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# Gender divides in the clinical profiles of patients with acute myocardial infarction at a tertiary care center in South India

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## Abstract:

**BACKGROUND:** Early identification of myocardial infarction (MI) is a determinant in the provision of appropriate treatment modalities. The focus of the present study is on the identification of gender-based differences in risk factors, clinical manifestations, and coronary angiography findings in patients presenting with MI.

**MATERIALS AND METHODS:** A cross-sectional study was conducted among patients admitted with MI at a tertiary care center in South India during March 2016 to June 2017. Selected 120 male and 120 female consecutive patients admitted with acute MI, who had survived and been stabilized. Data was collected using a pre-tested structure data sheet. Appropriate parametric and nonparametric tests were used to analyze the data.

**RESULTS:** Participants were homogenous as regards age ( $P < 0.107$ ); majority of men and women were from the rural areas. About 32.5% of the men interpreted the pain as due to a cardiac problem or indigestion, whereas 60.8% of the women thought it was fatigue/muscle pain. The self-interpretation or perception of pain in both genders was statistically significant ( $P < 0.001$ ). Compared to the men, the females increasingly presented with atypical symptoms ( $P = 0.005$ ). Regarding ST-elevated MI, male preponderance was noted ( $P = 0.004$ ). Considering the anatomical location of MI, the presentation of Inferior Wall Myocardial Infarction (IWMI) was predominant in females compared to men ( $P = 0.003$ ). The majority of men had increased presentation of single-vessel disease compared to women ( $P = 0.02$ ), whereas normal coronaries and double-vessel disease were found statistically significantly higher in females ( $P = 0.03$  and  $P = 0.008$ , respectively).

**CONCLUSION:** Public education is needed on the atypical presentations which are common with women than in men. The public should, therefore, be informed of those symptoms and how to recognize them so that they may seek medical care promptly.

## Keywords:

Atypical symptoms, chest pain, gender difference in myocardial infarction, myocardial infarction

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## Introduction

Cardiovascular diseases (CVDs) have become an important cause of mortality. This epidemiological alteration is mainly due to the increase in the prevalence

of CVDs and CVD risk factors.<sup>[1]</sup> Coronary artery disease (CAD) is of significant human cost and financial burden worldwide. Individuals lifestyle, hereditary history, and environmental factors are the risk factors in the development of the CVD.<sup>[2,3]</sup> CAD develops as a result of plaque deposition within coronary arteries that are responsible for blood supply

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to heart muscles leading to a condition known as atherosclerosis.<sup>[4]</sup> Atherosclerotic changes result in the narrowing of the coronary arteries and reduced blood flow to the heart. Myocardial infarction (MI) occurs as a result of prolonged myocardial cell ischemia with the involvement of myocardial necrosis that may lead to traumatic events that are life-threatening and uneventful.<sup>[1]</sup> Acute MI (AMI) is one of the most significant CVDs with significant morbidity and mortality. Although atherosclerotic plaque rupture with acute thrombosis development is shared pathology by both men and women, women reportedly have a lower incidence of MI, though with higher mortality.<sup>[5]</sup>

Gender differences in clinical presentation contribute to the outcome as patients with typical symptoms of CAD tend to seek early treatment than the patients with atypical symptoms. Since health-care workers often assess chest pain and its associated symptoms as primary symptoms, patients with atypical symptoms go unnoticed resulting in early discharge from emergency departments.<sup>[6,7]</sup> Although coronary plaque rupture with acute thrombosis formation is a common pathophysiology for men and women, women are usually older than men, with a low incidence of AMI, but with an increased atypical manifestations and greater mortality.<sup>[8]</sup>

There is a need to find current evidence of clinical presentations of symptoms following AMI in both men and women, but with greater focus on women with cardiovascular risk to make their management more evidence based.<sup>[6]</sup> Medical care and technologies have greatly improved and facilitated access to health care. However, primary prevention strategies of CVDs have not reached the common people.<sup>[9,10]</sup> This study was mainly to identify the gender-based difference in risk factors, clinical manifestations, and coronary angiography findings in patients presenting with MI.

## Materials and Methods

This cross-sectional study was conducted among patients admitted with MI at a tertiary care center in South India during March 2016 to June 2017. Selected 120 male and 120 female consecutive patients admitted with acute MI, who had survived and been stabilized. Considering proportion of males and females with atypical clinical features as 29% and 42%, respectively, the finite population of MI patients admitted in Emergency Department during the study period as 250, and relative precision of 20%, alpha = 5%, and power = 80%, the calculated sample size in each group was 114. Considering 5% attrition rate, the final sample size of each arm was 120.

