ORIGINAL ARTICLE

PATTERN OF CORONARY ARTERY DISEASES IN PATIENTS UNDER 40 YEARS OF AGE WITH ACUTE CORONARY SYNDROME

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Objectives: To determine the pattern of coronary artery diseases (CAD) in patients under 40 years of age with acute coronary syndrome (ACS) presenting at Hyderabad Satellite Center of National Institute of Cardiovascular Disease (NICVD), Pakistan.

Methodology: This cross-sectional study was conducted at cardiology department of the NICVD, Hyderabad Satellite Center. Both male and female patients, between 18 to 40 years of age, diagnosed with acute coronary syndrome (ACS), and undergone coronary angiography were included in this study. Angiographic patterns in terms of extent of the disease (number of diseased vessels and localization of lesion) were assessed.

Results: Total of 220 young patients included. Patients were predominantly male (91.8%) with the mean age of 35.3 ± 5 years. Smoking was observed 30.5% followed by hypertension (24.5%) and positive family history of CAD (19.1%). A majority of the patients (79.1%) were diagnosed as with ST-elevation myocardial infarction (STEMI) with anterior wall myocardial infarction (MI) as the most common (57.3%) type of MI. Most of the patients (70%) had single vessel diseases (SVD) with left anterior descending artery (LAD) as the most commonly diseased vessel (53.6%). Nine (4.1%) patients had significant left main disease and 6.4% had non-obstructive CAD.

Conclusion: The common clinical presentation of ACS in younger patients is STEMI. Smoking is the commonest risk factor followed by hypertension and family history of CAD. More than 2/3rd of the young patients are expected to have single vessel diseases with LAD as the most commonly diseased vessel.

Keywords: STEMI, Acute Coronary Syndrome, Angiography

INTRODUCTION

Once considered to be the disease of the old, ischemic heart disease (IHD) in young population, also termed as premature coronary artery disease (CAD), remains a rising public health concern in our society.1 The frequency of IHD in South Asian population is more than that of population in the western world. Necropsy studies have demonstrated that atherosclerotic changes initiated in the blood vessels in early life and become symptomatic after 40 years of life.2 The increase frequency of cardiovascular disorders in young generation is an alarming public health issue.3 In younger patients with IHD, a greater participation of the genetic component has been discussed.4 The incidence of younger age group was significantly higher in men compared to women and majority of those sufferings belong to lower middle class socioeconomic structure of the society.5 It is unclear that the pathophysiology of myocardial infarction at a young age is same as same observed in older patients. MI is mainly owing to congenital coronary anomaly, coronary spasm, premature atherosclerosis, and drug induced. Some researchers reported that drug induced myocardial infarction is related with atherogenic consequences in young individuals due to long term abuse of drugs.6 The data regarding risk factors and coronary angiographic findings in young adults with ACS in Pakistan is limited. Despite the fact that few studies have been carried out in subcontinent there is expected variability in the results in our population due to socioeconomic and cultural diversity. Hence this study was conducted with aim to determine the pattern of CAD in patients under 40 years of age with ACS. The current study aims not only to contribute to the scientific understanding of the disease but also helps in the development of appropriate strategies of screening such patients at an appropriate age so to prevent IHD among young population.
METHODOLOGY

This descriptive cross-sectional study was performed at the cardiology department of National Institute of Cardiovascular Disease (NICVD), Hyderabad Satellite Center during January 2020 to June 2020. All patients between the 20-40 years of age were included in this study considering the inclusion and exclusion criteria. Inclusion criteria were both male and female patients, age between 18 to 40 years, diagnosed with acute coronary syndrome (ACS), and undergoing percutaneous coronary intervention (PCI). Exclusion criteria were patient with prior history of ACS, history of any cardiac surgery, or refused to give consent for participation. Approval of ethical review committee of NICVD was taken prior to the data collection (ERC-02/2020). Consecutive patients fulfilling the inclusion/exclusion criteria were included. Prior to inclusion the purpose, and benefits of the study were explained to all participants and verbal informed consent was taken by the principal investigator from all patients regarding their participation in the study and publication of obtained data while maintaining confidentiality.

