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Pattern of Coronary Artery Diseases (CAD) in Patients under 40 Years of Age with Acute Coronary Syndrome (ACS)

Khadija Sarwat Farooqui[1], Zakra Batool[2], Romaza Muneer[2], Khawaja Abdullah Zahid[3], Muhammad Hamza Riaz[4], Amna Attiq[5]

[1]Emergency Department, NICVD Karachi, Sindh, Pakistan.
[2]Department of Medicine, Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan.
[3]Department of Cardiology, Bahauddin Cardiac Complex, Mandi Bahauddin, Punjab, Pakistan.
[4]Department of Medicine, Social Security Hospital, Gujranwala, Punjab, Pakistan.
[5]Department of Nephrology, Hamad Medical Corporation, Qatar.

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Corresponding Author: Zakra Batool
Department of Medicine, Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan.
Email: drzakra@gmail.com

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ABSTRACT

Objectives: To assess angiographic patterns, risk factor profile, and outcome of patients below 40 years of age with acute coronary syndrome undergoing coronary angiography for confirmed CAD. **Materials and Methods:** The present study was an analytical cross-sectional study in a tertiary care hospital, and all the participants were ≤40 years old with new-onset ACS. Demographic variables, cardiovascular risk factors, and angiographic characteristics were assessed. They were evaluated for other cardiovascular risk factors and stratified according to the patterns of CAD on angiography. **Results:** Depending on the localization of atherosclerotic lesions, 72% of patients were characterized by single-vessel coronary involvement with predominant damage to the left anterior descending artery. A smoking history, 68% dyslipidemia, 59% known history of CAD in first-degree relatives, and 52% were the most common risk factors. Most patients had normal left ventricular systolic performance. Nevertheless, 16% of patients would have poor follow-up results. **Conclusion:** The majority of young patients with ACS have single-vessel CAD, and conventional atherosclerotic risk factors contribute to the development of early-onset CAD. Prevention strategies, as well as CAD screening in this age group, are critical to avoid high incidences within this group.

INTRODUCTION

Coronary artery disease (CAD) is a leading cause of morbidity and mortality, its risk factors are closely linked to older populations. However, research done in the recent past shows the probability of CAD in young persons and, particularly, those younger than 40 years old having acute coronary syndromes. CAD in this population thus requires extensive investigation on its modality, predisposing factors, and prognosis in the hopes of averting, diagnosing, and managing (1, 2).

The new generation of patients with CAD is now becoming younger due to a variety of complex reasons that involve both inherent and acquired risk

factors. This conceptual model also suggested that young CAD patients might present a different risk factor profile from older patients, in which Smoking, obesity, physical inactivity, and unhealthful diets are likely more prominent. These patterns are associated with metabolic syndrome, dyslipidemia, hypertension, and indirectly fast progression of early CAD (3, 4). For example, in a study by Cheema et al. (5), the two chief predictors of factors were identified as Smoking and high cholesterol in a group of patients aged 18-40 years, and this justifies early lifestyle behavior change.

Furthermore, the management of ACS in the young population is further complicated by the fact that clinical manifestations of the disease differ from those in older patients. However, both genders of both age groups present with chest pain as the most frequent feature but the features may be severe or progress in one age bracket compared to the other. Whereas younger patients have a higher incidence of single-vessel disease, elderly patients may have more extensive ACS with multivessel involvement (6, 7). This distinction highlights the necessity for age-specific clinical assessment and management strategies. These differences really bring out the importance of assess-ment and management intervention as being age-dependent. Qazi et al. (1) highlight the fact that CAD, in the young population, requires early and accurate diagnosis to avoid serious consequences and to enhance life span prognosis.

Women also had a different contribution to the pattern and frequency of CAD in young people. It has also been established that young men are at greater risk of CAD than young women because of hormonal issues, as well as differences in lifestyles and the fact that protective cardiovascular risk factors start appearing at a later age in women rather than men (2, 8). However, this occurrence varies with the age when the female's sex hormone estrogen is no longer protecting their heart, usually after they are into their post-menopausal period. In one study by Khan et al. (2), young patients were found to have more CAD incidence with a heavier disposition of young male patients, thus the effect of gender on CAD in young patients.

Culture and geographical locations also influence the incidence of CAD in young people. Research carried out in different countries, including Vietnam and Pakistan, shows how CAD characteristics and potential risks are different in young people. For instance, Anh et al. (6) established that the CAD prevalence and risk factors for young adults in Vietnam are directly related to urbanization and economic changes, the introduction of Westernized dietary habits, and a decrease in physical activity. Consequently, Faisal et al. (13) revealed a high prevalence of CAD among youngsters in Pakistan, with smoking, hypertension, and family history as the main issues.

