

Acute Myocardial Infarction in Women, a Study on Risk Factors, Angiographic Features and Outcomes

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ABSTRACT

Background: Women with acute coronary syndrome are more likely to have cardiovascular disease risk factors and atypical symptoms as compared to men. In Nepal, there is a rising trend of Coronary Artery Disease and myocardial infarction in women. However, research on acute myocardial infarction in women is lacking. The aim of this study was to study the cardiac risk factors, clinical features, angiographic features, and outcome of acute myocardial infarction in Nepalese women admitted to Hospital.

Methods: This was a cross sectional study done at Shahid Gangalal National Heart Center Kathmandu from September 2016 to March 2017. Female patients admitted with a diagnosis of acute ST-segment elevation myocardial infarction or non-ST segment elevation myocardial infarction, who fulfilled the inclusion criteria were included in the study. The details of the patients, demographic profile, major clinical symptoms, major coronary artery disease risk factors, angiographic features and outcomes were recorded and assessed during the study period. Coronary angiography was done in 112 patients out of 178 patients.

Results: Out of 178 patients, 85.95 % had ST-segment elevation myocardial infarction and 14.05% had non-ST segment elevation myocardial infarction. The mean patient age was 62.53 ± 12.1 . 26.4% patients were of age less than 55 years. Major risk factors were central obesity (94.61%), dyslipidemia due to low HDL (78.65%), hypertension (54.49%), smoking (54.49%) and type 2 diabetes (34.83%). The most common atypical symptoms were shortness of breath (35.39 %), nausea and vomiting (23.6%) and epigastric pain (6.74%). Single vessel disease was found in 36%; double vessel disease in 26.3% and triple vessel disease in 28.9% of patients. The primary outcome of in-hospital mortality was 3.37 %.

Conclusions: Our study showed that significant number of females had Coronary Artery Disease at early age. Among women with myocardial infarction in Nepal, obesity due to high waist to hip ratio was the most common risk factor followed by dyslipidemia due to low high density lipoproteins, smoking, hypertension, and diabetes. Atypical symptoms were also common findings. Single vessel disease was the most common lesion and left anterior descending artery was the most commonly involved vessel. Mortality was seen in ST-segment elevation myocardial infarction patients only.

Keywords: MI in women; outcome; risk factors.

INTRODUCTION

Coronary artery disease (CAD) in women continues to be a major public health problem leading to death and disability.¹ Cardiac risk factors have different impact on cardiovascular (CV) morbidity and mortality of women as compared to men.² There are non-modifiable and modifiable cardiac risk factors.³⁻⁵ CAD is an under

diagnosed, undertreated and under researched disease in women.⁶ Sex-specific differences exist in the presentation, pathophysiological mechanisms, and outcomes in patients with acute myocardial infarction.⁷

Women with acute coronary syndrome (ACS) were more likely to have cardiovascular disease risk factors and

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atypical symptoms.^{8,9} As compared to men, women were more likely to have normal/mild angiographic coronary artery disease.⁹ Plaque erosion is the most frequent cause of ACS in women,¹⁰ Women, on an average, have worse outcomes than men following MI.^{11,12}

In Nepal, coronary heart disease is rapidly increasing among women due to rise in the prevalence of coronary risk factors like diabetes, hypertension, dyslipidemia, smoking, and obesity. In this study, the angiographic features, clinical features, risk factors and clinical outcomes for acute myocardial infarction had been studied in Nepalese women admitted with acute MI. As patients from all over Nepal are referred to SGNHC, it would give the real picture of CAD of Nepalese women. This type of study may help the concerned people or authorities to address the problem of CAD in women of Nepal.

METHODS

This was a hospital based cross sectional study conducted at SGNHC Kathmandu, from September 2016 to March 2017 which included 178 patients of acute STEMI and NSTEMI. Inclusion criteria was female patients with diagnosis of acute STEMI or NSTEMI, admitted at SGNHC. Exclusion criteria were patients admitted with diagnosis of unstable angina, male patients, patients with hypertrophic or dilated cardiomyopathy and patients with congenital heart disease. The details of the patient's clinical characteristics, major cardiac risk factors, angiographic profile and outcomes were recorded and assessed during the study period. Diagnosis of Acute STEMI or NSTEMI were based on third universal definition of myocardial infarction.¹³ The primary outcome of the study was in-hospital mortality. Formal permission for the study was taken from the IRB of the NAMS. Written informed consent was taken from the patient or their relatives.

