admission systolic blood pressure (*P* = .06), admission serum creatinine (*P* = .41), and the type of STEMI (*P* = .95), did not differ significantly between groups.

In accordance, Gevaert et al. aimed to compare in-hospital mortality and predictive performance of the TIMI risk score between Belgian women and men undergoing primary PCI among 8,073 consecutive primary PCI-treated STEMI patients and found significant differences among males and females regarding BP, Killip class, and HR which matched with ours (*P* values were <0.001) **(Gevaert, De Bacquer, 2014)**.

Males tend to exhibit higher sympathetic nervous system activity, which can increase heart rate, particularly during acute conditions like STEMI **(Kasahara, Yoshida, 2021)**. Smoking, more common among males, further elevates heart rate by stimulating the sympathetic system **(Price and Martinez, 2019)**. Gender differences in physiological responses to ischemia and acute stress may also play a role, with males potentially experiencing greater heart rate increases due to higher baseline physical stress levels or variations in autonomic cardiovascular regulation **(Vaccarino, Shah, 2014)**. Additionally, testosterone's influence on cardiovascular responses during acute events like STEMI may contribute to these differences **(Kaur and Werstuck, 2021)**.

The Killip class distribution shows that males were more likely to present with milder heart failure symptoms (Killip I), while females had higher rates of moderate to severe heart failure (Killip II and III), indicating a more critical clinical presentation. Which was further supported by significantly elevated NT-proBNP levels in females, a marker of cardiac stress and worse heart failure severity. Similar results were found by Murat et al., who aimed to investigate the clinical characteristics, risk factors, angiographic findings, in-hospital and one-year mortality of patients under the age of 40, and their gender differences, including 244 patients and found that men presented more often with Killip class 1, women presented more often with Killip class 2 (*P* value= .02) **(Murat, Kivanc, 2021)**. In previous VIRGO (Variation in Recovery, Role of Gender on Outcome of Young AMI patients) and NRMI (National Registry of Myocardial Infarction) studies, too, it was reported that women applied with more atypical symptoms and, therefore, late-diagnosed or misdiagnosed (17).

Females exhibited significantly lower LVEF (40.8 ±5.9) than males (43 ±4), with a *P* value of .02. No significant differences were found between males and females in left ventricular end-diastolic volume (*P* = .41), left ventricular end-systolic volume (*P* = .27), left atrial diameter (*P* = .83), tricuspid annular plane systolic excursion (*P* = .57), or pulmonary artery systolic pressure (*P* = .42).

In accordance, Murat et al. found that LVEF was significantly lower in transthoracic echocardiography in women than in men before discharge (*P* value= .02) **(Murat, Kivanc, 2021)**. This may be due to their older age, higher prevalence of comorbidities such as hypertension and diabetes, and delayed presentation or diagnosis, leading to more extensive myocardial damage. Hormonal changes post-menopause, smaller coronary artery size, and higher myocardial stress (evidenced by elevated NT-proBNPlevels) further contribute to impaired systolic function. Additionally, women may experience distinct adverse ventricular remodelling following STEMI, exacerbating LVEF reduction **(Schamroth Pravda, Karny-Rahkovich, 2021)**.

In contrast, Leboube et al. included 791 patients to compare the prevalence of HF after primary PCI-treated STEMI between sexes and found no difference in the increase in LV volumes or the percentage of adverse LV remodelling between men and women (44.4% vs. 48.5%, respectively; P = .64). LVEF was similar in the two groups both initially and at 1 year of follow-up (45.4 ± 9.5% in women vs. 46.4 ± 8.8% in men, P= 0.74, and 51.0 ± 11.9 vs. 50.7 ± 10.1%, respectively; P= .55). **(Leboube, Camboulives, 2024)**.

At 3-month follow-up, acute heart failure was significantly higher in females (48.3%) compared to males (15.5%), with a *P* value of < 0.001. Cardiovascular death at three months was significantly higher in females compared to males (20.7% vs. 6.9%, *P* = .03). Other variables, including non-fatal stroke (*P* = 1.0) and non-fatal myocardial infarction (*P* = .47), showed no significant differences between males and females.

Similarly, Cenko et al. found that women were at increased risk of 30-day mortality compared with men (29.8% vs 25.5%; RR: 1.24; 95% CI: 1.17-1.31). The mortality rates were attenuated in the cohort of ACS patients without clinical acute HF on presentation. Nonetheless, the sex difference in 30-day mortality persisted. After PCI, the mortality rate consistently decreased in both sexes but remained higher in women than men (24.0% vs 20.1%; RR: 1.25; 95% CI: 1.12-1.39) **(Cenko, van der Schaar, 2019)**.

Females showed significantly higher MACE than males (60.3% vs. 37.9%), with a P-value of 0.016.

Similarly, Martinho conducted a retrospective observational study that enrolled 884 consecutive patients admitted with STEMI and treated with PCI within 48 hours of symptom onset between 2010 and 2015 to compare the risk of adverse outcomes between women and men and found that at 30 days, 11.8% of women had died compared to 4.6% of men, for a hazard ratio (HR) of 2.76. At five years, nearly one-third of women (32.1%) had died versus 16.9% of men (HR 2.33). More than one-third of women (34.2%) experienced MACE within five years, compared with 19.8% of men (HR 2.10) **(Martinho, 2023)**.

Multivariate logistic regression analysis was done to predict mortality. Gender was a significant predictor, with females having a higher odds ratio for the outcome than males (OR: 4.62, 95% CI: 1.004 - 21.259, *P* = .05). Other variables, including age (*P* = .94), family history of coronary artery disease (*P* = .46), diabetes (*P* = .43), hypertension (*P* = .58), smoking status (*P* = .43), and hypercholesterolemia (*P* = .85), were not statistically significant predictors.

In the study by Cenko et al. a multivariable model was created to examine further the effect of sex on acute HF and 30-day mortality. Female sex was independently associated with acute HF (OR: 1.14; 95% CI: 1.11-1.18) and 30-day mortality (OR: 1.27; 95% CI: 1.20-1.34). Multivariable analysis also showed that acute HF was independently associated with 30-day mortality (OR: 6.60; 95% CI: 6.25-6.98) **(Cenko, van der Schaar, 2019)**.

Furthermore, Izadnegahdar et al. aimed to provide a 10-year, descriptive analysis of mortality risk in a Canadian setting, including 70,628 AMI hospitalizations in adults aged ≥20 years in British Columbia, Canada, with 17.1% of the cohort being younger adults ≤55 years found that 30-day mortality rates declined similarly for women (19.4% to 13.9%) and men (13.0% to 9.3%) (sex-year interaction *p* = .33). However, younger women continued to have excess mortality risk, compared with younger men, even in the most recent period [odds ratio: (2008-09) =1.61 (95% confidence interval: 1.25, 2.08)] **(Izadnegahdar, Singer, 2014)**.

**Study limitation :**

Our study had some limitations. First,The study was conducted at two hospitals with a relatively small number of included patients, which may not fully represent the broader population of STEMI patients in both genders.Additionally the follow-up period of 3 months may not have been long enough to capture the long-term outcomes of systolic heart failure in STEMI patients.

1. **Conclusion:**

Female patients with systolic heart failure following ST-elevation myocardial infarction who undergo primary PCI have a higher risk of cardiovascular mortality and readmission with acute heart failure within the first three months compared to males. The observed difference in mortality suggests that female patients may require different clinical approaches and closer follow-up to improve outcomes. This study points to the necessity of further research to understand the underlying factors contributing to these sex-specific disparities in prognosis, aiming to develop more effective and individualized treatment strategies for female patients post-PCI.

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