Demographic detail such as gender and age (years), and history of the patients were taken regarding hypertension, diabetic mellitus, family history, and obesity. A baseline 12-lead electrocardiogram (ECG) was obtained for all the patients and type and location of myocardial infarction was classified. Percutaneous coronary intervention (PCI) was performed in all the patients and angiographic patterns in terms of extent of the disease (number of diseased vessels, localization of diseases and stenosis (%), left ventricular ejection fraction (LVEF), initial TIMI flow grade, and thrombus grade) and procedural characteristics (use of export, pre balloon used, and tiroflaban infusion, type of stent, and final TIMI flow grade) were recorded. Localization of diseases and stenosis (%) was assessed as ostial, proximal, mid, or distal for all major coronary arteries namely left main (LM), left anterior descending artery (LAD), left circumflex artery (LCX), right coronary artery (RCA), obtuse marginal (OM), and ramus intermedius. Data will be entered and analysis using SPSS version-21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). Continuous variables were expressed using descriptive statistics such as mean ± standard deviation (SD) or median [interquartile range (IQR)] appropriately. Frequency and percentages were calculated for categorical variables.

RESULTS

A total of 220 young patients between the 20 to 40 years of age were included in this study. Patients were predominantly male (91.8%) with the mean age of 35.3 ± 5 years. Smoking was found to be the most common (30.5%) co-morbid followed by hypertension (24.5%) and 19.1% of the patients had positive family history of CAD. A majority of the patients (79.1%) were diagnosed with STEMI at presentation with anterior wall MI as the most common (57.3%) type of MI. Baseline demographic and clinical characteristics are presented in Table 1.

| Table 1: Demographic and Clinical Features |
|------------------------------------------|
| **Characteristics**                      | **Total** |
| **Subjects (N)**                          | 220       |
| **Gender**                                |           |
| Male                                      | 91.8% (202) |
| Female                                    | 8.2% (18)  |
| **Age (years)**                           |           |
| 20 to 30 years                            | 19.1% (42) |
| 31 to 40 years                            | 80.9% (178) |
| **Risk Factors**                          |           |
| Hypertension                              | 24.5% (54) |
| Diabetes mellitus                         | 9.1% (20)  |
| Smoking                                   | 30.5% (67) |
| Obesity                                   | 7.7% (17)  |
| Dyslipidemia                              | 3.2% (7)   |
| Family history of coronary artery diseases| 19.1% (42) |
| **Acute coronary syndrome (ACS)**         |           |
| STEMI                                     | 79.1% (174) |
| NSTEMI                                    | 20% (44)   |
| Unstable angina (UA)                      | 0.9% (2)   |
| **Type of myocardial infarction (MI)**    |           |
| Inferior Wall                             | 35.5% (78) |
| Posterior Wall                            | 20.9% (46) |
| Anterior Wall                             | 57.3% (126) |
| Lateral Wall                              | 7.7% (17)  |
| High Lateral Wall                         | 3.2% (7)   |
| **Cardiac Catheterization**               |           |
| **Characteristics**                       | **Total** |
| **Subjects (n)**                          | 220       |
| **Vessels involved**                      |           |
| Single vessel diseased (SVD)              | 70% (154)  |
| Two vessels diseased (2VD)                | 24.1% (53) |
| Three vessels diseased (3VD)              | 5.9% (13)  |
| **Diseased vessels**                      |           |
| Left main (LM)                            | 4.1% (9)   |
| Left anterior descending artery (LAD)     | 53.6% (118) |
| Left circumflex artery (LCX)              | 26.4% (58) |
| Right coronary artery (RCA)               | 26.8% (59) |
| Obtuse marginal (OM)                      | 0.5% (1)   |
| Ramus intermedius                         | 1.8% (4)   |
| Non Obstructive                           | 6.4% (14)  |
| **Left ventricular ejection fraction (LVEF)** |
| 20-25%                                    | 4.5% (10)  |
| 25-30%                                    | 29.1% (64) |
| 30-35%                                    | 8.6% (19)  |
| 35-40%                                    | 6.8% (15)  |
| 40-45%                                    | 31.8% (70) |
| 45-50%                                    | 13.6% (30) |
Most of the patients (70%) had single vessel coronary artery diseases with LAD as the most commonly diseases vessel (53.6%) followed by RCA (26.8%), and LCX (26.4%). Nine (4.1%) patients had significant left main disease and 6.4% had non-obstructive coronary artery diseases. In this cohort we observed a significant thrombus burden with thrombus grade V in 29.1% and IV in 33.6% of the patients. Export was used in 45.5% of the patients, DES was deployed in 86.4%, and final TIMI flow grade II-III was observed in 92.7% of the patients. Characteristics and finding of cardiac catheterization are presented in Table 2. Distribution of localization of disease is presented in Table 3.