According to latest three-year annual report data (2013, 2014 and 2015)¹⁴ of SGNHC, during this period a total of 4018 ACS patients were admitted and out of which 72.1% were male and 27.92% were female. So based on these data taking prevalence of ACS in female patients 28% the sample size was calculated as follows:

Sample size calculation, $N = z^2 pq / d^2$. $q = 1 - p$, $P = 28\%$ or 0.28, $q = 1 - p = 0.72$, $Z = 1.96$ for 95 % of confidence interval, d maximum % of allowable error = 2.0 %, $N = 1.96 \times 1.96 \times 0.28 \times 0.72 / 0.02 \times 0.02 = 1937$, This is the infinite sample size is 1937

As study population is less than 5000 so we have to calculate finite sample size.

Based on the hospital data of SGNHC, where we are doing study, in the previous year in seven-month period about 192 female patients of acute myocardial infarction were admitted. So finite sample size $n_1 = n \times N / N + n - 1$

$$192 \times 1937 / 1937 + 192 - 1$$

$$371904 / 2128 = 174,77 = 175$$

Altogether 178 patients who fulfilled inclusion criteria were enrolled during the study period.

All data had been entered and coded in electronic spread sheet. The Statistical Analysis was done using the SPSS VERSION 23 Software (SPSS INC CHICAGO). Descriptive statistics were used to describe and summarize the data. Categorical variables were analyzed as percentage, continuous variable with normal distribution presented as mean \pm SD. Demographic and outcome variables were compared using Chi-square test, or likelihood ratio where applicable. P value less than 0.05 was considered as statistically significant.

RESULTS

During the study period 178 patients were included in the study. Out of 178 patients, 153 (85.95 %) were with STEMI and 25 (14.05%) were with NSTEMI.

The mean age of patient was 62.53 ± 12.1 , 97 (54.9 %) were of age less than 65 years and, nearly one fourth of the patients, 47 (26.4%) were of age less than 55 years. Three patients (1.68%) were of age less than 40 years. The youngest patient with anterior wall MI was of age 32 years. Major risk factors were obesity due to high waist hip ratio (94.61%), dyslipidemia mainly due to low HDL (78.65%), hypertension (54.49%), type 2 diabetes (34.83%), and smoking (54.49%) menopause was present in 151 (84%) patients. 25 (16.56%) patients had menopause at the age of 40 and below and 26 (17.23%) patients had menopause at the age of 41-45 years. Menopause was natural as well as surgical due to hysterectomy. (Table 1).

Table 1. Baseline clinical characteristics and cardiovascular risk factor among the study population (N=178).

Variable	Frequency
Age in years (mean ±SD)	62.53±12.1
Age group (N/%)	97 (54.49%)
< 65 years	
< 55 years	47(26.4%)
BMI kg/m2 (mean ±SD)	24.14±4.6
Waist /Hip (mean ±SD)	0.912± 0.1
Central Obesity (N/%) (Waist/hip ratio ≥0.85)	158 (94.61%)
Dyslipidemia(Low HDL<50mg/dl) (N/%)	140 (78.65%)
Hypertension ((N/%)	97 (54.49%)
Smoking ((N/%)	97 (54.49%)
Diabetes ((N/%)	62 (34.83%)
Family H/O of CAD	11 (6.1%)
Menopause	151(84.83%)

Regarding clinical symptoms, most common symptoms were chest pain in 83.71 % cases, followed by shortness of breath in 35.39 % cases, sweating in 46 % cases, nausea and vomiting in 23. 6% cases, epigastric pain in 6.74 % cases, syncope in 2.25 % and dizziness in 1.12% cases. The typical radiation of chest pain was found in 58.9 % cases (Table 2).

Table 2. Clinical presentation of patients with myocardial infarction.

COMMON SYMPTOPMS	N/%
Chest pain	149 (83.7)
Shortness of breath	63 (35.39)
Radiation of pain	105 (58.9)
Sweating	82 (46)
Nausea & vomiting	42 (23.6)
Epigastric pain	12 (6.74)
Syncope	4 (2.25)
Dizziness	2 (1.12)

Out of 178 patients, coronary angiography (CAG) was done in 114 patients. The result of CAG was as follows: Single vessel disease (SVD) was present in 41 (36%) patients, double vessel disease (DVD) in 30 (26.3%) patients, triple vessel disease (TVD) in 33(28.9%) patients, non -critical coronaries in 8 (7.01%) patients and normal coronaries in 2 (1.8%) patients.

While comparing lesion between STEMI and NSTEMI, there was significant difference in the involvement of vessels between two types of MI (P value 0.007). SVD and DVD were higher in patients with STEM (41% vs 13%) and (21.3% vs 18.2%) respectively, while TVD was higher in NSTEMI group (50% vs 28.9%). Lesion with noncritical coronaries was higher in NSTEMI groups (18.2% vs 4.3). Normal coronaries were absent in NSTEMI group. Table 3

Table 3. Pattern of lesion according to types of MI.