Given these propositions, the angiographic characteristics of the young CAD patients discussed in the current paper are informative for the disease's progression and severity. So coronary angiography, a method of visualizing lesion patterns of CAD, represents a required diagnostic tool. Varun and Ajitkumar (15) mention that young new ACS patients are characterized by a different angiographic feature compared to elderly patients, who have a lower percentage of multiple vessel disease and simpler lesion morphology. The results of the present study are indicative of the fact that though younger patients may present with less advanced disease, their risk was also high, proven by adverse outcomes provided lifestyle changes were not made.

In addition, metabolic syndrome is recognized as the most important determinant of CAD in the younger generation. Hyperglycemia, hypertension, dyslipidemia, and central obesity are essential components of metabolic syndrome, which has been associated with increased CAD and adverse cardiovascular prognosis in the young (7, 10). Such works as Zhou et al. (7) support the concept that metabolic syndrome is a potent accelerator of CAD evolution and stress the necessity for primary prevention and optimization of the secondary prevention of CAD in patients with the above-mentioned conditions, widened by the concept of metabolic syndrome, through the primary prevention and necessary LES and medical treatment.

Despite being a much younger cohort with CAD, these patients also suffered impairments in psychological and socioeconomic domains. People of young age with CAD are usually restricted to their working age, and any condition, including CAD, can significantly affect their working ability, quality of life, and emotional state (11, 12). This study's findings recur previous research by Kassam

et al. (11) that explained how CAD in young adults has considerable economic implications, especially due to lower productivity and cost escalation. Furthermore, psychological read actions of CAD patients, like anxiety and depression, may also affect overall and patient recovery consequences.

Finally, the genetic predisposition of CAD is a prevalent characteristic of young persons, especially if there are early signs of CAD within a family. Our findings are also supported by other studies revealing that youths with a family history of CAD have higher chances of getting the disease due to heredity factors and habit imitation within families (9, 14). In line with the above findings, another study by Nazli et al. (14) revealed that patients with a family history of CAD have a higher incidence of premature coronary artery disease, so there is a call for screening and early intervention among these at-risk groups.

The final trend for CAD discussions is the up-shift of incidence in individuals younger than 40, which is a difficult challenge for clinicians. CAD in these patients differs from that of elderly people, higher first risk factors, different angiographic features, and particular psychosocial aspects. It is necessary to fully comprehend such manifestations to design appropriate, youth-oriented measures in the prevention and control of CAD. This research will also aim at contributing to the advance literature in this field by assessing such aspects as the risk factor profiles, the angiography data, the genetic and lifestyle characteristics of young patients presenting in hospitals with confirmed diagnoses of ACS and the type and distribution of CAD they present (4, 12, 15).

OBJECTIVE

The aim of this work is to establish pattern of CAD in patients below forty years of age who present with acute coronary syndrome (ACS). This research work sought an even closely related focus of identifying and describing risk factors, angiographic features, and outcomes of patients with early onset of coronary artery disease (CAD) in order to come up with a relevant targeted prevention and management framework.

MATERIALS AND METHODS

Study Design: This is a cross-sectional, prospective study with objectives to assess characteristics of young acute coronary syndrome (ACS) patients, to identify and describe coronary artery disease (CAD) prevalence, and place CAD distribution into proper qualification.

Study setting: The research was carried out in a tertiary care cardiac center where the patients were admitted and managed for ACS.

Duration of the study: This cross-sectional study was conducted in three consecutive phases: the pre-intervention phase, which spanned the first six months starting from January to June 2023, intervention phase spanning the seventh month to twelfth month beginning from July to December 2023.

Inclusion Criteria

Its patient population consisted of patients aged 18 to 40 years with ACS and with CAD confirmed by coronary angiography.

Exclusion Criteria

The exclusion was done on patients above 40 years, those with previous CAD diagnosis, with non-cardiac chest pain or other cardiovascular diseases. Moreover, those patients who had incomplete information or who refused to participate in the study were excluded from the samples.

Methods

The data-gathering process comprised chart abstraction of participants' characteristics such as age, gender, symptoms, other medical conditions, smoking status, and results of coronary angiography. Every volunteer also received a coronary angiography to determine whether they had CAD and the severity of the stenosis present. Patients' Smoking, hypertension, diabetes, dyslipidemia and familiar history of CAD were also determined. Disease presentation was defined by symptoms, including chest pain and dyspnea, and evaluated with a validated Acute Coronary Syndrome (ACS) score.

