AMDHS ADVANCES IN MEDICAL, DENTAL AND HEALTH SCIENCES

e-ISSN: 2581-8538

RESEARCH ARTICLE OPEN ACCESS

Prevalence of lipid abnormalities (Low HDL, High TG) among angiographically proved CAD patients

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Received: 27-Oct-2022,
Manuscript No. AMDHS-22-78321 ;
Editor assigned: 28-Oct-2022,
PreQC No. AMDHS-22-78321 (PQ);
Reviewed: 30-Oct-2022,
QC No. AMDHS-22-78321 (Q);
Revised: 31-Oct-2022,
Manuscript No. AMDHS-22-78321 (R); Published: 05-Nov-2022;
DOI: 10.5530/amdhs.2022.3.6

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Published by : OZZIE PUBLISHERS

Abstract

Introduction: Dyslipidemia is a major primary risk factor for Coronary Artery Disease (CAD). Asians differs in prevalence of various lipid abnormalities than non-Asians. This study was conducted with the objective to assess the prevalence and pattern of lipid abnormalities and there correlation in patients with angiographically documented Coronary Artery Disease (CAD). **Objective:** This study sought to determine the prevalence of lipid abnormality, specially in the form of low HDL-C and high TG, among patients with significant Coronary Artery Disease (CAD), (stenosis ≥ 50%) determined through coronary angiography as this is not well described in this population. B In a cross-sectional study, observational study, among 112 patients who underwent coronary angiography, we studied 81 cases who were diagnosed with significant CAD with stenosis ≥ 50%, as shown angiographically were found to have > 50% coronary stenosis, defined as significant CAD. All patients were evaluated for risk factors and blood samples were collected for measuring fasting lipid profile in all patients during the admission for the coronary angiography. The data was analyzed to find statistical evidence for association between HDL-C and the pattern of CAD. **Results:** Among 112 cases, 95 were diagnosed with significant CAD while 17 had non-significant disease. These 95 cases were include in the study. The mean age (± Standard deviation) was 53.63 ± 8.85, ranging from 28 years to 75 years. The majority of patients were males representing % of the cases {81/95 or 91/112}. The lipid profile analysis revealed that the mean total cholesterol was 179.79 ± 55.46 mg/dl, mean Low-Density Lipoprotein Cholesterol (LDL-C) was 103.54 ± 42.83 mg/dl, mean High Density Lipoprotein Cholesterol (HDL-C) was low, 34.47 ± 6.98 mg/dl and mean triglyceride level was high, 200.06 ± 143.3 mg/dl. 88% of patients had some form of dyslipidemia. The most frequent form of dyslipidemia among these patients was low levels of High-Density Lipoprotein Cholesterol (HDL-C) among 86.6% of the patients followed by 60.7% of patients with high Triglyceridemia (TG), 30.4% of the patients having high Total Cholesterol (TC) and 24.7% with high Low-Density Lipoprotein Cholesterol (LDL-C). 17 (15.2%) patients had normal coronary arteries, 32 (28.6%) had one vessel disease, 29 (25.9 %) had two vessel disease and 30 (26.8%) had three vessel disease. **Conclusion:** Dyslipidemia is a highly prevalent risk factor among Bangladeshi patients with CAD. Low HDL-C was the most frequent lipid abnormality. Hypertriglyceridemia and low HDL cholesterol is common in patients with CAD compared with hypercholesterolemia and high LDL-C. This suggests the need to rethink treatment thresholds and targets in this population. The low HDL-C level among Bangladeshi patients require further study and targeted intervention.

Key words: Prevalence, Lipid abnormalities, Angiographically, CAD

Introduction

According to WHO, Cardiovascular Diseases (CVD) are by far the largest cause of death worldwide, representing 31% of the annual deaths globally in 2015. Like elsewhere, CVDs are also a huge burden for Bangladesh and accounts for 17% of the annual deaths (World Health Organization-Noncommunicable Diseases (NCD) Country Profiles, 2014).Coronary Artery Disease (CAD), one of the CVDs, is an important medical and public health issue currently, because it is one of the most common and leading causes of death [1]. Bangladesh has been experiencing an epidemiological transition from communicable to Non-Communicable Diseases (NCD) and hence CAD poses as an emerging threat. Conventional cardiovascular risk factors, such as hypertension, diabetes, smoking, and dyslipidemia, increase the risk of developing Coronary Artery Disease (CAD) [2-4]. Coronary Artery Disease (CAD) is defined as the occlusion of coronary arteries due to atherosclerosis which leads to impairment of blood supply to the heart. Depending on the severity of this stenosis it may lead to various outcomes. Atherosclerosis is defined as the thickening of arteries due to formation of plaques within the inner layer of the artery due to deposition of excess fat, macrophages, fibrous tissue and other cellular debris often occluding the vessels. As described by the pathology, dyslipidemia is one of the major contributors of atherosclerosis. Although at different times, different lipoproteins have been associated with atherosclerosis, contrary to the previous believes as LDL being the predominant lipoprotein contributing to CAD, a number of epidemiological studies have portrayed a strong association between low levels of high density lipoprotein (HDL) cholesterol and development and progression of atherosclerotic Coronary Artery Disease. Primary prevention studies have shown that the early detection and aggressive treatment of risk factors prevent cardiovascular events [5,6]. One of the largest of such studies, the INTERHEART study, was a worldwide study designed to assess the relevance of different risk factors on myocardial