TYPES OF LESION						
Types of MI	SVD	DVD	TVD	Non-critical coronaris	Normal coronaries	Total
STEMI	38 (41.3%)	26 (21.3%)	22(28.9)	4(4.3%)	2(2.2%)	92 (100%)
NSTEMI	3(13.6%)	4(18.2%)	11(50.0%)	4(18.2%)	0.00%	22 (100%)
TOTAL	41(36.0%)	30(26.3%)	33(28.6%)	8(7.0%)	2(2.9)	114 (100%)
p value 0.007						

The most common coronary artery involved was LAD 76 (38%) followed by RCA 62 (31%) and LCX 59 (29.5%). LM was involved in 3(1.5%) of patients. Table 4 and Fig 1

Table 4. Pattern of coronary artery involvement.

Artery Involved	Frequency	Percent
LM	3	1.5
LAD	76	38.0%
RCA	62	31.
LCX	59	29.5%
TOTAL	200	100%

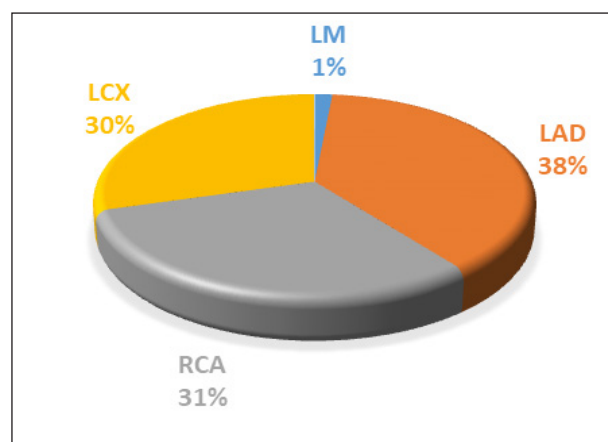


Figure 1. Pattern of coronary artery involvement.

The primary outcome of in hospital mortality occurred in 3.37 % cases and all mortality occurred in STEMI

patients only. Among the various complications, most common complication were moderate to severe LV systolic dysfunction (53.8 %), followed by complete heart block (10.1%), acute renal impairment (6.1%), acute pulmonary edema (5%), cardiogenic shock (3.9%), ventricular septal rupture (1.6%), ventricular tachycardia (1.6 %), cardiac tamponade (0.5 %) and resuscitated cardiac arrest in 0.5% case (Table 5).

Table 5. Complications of acute myocardial infarction among the study population.

Complications	STEMI	NSTEMI	Total patients N/%
Moderate LV systolic Dysfunction	68	4	72 (43.2%)
Severe LV systolic dysfunction	19	0	19 (10.6%)
Complete heart block	17	1	18 (10.1%)
Acute Renal Impairment	10	1	11(6.1%)
Cardiogenic Shock	8	1	9 (5%)
Acute pulmonary edema	5	2	7 (3.9%)
Ventricular Septal Rupture	3	0	3 (1.6%)
Ventricular tachycardia	3	0	3 (1.6%)
Cardiac Tamponade	1	0	1 (0.5%)
Resuscitated cardiac arrest	1	0	1 (0.5%)

DISCUSSION

In this cross sectional study of acute myocardial infarction in women including both STEMI and NSTEMI, we found that significant number of women had premature coronary artery disease. Obesity due to high weight hip ratio and low HDL level were the most common cardiac risk factors others being hypertension diabetes mellitus, smoking and menopause. In angiographic study we found that SVD was the most common lesion and LAD was the most commonly involved vessel. Hospital mortality was seen only in STEMI patients.

The prevalence of coronary heart disease in women is increasing in Nepal as in other South Asian countries. However, lack of research in the field of women and coronary heart disease makes the problem under noticed. Our study showed that significant number

of females were having CAD at early age as 26.4 % of patients were of age less than 55 years and 1.6 % patients belonged to age group less than 40 years

In our study, the mean age was 62.53 ±12.1 which is comparable to INTERHEART study and other studies done in Nepal and India.¹⁴⁻¹⁹ Another study done in Nepal also reported the increasing risk of CAD in young. male and female patients.²⁰ Similar to our findings of higher rates of premature CAD, in INTERHEART study the first MI attack occurred in 4.4% of Asian women and 9.7% of men at age less than 40 years, which was 2- to 3.5-fold higher than in the West European population and was third highest of all the regions studied worldwide.

