

# Clinical Characteristics and Outcomes of Coronary Artery Disease among South Indian Women- A Retrospective Study

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## ABSTRACT

**Introduction:** The prevalence of Coronary Artery Disease (CAD) is increasing among Indian women and is the leading cause of death. Clinical presentation of CAD in women can widely vary from atypical chest pain, silent ischemia to massive myocardial infarction and death. Women have poor prognosis than men after myocardial infarction and are less likely to undergo revascularisation compared to men.

**Aim:** To study the risk factors, clinical characteristics, severity of CAD and to evaluate the outcomes in women undergoing coronary angiogram.

**Materials and Methods:** This retrospective study included 912 women who had undergone coronary angiogram in our hospital from January 2018 to December 2018. The patients were divided into three groups- Group A consisted of 230 (25%) women with age <50 years. Group B consisted of 591 (65%) women with age between 50 to 69 years. Group C consisted of 91 (10%) women

with age >70 years. Continuous variables were analysed by paired t-test and categorical variables were analysed by chi-square test.

**Results:** Most women were post menopausal (73.6%). Common risk factors were diabetes mellitus (63%) hypertension (56%), and hypothyroidism (16.8%). Out of the total study population, 51% (n=466) presented with a diagnosis of chronic stable angina, 34.7% (n=317) presented with acute coronary syndrome, and 7% (n=66) had atypical chest pain. Out of 500 patients with significant CAD, requiring revascularisation only 316 (63.2%) had undergone interventions out of which 193 (61%) had undergone percutaneous coronary intervention and 123 (39%) had undergone Coronary Artery Bypass Grafting (CABG) as the modality of revascularisation.

**Conclusion:** Clinical presentation of CAD in women varies widely from atypical chest pain to acute infarction. Diabetes and hypertension are the most common risk factors for CAD in our study. Chronic stable angina was the most common spectrum of presentation. Single vessel disease is the most common finding on coronary angiogram.

**Keywords:** Chest pain, Diabetes, Hypertension, Post menopausal

## INTRODUCTION

Cardiovascular Disease (CVD) incidence in women increases after menopause and equals men by the sixth decade [1-3]. In India, 16.9% of mortality in women is attributed to CVD [4]. CAD has resulted in more number of deaths than the combined number of deaths due to infections, malignancy and accidents [5,6]. Change in hormones after menopause alone cannot explain the increased risk of CVD. Traditional risk factors like age, hypertension, diabetes mellitus, dyslipidemia, tobacco use, family history along with emerging risk factors, metabolic syndrome, polycystic ovarian disease and hysterectomy contributes to CAD [7]. Two out of three women with CVD have risk factors [8]. Diabetes mellitus and metabolic syndrome increase the risk of CAD more in women compared to men [9-12]. According to Global Longitudinal Study of Osteoporosis in Women (GLOW) metanalysis, women with ST-Segment Elevation Myocardial Infarction (STEMI) had more risk factors, had a more extended door to balloon time and two-fold higher in-hospital mortality [13]. Among the women undergoing Coronary artery bypass graft (CABG) for CAD, there were higher mortality and morbidity and less relief of angina [14]. Although being a predominant cause for mortality in women, CAD risk factor profile and angiographic patterns in Indian women is not studied well [15,16]. CAD is also underdiagnosed and undertreated in women [17], hence, this present study was conducted to study the risk factors, the severity of CAD and the management of the same.

## MATERIALS AND METHODS

This study was a single center, retrospective observational study conducted at Sri Ramachandra Medical Center in Chennai, Tamil Nadu, India from January 2018 to December 2018. Data was analysed during December 2019 to February 2020.

**Inclusion criteria:** All women aged 18 years and above, who had undergone coronary angiogram in the study centre during the study period were included in this study.

**Exclusion criteria:** Women aged less than 18 years, women who had undergone coronary angiogram previously and diagnosed to have CAD, women who had undergone prior percutaneous coronary intervention or CABG were excluded from the study.

**Sample size calculation:** The data of total of 912 women who had undergone treatment in the study medical centre during the study time period and fulfilling the inclusion criteria formed the sample of the present study and was categorised into three groups based on age to <50 years [Group A, n=230 (25%)], 50 to 69 years [Group B, n=591 (65%)] and >70 years [Group C, n=91 (10%)].

## Study Procedure

Data were collected from Medical Records Department electronic data base of the study institute. Information pertaining to risk factors, electrocardiogram (ECG), echocardiogram (echo), Treadmill Test (TMT) findings, details of coronary angiogram and revascularisation were collected from the case sheets stored in the electronic data base.

Demography, risk factor profiling, treadmill test positivity and its association with angiographic CAD severity was analysed. Data regarding the women who had undergone revascularisation after being diagnosed to have significant obstructive CAD post-coronary angiogram was also collected.