infarct development, 85% had at least one of the conventional risk factors [7,8]. Knowledge of a baseline lipid level may help in therapeutic decisions of initiation of lipid-lowering treatment and the patient's willingness to adhere to a recommendation for long-term lipid-lowering therapy. Previous reports of the prevalence of the risk factors and lipid profiles in CAD have been done in patients without considering the presence or absence of coronary lesions. The aims of our study were to investigate the prevalence of abnormal lipid profiles at the time of admission in a cohort of patients with and significant CAD (stenosis ≥ 50%) determined through coronary angiography.

MATERIALS AND METHODS

This was a retrospective cross-sectional study. We studied the pattern and prevalence of dyslipidemia and sought to find the most common lipid abnormalities among angiographically proved CAD patients. Information was gathered from medical records of patients admitted for coronary angiography between 2018 and 2019 in a Tertiary Hospital, Dhaka, Bangladesh. Coronary angiography was performed in the catheterization laboratory of the institute and interpreted by interventionist cardiologists. Reporting was done regarding the stenosis percentage of the main epicardial coronary arteries, and the extent of CAD was categorized as one-vessel, two-vessel, or three-vessel disease, according to the number of affected vessels. Only patients with significant CAD, defined as the presence of ≥ 50% stenosis of any of the epicardial vessels, were included in the study. Patients with normal coronary angiography or mild disease, defined as <50% stenosis in any of the epicardial vessels, were excluded.

Lipid profile measurements were done routinely, within 24 hours of admission of the patients, in fasting state. All results were obtained from the same pathological laboratory (i.e. within the hospital) and thus ensured maintenance strategy and standardization. Lipid profile parameters namely Total Cholesterol (TC), TG, HDL-C/HDL, LDL-C/LDL were recorded as variables. Lipid profile evaluation is done in this laboratory by end point kinetic method by Roche, for TC, TG and HDL-C, while LDL-C is calculated with the Friedewald formula unless TG are elevated (greater than 400 mg/dL): Friedewald formula, in mg/dL:

- LDL-C ¼ TC - HDL-C - TG/5.
- Dyslipidemia was defined as high serum levels of TC ≥ 200 mg/dL, LDL-C ≥ 130 mg/dL, and TG ≥ 150 mg/dL; a low serum level of HDL-C was defined as ≤ 40 mg/dL [9].

Statistical analysis

Statistical analysis were performed with SPSS version 20 (SPSS, Inc., Chicago, IL, USA) statistical software. Categorical variables were reported by frequency and percentage; groups were compared using the chi-square test. Continuous variables were reported as means and standard deviation. All p-values were reported as 2-tailed with statistical significance set at 0.05 and confidence intervals calculated at the 95%.

RESULTS

During the study period, we identified 112 patients who were subjected to coronary angiography. 17 patients were excluded due to normal coronary results and/or nonsignificant lesions. We thus analyzed 95 patients with significant coronary stenosis, ≥ 50%. The mean age of patients were 54.40 years (± SD 8.78 years), where the minimum age was 28 and maximum age was 75. Majority of the patients were young, with around 78.9% (75) of the patients being less than or equal to 60 years of age. The study consisted predominantly of males as represented by 85.3% of the patients, while 14.7% were females (81 versus 14), as shown in **FIGURE 1.**

The lipid profile analysis revealed that the mean total cholesterol was 182.60 ± 54.41 mg/dl, mean Low-Density Lipoprotein Cholesterol (LDL-C) was 105.46 ± 40.85 mg/dL, mean High Density Lipoprotein Cholesterol (HDL-C) was low, 34.26 ± 7.234 mg/dL and mean triglyceride level was high, 207.64 ± 151.20 mg/dL. The mean levels of different lipids are shown in **TABLE 1**.