In our study major risk factors were hypertension, diabetes, dyslipidemia due to low HDL, smoking and obesity due to high waist hip ratio which is comparable to Step Survey and other studies done in Nepal as well as INTERHEART study.^{4, 21-23}

In our study, diabetes was present in 34.83% of patients which was more or less comparable to other studies done in India.^{17-19,24} In our study more than 50 % of patients were hypertensive which was higher as compared to the cases of South Asian cohort of INTERHEART study (30-40%) and other studies done in India where 30 to 40% had hypertension.^{16,17,19} However one study done in India showed more than 70% of patients had hypertension.²⁴

Smoking is one of the prominent risk factor in Nepalese women (54.49%). In INTERHEART study and CREATE registry 45.2% and 40.2% patients were smokers.^{4, 19} However as compared to Nepal, tobacco chewing is common in Indian women.^{16, 18}

Central/Abdominal obesity is generally regarded as a more important predictor of ischemic heart disease than generalized obesity. According to INTERHEART study, South Asians have significantly higher population attributable risk associated with waist-to-hip ratio and it is a better indicator of myocardial infarction than BMI. Our study has shown that obesity due to high waist hip ratio is a major cardiac risk factor (94.61 %) among the Nepalese women and seems to be a serious threat to the health of Nepalese women. So, further research needs to be done to understand the exact magnitude of this problem.

Reduced high-density lipoprotein cholesterol and high triglyceride levels are powerful risk factors for CAD in women. Among 32826 postmenopausal women from the Nurses' Health Study, high-density lipoprotein cholesterol

was the lipid parameter that best discriminated risk of CHD. ²⁵ According to Step survey, dyslipidemia mainly due to low HDL level is one of the important causes of dyslipidemia in Nepalese population. ²³ Dyslipidemia was one of the main risk factor in our study, it was mainly due to low HDL level.

Thus, in comparison to South Asian cohort of INTERHEART study, and female patients in other Indian studies, smoking, obesity due to high waist to hip ratio and dyslipidemia due to low HDL level seems to be higher and most prominent risk factors among Nepalese women.

In our study, ST-Elevation Myocardial Infarction was present in 85.59% and Non ST-Elevation MI in 14.04% patients. Similar result was reported in other hospital data based studies, done in Nepal ^{15, 26} as well as other studies done in India. ^{27, 28} In our study SVD (36%) was the most common lesion followed by TVD (28.9%) and DVD (26.3%). Similarly, in studies done in Nepal and India, SVD was the most common lesion followed by DVD and TVD. ^{15, 18, 20, 27}

Comparing the pattern of lesion in between STEMI and NSTEMI, SVD and DVD were more common in STEMI patients while TVD was more common in NSTEMI patients. This was statistically significant ($P = 0.007$). Similar to our study, in the study done by Deora S et al single vessel disease was more frequent in the STEMI group while multiple vessel involvement, was frequent in NSTEMI/UA. ²⁸ Regarding involvement of cardiac arteries, the most commonly involved artery in our study was left anterior descending artery(LAD) and least common was left main (LM). Similar result was reported in another study done in Nepal. ¹⁵ Other studies done in India also had shown similar types of result. LAD was the most commonly involved vessel whereas left main was the least commonly involved vessel in CAD patients. ^{28, 29} In our study most common complications were moderate to severe LV systolic dysfunction, complete heart block, renal impairment, acute pulmonary edema and cardiogenic shock. Similar types of complications were seen in other studies also. ^{16, 18} Complication and mortality rates after MI were higher in women than in men. ^{26, 30} In our study, mortality was seen only in STEMI. In hospital mortality was low in our study as compared to other studies. ^{16, 18, 19, 26} The reason may be, that our study period was short, and no of patients involved were less than other studies.

This study is a single center study and the study period is short with less sample size which is its major limitation.

There is need of further multicenter prospective study with longer follow up period to overcome this limitation.

CONCLUSIONS

Our study showed that significant number of females had premature coronary artery disease. Dyslipidemia due to low HDL-C was the most common risk factor followed by hypertension, smoking and diabetes. Besides this, abdominal obesity also seems to be a serious problem among Nepalese women further research is needed to address this problem. Among the patient who underwent coronary angiography, majority had significant CAD. The in hospital mortality was seen only in STEMI patients and majority of patients had Moderate to severe LV dysfunction.

It is high time that the concerned authorities take some serious steps to address the problem of increasing CAD among women in Nepal. The most important thing is to change individual, family, and community behavior towards healthy lifestyle and to strengthen the condition of the health facilities for proper and timely treatment of diabetes, hypertension and dyslipidemia and CAD. Interventions to reduce modifiable risk factors should be initiated.

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CONFLICT OF INTEREST

The authors do not have any conflict of interest including financial in publication of this article.

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