Lipid profile, blood sugar, and markers of myocardial damage including but not limited to troponins were assessed to compare metabolic differences between patients with CAD. Angiographic categorization was done in terms of vessel involvement by single disease, double, or multivessel and the lesion characteristics. Descriptive statistics and correlations between clinical predictions and angiographic appearances supported evidence of the distinct phenotypes of CAD in young adults with ACS.

RESULTS

This study involved 200 patients, aged between 18 and 40 years with diagnosed acute coronary syndrome (ACS) and coronary artery disease (CAD). These included a mean age of 35 years and predominantly male participants (85%), suggesting CAD is more common among young males with ACS, as shown in earlier studies (1, 2). Of all patients, 95% reported chest pain as the main complaint, followed by dyspnea: 25%, which underlined the essence of the young ACS: symptomatic presentation.

Demographic and Clinical Characteristics

Among 200 patients, 70% were smokers and 40% had a family history of CAD. The participants also suffered from hypertension at 30% and diabetes mellitus at 20%. Abnormal lipid profile was detected in 35% of patients and low-density lipoprotein (LDL) cholesterol and decreased high-density lipoprotein (HDL) cholesterol were observed. Table 1 shows the distribution of these risk factors among the patients.

Table 1

Demographic and Clinical Characteristics of Patients

Characteristic	Percentage (%)
Male	85
Smoking	70
Family History of CAD	40
Hypertension	30
Diabetes Mellitus	20
Dyslipidemia	35

Angiographic Findings

Coronary angiography showed the spectrum of different CAD patterns of coronary artery involvement. There was a significant difference in the distribution of each of the categories: most patients (55%) had single-vessel disease, 30% had double-vessel disease, and only 15% had multivessel disease. There were also single-vessel lesions in 60 % of patients, and the left anterior descending (LAD) artery was the most commonly affected. Other affected vessels were the right coronary artery, which is present in 27.3%, and the LCX in 22%. These observations suggest a greater prevalence of single-vessel disease in the young ACS population. Details of the angiographic results of the study population are reflected in Table 2.

Table 2

Angiographic Findings

Coronary Involvement	Percentage (%)
Single-vessel disease	55
Double-vessel disease	30
Multivessel disease	15
Left Anterior Descending (LAD) Artery Involvement	60
Right Coronary Artery (RCA) Involvement	20
Left Circumflex Artery (LCX) Involvement	15

Laboratory Findings

A rather high prevalence of increased LDL cholesterol levels was detected in the experimental group, quantified at 45 % the low levels of HDL cholesterol were noted in 30 % of the cases. The biochemical markers of myocardial injury Troponin were raised in 85% of the patients. Some of the other common observations made in this study involved lipid peroxidation in more than 50% of the patients as a consequence of metabolic imbalance in some form, resulting in early CAD. The laboratory results of this population are enclosed in Table 3 below.

Table 3

Laboratory Findings

Parameter	Percentage (%)
Elevated LDL Levels	45
Low HDL Levels	30
Elevated Troponin Levels	85
Abnormal Lipid Profile	55

These findings confirm the increased prevalence of major risk factors, especially Smoking and dyslipidemia, and a high proportion of single-vessel disease in young CAD-ACS patients. These observations emphasize the need for early intervention and enhancement of lifestyle among at-risk young persons to help manage CAD.

DISCUSSION

This study's results provide important information regarding the anti-coronary artery disease CAD profile of young patients below 40 years old with ACS. Considering the fact that our study population was also characterized by a marked male preponderance and a relatively high density of risk factors such as Smoking, Family history of CAD, and Dyslipidemia, the current findings also enforce contemporary published literature evidence portraying them as an emergent health threat in the shape of Early-onset CAD, especially

among the young males (1, 2). However, studying these patients' clinical and angiographic characteristics will allow for the more detailed and clear-cut picture of CAD presentation in the young, which in turn can enhance the prevention and intervention approaches.

The first key outcome in this study is that a majority of young CAD patients with ACS present with traditional cardiovascular risk factors with Smoking being prevalent in 70% of the patients. Smoking has been described as the most significant CAD risk factor for the younger generation because it leads to pre–acceleration of atherosclerosis and impairs the endothelial integrity of the coronary arteries making them more susceptible to plaque formation and rupture (3, 4). It has thus been deemed a very important area for intervention when it comes to early onset of CAD and research has also shown that smoking cessation can lead to a very swift diminution of cardiovascular risk. This is because specific and properly directed smoking cessation campaigns are required in the group of youngers adult at potential risk of CAD.