Structured participant datasheet had sociodemographic data, clinical presentation survey, clinical variables including electrocardiogram findings, an anatomical area involved, left ventricular ejection fraction details, location of MI, and prehospitalization delay and coronary angiogram findings. It was developed through extensive literature review followed by the validation of contents of participants' datasheet by experts in cardiology. The developed participant datasheet was translated into the local language and retranslated into English. Pretesting of the participant datasheet was done on 10 patients who were admitted into the cardiology department. The patients found clinical presentation survey and sociodemographic components comprehensible. Reliability of the participant datasheet was assessed by the test-retest method. The value of 'r' was established at 0.9.

Ethical approval was obtained from the Institutional Ethics Committee vide Letter No. JIP/IEC/2016/1110 dated 30/01/2016. Informed written consent was taken from all participants.

Sociodemographic variables, including age, sex, income, education, domicile, and occupation, were analyzed using the descriptive statistics including frequency with percentage, mean, and standard deviation. The Chi-square test was used as a test of significance to analyze the difference in risk factor profiles in men and women. The Chi-square test and Fisher's exact test was used as a test of significance to analyze the difference in clinical profile and coronary angiogram profile in men and women.

## Results

In this study, the participants were homogeneous with regard to age ( $P = 0.107$ ). However, the educational qualification of males was higher than females ( $P = 0.003$ ). The majority of men and women were from the rural areas and more women than men were unemployed ( $P < 0.001$ ) [Table 1].

The difference in self-perception or interpretation by the two genders of myocardial chest pain reported as due to other illness has been shown in Table 2. This study revealed that 32.5% of men interpreted chest pain as due to indigestion/stomach problem, whereas majority of the women interpreted it as due to fatigue/muscle pain (60.8%) and indigestion (15.5%). Overall, the self-perception or interpretation of myocardial pain as of noncardiac origin by both genders was statistically significant ( $P < 0.000$ ). When compared to men, females increasingly presented with atypical symptoms such as dizziness, sweating, shortness of breath, vomiting, palpitation, fainting, back pain, and fatigue ( $P = 0.005$ ).

Risk factors such as, diabetes, hypertension, known history of IHD and obesity were still observed more often in women, whereas smoking as a risk factor was noted only in men. Regarding ST-elevated MI (STEMI), male preponderance was noted whereas, women increasingly presented with non-STEMI (NSTEMI) which was significant ( $P = 0.004$ ). Considering anatomical location of MI, presentation of IWMI was more predominant in females than men ( $P = 0.003$ ), and the groups were homogenous in the presentation of other types of MI. Prehospitalization delay between groups was found to be nonsignificant ( $P = 0.160$ ). Compared to men, a smaller proportion of the women had thrombolysis ( $P = 0.041$ ) [Table 3].

Increased presentation of single-vessel disease (SVD) and triple-vessel disease (TVD) was observed in more males than women ( $P = 0.02$ ). Normal coronaries and nonobstructive CAD preponderance in coronary angiograms were found to be statistically significantly higher in females ( $P = 0.018$ ,  $P = 0.028$ ) [Table 4].

**Table 1: Sociodemographic variables of men and women with myocardial infarction (n=240)**

Variables	Male (n=120) N (%)	Female (n=120) N (%)	P-value <sup>#</sup>
Age, mean±SD	54.8±10.04	56.8±9.84	0.107
Education			
Illiterate	34 (28.3)	61 (50.8)	0.003
Primary education	70 (58.3)	52 (43.3)	
Higher education	8 (6.7)	4 (3.3)	
Graduate/ postgraduate	8 (6.7)	3 (2.5)	
Domicile			
Urban	14 (11.7)	26 (21.7)	0.038
Rural	106 (88.3)	94 (78.3)	
Occupation			
Unemployed	26 (21.7)	93 (77.5)	<0.001
Skilled workers	93 (77.5)	25 (20.8)	
Professional workers	1 (0.8)	2 (1.7)	

<sup>#</sup>Chi-square test. SD=Standard deviation

**Table 2: Comparison of self-interpretation of chest pain and presence of atypical manifestations of men and women with myocardial infarction (n=240)**

Variables	Male (n=120) N (%)	Female (n=120) N (%)	P-value
Self-interpreted of chest pain as			
Related to heart	39 (32.5)	13 (10.8)	<0.001*
Indigestion or stomach problem	39 (32.5)	19 (15.8)	
Fatigue/muscle pain	29 (24.2)	73 (60.8)	
Related to stress	2 (1.7)	12 (10.0)	
Related to diabetes/hypertension	7 (5.8)	10 (8.4)	
Breathing problem	0	1 (1.8)	
Thyroid problem	1 (0.8)	4 (3.3)	
Due to smoking	5 (4.1)	0	
Presence of atypical clinical presentations	84 (70.0)	102 (85.0)	0.005