## STATISTICAL ANALYSIS

International Business Machines (IBM) Statistical Package for Social Sciences (SPSS) version 20.0 was used for statistical analysis. Descriptive statistics were expressed in terms of ratio, proportion or percentage for categorical data, mean, median, and range for discrete quantitative data. Continuous variables were analysed by paired t-test when appropriate. Categorical variables were analysed by Chi-square test.

## RESULTS

The patients were divided into three groups. The mean age group of study population was 56.8±9.7 years. The baseline characteristics

and risk profiles are listed in [Table/Fig-1]. Diabetes was the most common risk factor constituting 63% (n=576) of the present study population. Hypertension was the next most common risk factor constituting 56% (n=508) of the present study population.

| Characteristics              | Total N (%) | Group A <50 years (%) | Group B 50-70 years (%) | Group C >70 years (%) | p-value |
|------------------------------|-------------|-----------------------|-------------------------|-----------------------|---------|
| Total patients               | 912         | 230 (25)              | 591(65)                 | 91 (10)               | <0.0001 |
| Diabetes mellitus            | 576 (63)    | 140 (61)              | 378 (64)                | 58 (64)               | 0.70    |
| Hypertension                 | 508 (56)    | 101 (44)              | 356 (69)                | 51 (56)               | <0.001  |
| <b>Lipid profile (n=583)</b> |             |                       |                         |                       |         |
| LDL-C >130 mg/dL             | 214 (36.7)  | 61(28.5)              | 131 (61.2)              | 22 (10.2)             | <0.0001 |
| HDL-C <40 mg/dL              | 102 (17.4)  | 29 (28.4)             | 65 (63.7)               | 8 (7.8)               | <0.0001 |
| Hypothyroidism               | 154 (16.8)  | 36 (15)               | 98 (16.5)               | 20 (28)               | 0.37    |
| Tobacco                      | 48 (5.2)    | 25 (12)               | 23 (4)                  | 0 (0)                 | <0.0001 |
| Post menopausal              | 673 (73.8)  | 78 (33.9)             | 504 (85.2)              | 91 (100)              | <0.0001 |
| Family history of CAD        | 66 (7.2)    | 23 (11)               | 42 (7.6)                | 1 (1.1)               | 0.02    |
| Abnormal ECG                 | 528 (57.8)  | 109 (47.3)            | 357 (60.4)              | 62 (68.1)             | <0.0001 |
| Abnormal ECHO                | 353 (38.7)  | 71 (20.1)             | 243 (41.1)              | 39 (42.9)             | 0.018   |
| <b>TMT</b>                   |             |                       |                         |                       |         |
| Positive                     | 279 (86.6)  | 92 (88.1)             | 170 (87.6)              | 17 (66.6)             |         |
| Negative                     | 22 (6.8)    | 5 (4.5)               | 14 (7.2)                | 3 (16.6)              |         |
| Inconclusive                 | 21 (6.6)    | 8 (7.2)               | 10 (5.1)                | 3 (16.6)              |         |
| Not done                     | 590 (64.6)  | 120 (52.1)            | 397 (67.1)              | 73 (80.2)             |         |
| <b>Diagnosis</b>             |             |                       |                         |                       |         |
| CSA                          | 466 (51)    | 129 (56)              | 293 (49.5)              | 44 (48.3)             |         |
| Atypical chest pain          | 66 (7.2)    | 36 (15.6)             | 28 (4.7)                | 2 (2.1)               |         |
| Unstable angina              | 92 (10.1)   | 11 (4.7)              | 65 (10.9)               | 16 (17.5)             |         |
| NSTEMI                       | 109 (11.9)  | 14 (6)                | 81 (13.7)               | 14 (15.3)             |         |
| STEMI                        | 116 (12.7)  | 23 (10)               | 85 (14.3)               | 8 (8.7)               |         |

**[Table/Fig-1]:** Baseline demographic, risk factor and clinical profile of study population. A 63 (6.2) had presented with various conditions like Rheumatic heart disease, supra ventricular tachycardia and dilated cardiomyopathy, who had undergone coronary angiogram as a preoperative routine; LDL-C: Low density lipoprotein cholesterol; HDL-C: High density lipoprotein cholesterol; ECG: Electrocardiogram; ECHO: Echocardiogram; TMT: Tread mill test; CSA: Chronic stable angina; NSTEMI: Non ST elevation myocardial infarction; STEMI: ST elevation myocardial infarction (p-value: 2-sided Chi-square test)

Out of the total study population, lipid profile was done in 583 (63.9%) patients. In the patients with lipid profile, Low Density Lipoprotein-Cholesterol (LDL-C) >130 mg/dL was seen in 214 (36.7%), High Density Lipoprotein-Cholesterol (HDL-C) <40 mg/dL was seen in 102 (17.4%) patients. Hypothyroidism was seen in 16.8% (n=154) of the study population. Tobacco abuse was seen in 5.2% (n=48) of the study population. Positive family history for CAD was noticed in 7.2% (n=66) of the study population.