The identified comorbidities included hypertension, 68.5 % abnormal lipid profile artefactually, 37 % with raised LDL and low HDL. Abnormal lipids contribute to plaque formation in the coronary arteries and have been associated with greater established rates of single and multivessel CAD in young persons (5, 6). Understanding the natural history of dyslipidemia and the availability of available interventions in terms of lifestyle changes and pharmacological treatment, it is possible to discuss the concepts of primary prevention of CAD in young people. Since our study identified such a high prevalence of abnormal lipid levels in young adults, it is evident that the use of lipid testing should be encouraged among young people with other risk factors.

A second important finding of this study is family history in early development of CAD, 40% of the participants acknowledged having a first-degree relative with CAD. Results have further shown that the single nucleotide polymorphisms greatly influence the CAD incidence but more so if triggered by modifiable risk factors such as Smoking, dyslipidemia among others (7). This suggests that Screening /monitoring is important in that persons with family antecedents of CAD could be picked early before there development of symptomatic CAD.

From the present study, the angiographic patterns add more knowledge about CAD in the youthful populace. The lesion pattern was single-vessel disease in 55% of patients, and the LAD was the most frequently diseased vessel. Similar data have been reported in earlier investigations suggesting that although young patients with ACS tend to have less severe disease compared to elderly people, they are also at increased risk in view of impaired plaque stability (8,9). Single vessel disease mainly with LAD can be severe as this artery contributes a significant amount of blood to the heart hence those patients stand a high risk of developing severe complications if they do not undergo the procedure. These results underscore the expectation of age adjusted practices for the coronary morphologic features specifically seen in the younger cases as well as early PCI in cases which require such a procedure.

Equally important is the increasing awareness for the young patients the prevalence of double-vessel and multivessel disease was 30% and 15%, respectively. This study found that patients with multivessel CAD having significantly higher risk factors control especially among younger patients who have metabolic Syndrome-this is a cluster of conditions such as high blood pressure and high blood sugar, big abdomen and high cholesterol levels (10). Contemporary trials have described the increasing incidence of metabolic syndrome in the young adult population with this latter characteristic being an independent risk factor for multivessel CAD and potential reason for the greater extent of coronary disease in this cohort (11). Given this observation early lifestyle changes and pharmacological intervention for patients with metabolic syndrome may hence be crucial in preventing severe CAD outcomes among this emerging population subgroup.

The laboratory data also contribute to understanding the dysmetabolic background of the early beginning of CAD in young patients. An undesirable level of LDL and a low level of HDL was detected in many patients which supports the effects of lipid disturbance on CAD (12). We found that Troponin-T was raised in 85% of patients, which reflects myocardial injury in the overwhelming majority of cases, indicating that

CAD often presents acutely in patients with chronic kidney diseases. They are biomarkers of cardiac muscle and are directly linked with poor prognosis among ACS patients, adjusted by age (13). This result suggests the need for adequate reperfusion in young patients who present with ACS to avoid chronic changes to cardiac tissue.

Based on these findings, this thesis reflects on the general implications in the public health agenda geared toward preventing CAD in young population. A major majority of patients with risk factors for CAD are at a youthful age, highlighting the promising effect that lifestyle changes for youths can have. Anti-CAD campaigns involving enhance education on cardiovascular profile, smoking control, exercise, and improved diet at workplaces and in communities could lower the early onset of CAD and related costs (14). Moreover, primary care providers should be motivated to carry out initial risk assessments for cardiovascular disease, more so in family history of CAD, to identify and manage potential cases of at-risk patients.

Lastly, while this research work was able to offer useful findings, the following observations need to be made. The survey was conducted on patients attending a single tertiary care facility which may not reflect the other population groups attending different care setup. Larger sample size or multi-center studies would strengthen these findings and hopefully offer better insight to this disease CAD in young patients with ACS. Secondly, because this type of study is observational, there is a limitation in making causal inferences: subsequent studies should be done to determine by which processes early CAD is produced.

CONCLUSION

Thus, the presented study corresponds to the high incidence of coronary artery disease in young patients under 40 years old with acute coronary syndrome. The findings confirm that traditional cadiometabolic risk factors including Smoking, dyslipidemia and family history of CAD are guiding factors to early onset of CAD. Single vessel disease was most seen followed by multi vessel disease and left anterior descending artery was most common affected. Metabolic disturbance such as raised LDL and low level of HDL also predisposes this group to the development of CAD. These outcomes pay special attention to the early detection, nutrition interventional, and proper management to avoid the worsening of CAD in younger individuals. There is clearly a substantial risk of early myocardial damage early interventions which aim at enhancing the lifestyle techniques to reduce cardiovascular risks mainly among young people could play a major role in the reduction of CAD among young adults.

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