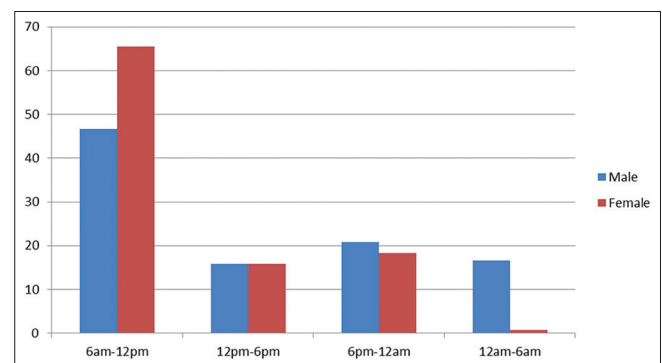
<sup>\*</sup>Pearson Chi-square test

The occurrence of MI was the highest in the morning hours in males and females [Figure 1]. Compared to females, men also had more MI between 12 am and 6 am ( $P < 0.001$ ) and between 6 am and 12 pm ( $P = 0.004$ ).

## Discussion

Understanding women's clinical symptoms during AMI and its clinical significance is paramount in the provision of treatment. The present explanation of "typical" cardiac symptoms is based primarily on the experience of white, middle-aged men, with deviations called "atypical." However, studies<sup>[6,11-15]</sup> have shown that this tag contributes to misunderstanding by clinicians and lay individuals, leading to inaccurate diagnoses, causing women to delay in seeking treatment.

Accurate information about women's symptoms and their pattern during AMI would provide a normative explanation of women's cardiac symptom experience. In this study, although the predominant symptom exhibited by men and women was chest pain, compared to men, females increasingly presented with atypical presentations such as dyspnea, nausea, vomiting, dizziness, sweating, and back pain. Similar studies with reported high presentation of atypical symptoms such



**Figure 1: Comparison of time of onset of pain among men and women with myocardial infarction**

**Table 3: Clinical presentation survey of men and women with myocardial infarction (n=240)**

Variables	Male (n=120) N (%)	Female (n=120) N (%)	P-value
<b>Risk factors survey</b>			
Smoking	72 (60.0)	0	<0.001
Hypertension	51 (42.5)	75 (62.5)	0.002
Diabetes	53 (44.2)	65 (54.2)	0.121
Dyslipidemia	21 (17.5)	24 (20.0)	0.620
Prior PCI	8 (6.7)	2 (1.7)	0.053
<b>Co-morbid illness</b>			
Known IHD	17 (14.2)	39 (32.5)	0.001
Co-morbidities	103 (85.8)	81 (67.5)	
<b>ECG findings</b>			
STEMI	83 (69.2)	61 (50.8)	0.004
NSTEMI	37 (30.8)	59 (49.2)	
Treated with thrombolysis	39 (32.5)	25 (20.8)	0.041
<b>LVEF findings (%)</b>			
>50	52 (43.3)	60 (50.0)	0.483
40-50	52 (43.3)	43 (35.8)	
<40	16 (13.3)	17 (14.2)	
<b>Location of MI</b>			
Anterior	47 (56.6)	30 (49.2)	0.148
Antero septal	5 (6.0)	2 (3.3)	0.285
Inferior	23 (27.7)	28 (45.9)	0.003
Inferior posterior	2 (2.4)	0	0.330
Anterolateral	4 (4.8)	1 (1.6)	0.147
Lateral	2 (2.4)	0	0.330
<b>Prehospitalization delay (h)</b>			
<3	60 (50.0)	69 (57.5)	<0.160
3-6	10 (8.3)	11 (9.2)	
6-12	11 (9.2)	16 (13.3)	
>12	39 (32.5)	24 (20.0)	

MI: Myocardial infarction, STEMI: ST-elevated myocardial infarction, NSTEMI: Non-STEMI, PCI: Percutaneous coronary intervention, ECG: Electrocardiogram, LVEF: Left ventricular ejection fraction, IHD: Ischemic heart disease

as breathlessness and fatigue, nausea, and vomiting were higher in women.<sup>[16-18]</sup> It has been reported that the presentation of AMI symptoms are similar for young women and men, with chest pain as the predominant symptom for both sexes. Women presented with a greater number of additional nonchest pain symptoms regardless of the presence of chest pain, and both women and their health-care providers rather than men were less likely to attribute their prodromal symptoms to heart disease.<sup>[19,20]</sup>

The factors related to health-care-seeking behaviors of patients with AMI have been studied widely. Patient's perception or self-interpretation of chest pain contributes significantly to the delay of treatment.<sup>[21]</sup> The lack of correspondence between expectation and actual symptoms is always associated with longer prehospital delay and decreased use of emergency medical services. In this study, only a small proportion of patients interpreted their discomfort as being of cardiac origin. The majority of the men perceived it as indigestion while