**DISCUSSION**

ACS in young adults has to be taken as a serious public health issue in Pakistan, more efforts and resources are needed to understand the development and progression CVD in this population. Therefore, in present study our aim was to evaluate the pattern of CAD in young (≤40 years) patients presented with ACS. Patients were predominantly male with smoking as a most common conventional risk factor followed by hypertension and positive family history of CAD. More than 2/3rd of the patients had single vessel diseases (SVD) with LAD as the most commonly diseased vessel followed by RCA, and LCX and around 80% of them were diagnosed with ST-segment elevation myocardial infarction (STEMI) at presentation. Significant left main disease was not that common observed in about 4.1% of the patients and a significant thrombus burden was observed with thrombus grade IV or higher in more than 60% of the patients. The MI is more common in South Asian populations as compared to the western population and the South Asians, are unduly prone to develop CAD in young patients. The clinical proportion of premature MI is reported to be 2-12% of total STEMI. Some ACS studies reported similar male predominance in younger patients with CVD. CAD is less common in premenopausal women due to the protective effects of estrogen but the risk is enhancing in menopause. In general, various risk factors are considered to play a significant role in development of CAD is younger adults. We have observed that smoking, hypertension, family history of CAD were the leading conventional risk factors in this population, while, other conventional risk factors such as diabetes, obesity, and dyslipidemia were not that common. Similar to our study various studies in the past have highlighted sedentary lifestyle, smoking, and positive family history as a key risk factors of CAD younger population. A recent study by compared outcomes of primary PCI in young smokers and non-smoker patients without any other conventional risk factors of CAD and reported no significant differences in disease pattern and immediate clinical outcomes after primary PCI. Further they argued the need of understanding and identification of risk factors other than conventional risk factors and timely risk stratification in these patients. Similarly, also highlighted need of a population-specific risk stratification system for primary prevention in this population.

Multivessel disease (MVD) was less common in young patients, it account for only about 1/3rd of the total patients, which was smaller than some of the past studies on STEMI patients in Pakistani population. reported MVD in 40.1% of the patients with STEMI under 45 years of age. Similarly, in a study by

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**Table 3: Localization of Diseases**

| Characteristics | Total (N) | LM | LAD | LCX | RCA | OM | RAMUS |
|-----------------|----------|----|-----|-----|-----|----|-------|
|                  | 118      | 9  | 58  | 59  | 1   | 4  |       |
| Stenosis (%)     |          | 56.7 ± 13.2 | 92 ± 7.4 | 85.2 ± 9.1 | 92.1 ± 8.4 | 100 ± 0 | 90 ± 8.2 |
| Characteristics  |          | 0 (0%) | 25 (21.2%) | 2 (3.4%) | 3 (5.1%) | 0 (0%) | 0 (0%) |
|                  |          | 0 (0%) | 48 (40.7%) | 14 (21.4%) | 31 (52.5%) | 1 (100%) | 4 (100%) |
|                  |          | 0 (0%) | 48 (40.7%) | 42 (72.4%) | 22 (37.3%) | 0 (0%) | 0 (0%) |
|                  |          | 9 (100%) | 4 (3.4%) | 0 (0%) | 1 (1.7%) | 0 (0%) | 0 (0%) |

**LM** = left main, **LAD** = left anterior descending artery, **LCX** = left circumflex artery, **RCA** = right coronary artery, **OM** = obtuse marginal, **RAMUS** = ramus intermedius

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Batra MK et al. MVD was reported in 38% of young (≤40 years) patients with STEMI. The proportion of MVD in young patients is reported to be ranging from 16 to 56% in studies conducted in various populations of the world.21-25 A single center non-comparative study are the key limitation of this study. Further studies are needed to identify risk factors, in addition to the conventional risk factors of CAD, aggravating the cardiovascular diseases in young population.

CONCLUSION
The common clinical presentation of ACS in younger patients is STEMI. Smoking is the commonest risk factor followed by hypertension and family history of CAD. More than 2/3rd of the young patients are expected to have single vessel diseases with LAD as the most commonly diseased vessel followed by RCA, and LCX.

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