**Spectrum of clinical presentation:** Out of the total study population, 51% (n=466) presented with a diagnosis of Chronic Stable Angina (CSA) and 7.2% (n=66) had atypical chest pain. A total of 34.7% (n=317) presented with acute coronary syndrome (MI+NSTEMI+STEMI). CSA was the most common presentation among all the age groups. Another 6.2% (n=63) had presented with various conditions like rheumatic heart disease, supra ventricular tachycardia and dilated cardiomyopathy, who had undergone coronary angiogram as a preoperative routine.

**Assessment of CAD:** Abnormal ECG was noticed in 57.8% (N=528) of the study population. Prevalence of abnormal ECG increased with increasing age. Abnormal echocardiogram with Ejection Fraction (EF) <50% was seen in 353 (38.7%) patients. With increasing age, there was an increasing prevalence of abnormal echocardiogram. TMT was not performed in large group of study population constituting 64.6% (N=590). Out of 532 patients presenting with CSA and atypical chest, pain only 228 (42.8%) had undergone TMT. Among 322 people who had undergone TMT, it was positive in 279 (86.6%), inconclusive in 21 (6.6%) and negative in 22 (6.8%).

**Coronary angiogram:** Data regarding CAD severity pattern on angiogram is mentioned in [Table/Fig-2]. Out of 912 patients, 277 (30.3%) had normal epicardial coronaries. This was more commonly seen in Group A patients (46.3%) than in Group B (26%) and

Group C (18.6%) patients (p<0.0001). Non-obstructive CAD was seen in 135 (14.8%) patients with 35 (15.2%) in Group A and 90 (15.2%) in Group B followed by 10 (10.9%) of Group C population. Obstructive CAD was seen in 54.8% (n=500) of the study population.

| Characteristics          | Total (%)  | Group A <50 years (n=230), (%) | Group B 50-70 years (n=591), (%) | Group C >70 years (n=91), (%) | p-value |
|--------------------------|------------|--------------------------------|----------------------------------|-------------------------------|---------|
| Normal coronary arteries | 277 (30.3) | 106 (46.3)                     | 154 (26)                         | 17 (18.6)                     | <0.0001 |
| Non-obstructive CAD      | 135 (14.8) | 35 (15.2)                      | 90 (15.2)                        | 10 (10.9)                     | <0.0001 |
| Obstructive CAD          | 500 (54.8) | 89 (38.6)                      | 347 (58.7)                       | 64 (70.3)                     | <0.0001 |
| SVD                      | 190 (38)   | 40 (17.3)                      | 129 (21.9)                       | 21 (23)                       | <0.0001 |
| DVD                      | 131 (26.2) | 22 (9.5)                       | 95 (16)                          | 14 (15.3)                     | <0.0001 |
| TVD                      | 170 (34)   | 27 (11.7)                      | 116 (19.8)                       | 27 (29.6)                     | <0.0001 |
| Left main disease        | 9 (1.8)    | 0                              | 7 (1.2)                          | 2 (2.2)                       | <0.0001 |

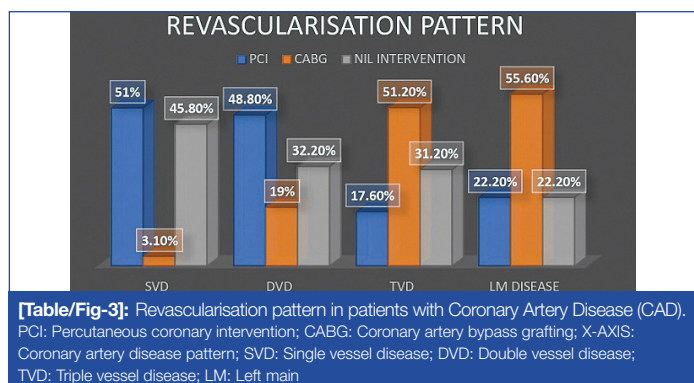
**[Table/Fig-2]:** Coronary angiogram pattern among study groups.

CAD: Coronary artery disease; SVD: Single vessel disease; DVD: Double vessel disease; TVD: Triple vessel disease. (p-value: 2-sided Chi-square test)

The frequency of obstructive CAD increases with increasing age as evidenced by 38.6% in Group A, 58.7% in Group B and 70.3% in Group C having significant CAD. Among the obstructive CAD, SVD was seen in 190 (38%) patients, DVD in 131 (26.2%), TVD in 170 (34%) and left main disease in 9 (1.8%) patients [Table/Fig-2].