**Table 4: Description of coronary angiography findings among men and women with ST elevated myocardial infarction and non-ST elevated myocardial infarction (n=240)**

Coronary angiogram findings	Male N (%)	Female N (%)	P-value
<b>Patients with STEMI n=83</b>			
Normal coronaries	0	4(6.5)	0.030 <sup>#</sup>
Non-obstructive CAD	2(2.4)	3(5.0)	0.357 <sup>#</sup>
Re-canalized coronaries	1(1.2)	1(1.5)	0.669 <sup>*</sup>
SVD	39(47.0)	19(31.0)	0.027 <sup>*</sup>
DVD	11(13.3)	18(30.0)	0.008 <sup>*</sup>
TVD	30(36.1)	16(26.2)	0.103 <sup>*</sup>
<b>Patients with NSTEMI n=37</b>			
Normal coronaries	1(2.7)	11(18.7)	0.018 <sup>#</sup>
Non-obstructive CAD	0	7(11.8)	0.028 <sup>#</sup>
SVD	19(51.4)	22(37.3)	0.087 <sup>*</sup>
DVD	7(18.9)	6(10.2)	0.111 <sup>*</sup>
TVD	10(27.0)	13(22.0)	0.288 <sup>*</sup>

<sup>#</sup> Fisher's exact test, <sup>\*</sup>Chi square test. STEMI: ST elevated myocardial infarction, NSTEMI: Non STEMI, SVD: Single vessel disease, DVD: Double vessel disease, TVD: Triple vessel disease, CAD: Coronary artery disease

women perceived it as of muscular origin or fatigue because their symptoms were atypical.<sup>[22-25]</sup> Owing to their misperception of the symptoms, one fourth of the males delayed their visit to the emergency department for more than 12 h. Although the current study focused on self-perception of symptoms in both genders, the correlation of self-perception of symptoms and prehospitalization delay was not studied. Several studies have reported longer prehospital delays of participants because of wrong perception of symptoms.<sup>[13,20]</sup>

The present study shows that the majority of men had presented with STEMI. Several studies have reported findings similar to those of the current study, showing higher prevalence of STEMI in men than women.<sup>[9-11]</sup> This study also noted that prehospitalization delay in both men and women was not significant, although one-fourth of the males delayed their visit to the emergency department by more than 12 h, but this was not statistically significant. Another study confirmed that gender was not a determinant factor for prehospitalization delay.<sup>[12,13]</sup>

In contrast to these findings, several studies have established an association of female gender as a cause for prehospitalization delay.<sup>[15,26-28]</sup>

Age, dyslipidemia, hypertension, smoking, diabetes, obesity, and physical inactivity are considered the common risk factors for both men and women. Further, women have added risk factors, such as the use of contraceptives and the reduction of ovarian function with age. Besides, coronary heart disease (CHD) was always considered a male problem, partly because of

delay of its clinical appearance in women owing to the effect of estrogen, which is thought to be beneficial because of effects on atherosclerotic plaque progression, vasodilatation, blood pressure, and its anti-oxidative and anti-inflammatory properties. Recent studies have emphasized this increase and the fact that CHD is the leading cause of death in women. In our study also, with the exception of smoking its preponderance as a risk factor in females was noted.<sup>[29]</sup>

Coronary angiography findings of patients with STEMI revealed that a majority of men had presented with increased SVD when compared to women, whereas normal coronaries and double vessel disease (DVD) were significantly higher in females than men. Coronary angiography findings of the patients with NSTEMI revealed that normal coronaries and nonobstructing CAD were statistically significantly higher in females than men ( $P < 0.01$  and  $P < 0.02$ , respectively). Similar results reported from previous studies showed that normal coronaries were significantly higher in females than men.<sup>[21-23]</sup> In contrast to the current study, several studies have reported that there was no gender difference in the presentation of SVD<sup>[4,21]</sup> Conti *et al.* reported equal prevalence of SVD, DVD, and TVD presentation in both genders.<sup>[26]</sup> The findings of Bajaj *et al.* were in conflict with ours, showing a higher prevalence of DVD in men.<sup>[6]</sup> Higher presentation of DVD in men with NSTEMI was reported by Sadowski *et al.*<sup>[29]</sup>

### Limitations

As the data were collected from participants using self-structured questionnaire and interview method, recall bias may have contributed to the loss of some relevant information. Further, the sample size of the study is limited.

### Conclusion

Gender-based differences in clinical presentation in men and women with MI had been a focus in research that emphasized the gender-specific approach. The current study also supports the need of a gender-specific approach as women increasingly presented with atypical manifestations and different presentation of coronary angiogram profile. The public has to be made aware of this to avoid the disparities in the treatment and delays in management despite the availability of a multifaceted health-care sector.

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### Conflicts of interest

There are no conflicts of interest.

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