Among 201 patients presenting with Unstable angina (92)/Non-STEMI (109), 9 (4.4%) had normal coronaries and 22 (10.9%) had non-obstructive CAD. SVD was seen in 60 (29.8%) patients, DVD in 38 (18.9%), TVD in 66 (32.8%) and left main disease in 6 (3%). Out of 116 patients with STEMI, normal coronaries were seen in 5 (4.3%), SVD in 30 (25.8%), DVD in 40 (34.4%), TVD in 38 (32.7%) and left main disease in 1 patient. Among 279 patients with TMT positivity, 136 (48.7%) had normal coronaries, 42 (15%) had non-obstructive CAD. SVD was seen in 47 (16.8%), DVD in 35 (12.5%), TVD in 19 (6.8%). Among 22 patients with negative TMT, 17 (77.2%) had normal/insignificant CAD.

**Revascularisation:** Out of 500 patients with significant CAD requiring revascularisation only 316 (63.2%) had undergone intervention out of which 193 (61%) had undergone percutaneous coronary intervention and 123 (39%) had undergone CABG as the modality of revascularisation [Table/Fig-3].



**[Table/Fig-3]:** Revascularisation pattern in patients with Coronary Artery Disease (CAD). PCI: Percutaneous coronary intervention; CABG: Coronary artery bypass grafting; X-AXIS: Coronary artery disease pattern; SVD: Single vessel disease; DVD: Double vessel disease; TVD: Triple vessel disease; LM: Left main

## DISCUSSION

In the present study, apart from age more than 50 years, diabetic status, hypertension, dyslipidemia contributed significantly for CAD in women. This was similar to study done by Mohammad AM et al., [18]. Chronic stable angina (51%) was the most common presentation for which angiogram was done. Angiogram was done for acute coronary syndrome in 317 patients (34.7%). Diabetes mellitus (63%), hypertension (56%), post menopausal status (73.6%) were three factors that correlated with significant CAD. Among 204 (22%) patients who had all the three risk factors, 176 (64%) had significant coronary disease. In pre-menopausal women who had undergone coronary angiogram, 48% had significant CAD. Diabetes (65%) and hypertension (45%) were the significant risk factors among pre-menopausal age group. Ankit S et al have showed diabetes and hypertension are predominant risk factors in pre-menopausal women [19]. In INTERHEART study, nine risk factors (current or former smoker, age, sex, obesity, diabetes mellitus, hypertension, no alcohol intake, less intake for fruits and

vegetables, psychosocial factors, dyslipidemia) contributed to acute myocardial infarction [7]. Women with multiple risk factors had higher odds ratio of myocardial infarction. Hypertension was more prevalent among women than men due to late presentation [7,20].

In the present study, Positive TMT was the reason for coronary angiogram in 279 women. TMT was done mostly among women with atypical chest pain and chronic stable angina. Only 36% of women with positive stress test had significant CAD. Another 34% of positive patients with diabetes had either normal or non-obstructive CAD, indicating that positive TMT may be secondary to microvascular dysfunction. Mark DB et al., have shown higher false positive TMT in low-risk women [21].

In the present study, 500 out of 912 (54.8%) women who underwent CAG had significant CAD. It's similar to another Indian study done by Ezhumalai B and Jayaraman B al in which incidence of significant CAD was 45% [15]. In women less than 50 years 60% had normal or non-obstructive CAD. In women more than 50 years and less than 69 years, 60% of them had significant CAD. In women aged above 70 years, 70% had significant CAD. A 60% of women aged above 50 years had multivessel disease but nearly 45% of women with age less than 50 years had single vessel disease. Only 1.8% of women in our study had Left Main Coronary Artery (LMCA) stenosis. This is in contrary to various other studies where LMCA stenosis was seen in range of 4-7% [15,22-24].

Revascularisation was done only in two third of the women with significant CAD. Nearly 36.8% did not undergo revascularisation in index admission. Various studies have also shown that women are more likely to have late presentation, mortality and are undertreated when compared with men [24-29].

### Limitation(s)

This is a single centre study. Since it's a retrospective study, there were limitations in data collection.

### CONCLUSION(S)

The present study is retrospective observational study on risk factor profile and CAD among south Indian women in a tertiary care university hospital. Women in younger age group had more false positive TMT. In premenopausal women diabetes was the predominant risk factor for CAD. Younger age group women have lesser chance of CAD when compared with higher age group. Non-obstructive CAD is also more common in younger age group, women presenting with chronic stable angina and atypical chest pain. Women aged above 50 years and who attained menopause had higher percentage of significant CAD. One third of women with significant CAD do not undergo revascularisation either by PCI or CABG. Larger multi-centre, prospective study will throw more light on risk factors for CAD in women.

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