The mean levels of the different lipid parameters were quite similar between the two categories of gender, with only significant difference (<0.05) in mean total cholesterol among males and females. Means of TG, LDL-C and HDL-C were equally high, normal and low respectively **(TABLE 2).**

In this study, the most frequent form of dyslipidemia among the patients with significant CAD was found to be low levels of HDL-C (<40mg/dL)

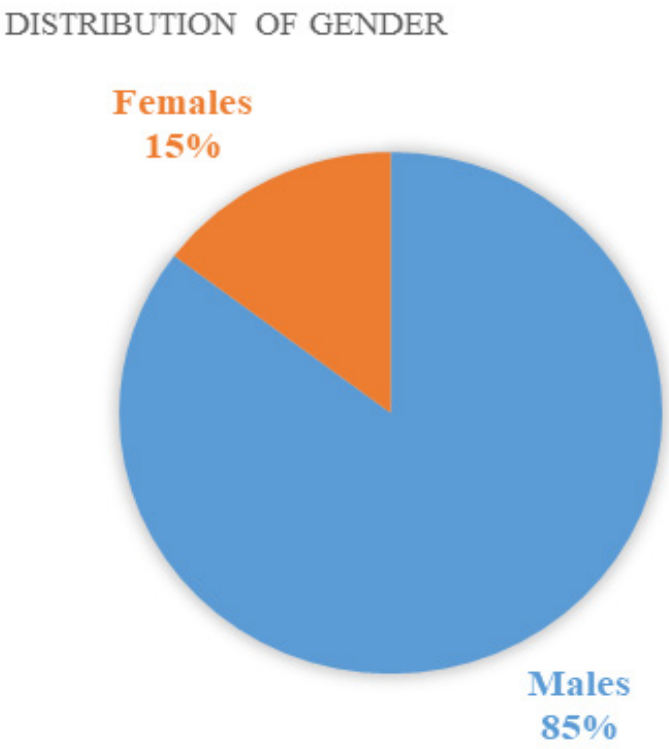

Figure 1. Distribution of gender.

Table 1. Descriptive analysis of lipid parameters (N=112).

Lipid parameters	N	Minimum	Maximum	Mean	Std. Deviation
Total Cholesterol (mg/dL)	95	80	482	182.6	54.413
HDL (mg/dL)	95	21	64	34.26	7.234
Triglyceride (mg/dL)	95	48	948	207.64	151.2
LDL (mg/dL)	95	14	198	105.46	40.85

TABLE 2: Mean lipid levels among genders (N=112)

Lipid levels among genders	Gender of Patient	N	Mean	SD
Total Cholesterol (mg/dL)	Males	81	177.52	53.45
	Females	14	212	45.12
LDL (mg/dL)	Males	81	105.1	43.25
	Females	14	107.57	35.26
HDL (mg/dL)	Males	81	34.07	41.7
	Females	14	35.36	36.26
Triglyceride (mg/dL)	Males	81	208.79	110.99
	Females	14	201	102.45

TABLE 3: Proportion of dyslipidemia (N=112)

Proportion of dyslipidemia	Number of patients (N)	Percentage (%)
High TC	30	31.60%
Low HDL-C	82	86.30%
High LDL-C	26	27.40%
High TG	60	63.20%

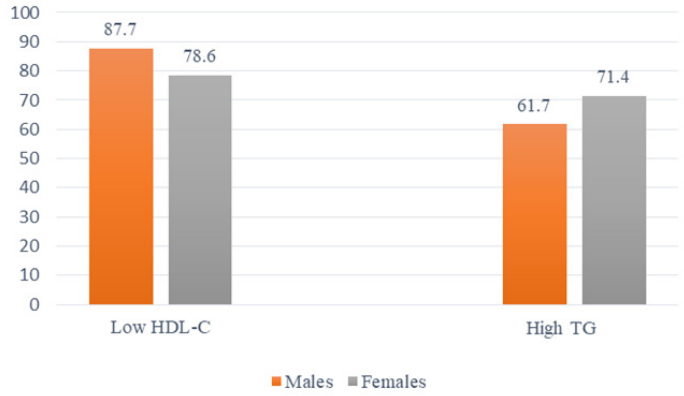

Figure 2: Between high TG and low HDL levels.

at 86.3%, followed by high TG levels (≥ 150mg/dL) to be 63.2%, high levels of total cholesterol (≥ 200mg/dL) at 31.6%, and high LDL-C (≥ 130mg/dL) to be 27.4% **(TABLE 3).**

The males had a higher tendency of having low HDL than females 87.7% vs 78.6%, while females were more frequently having high TG than their male counterparts, 71.4% vs 61.7% shown in the bar chart in **FIGURE 2**. A significant co-relation (<0.05, r=0.2) was found between High TG and low HDL levels.

DISCUSSION

The mean age of patients in this study was 54.40 years (± SD 8.78 years), where the minimum age was 28 and maximum age was 75. The mean age found in our study is similar to the average age of patients with CAD, found among the South Asian populations (52.5 to 61 years), in several other studies, and thus represents the typical age CAD patients in this region. However, this mean is much lower compared to the Western population, as found in the COURAGE trial10 in USA, which was 62 ± 5years and PRAIS-UK where the mean age was 66 ± 12 years, indicating a younger age of onset among Bangladeshis [10]. Majority of the cases (about 79%) were below 60 years of age. Our observations in this study regarding age is well supported by various studies that suggested ethnicity to have a major role in the undue susceptibility of South Asians to CAD, which is premature in onset and extensive by Silbiger JJ et al, Gupta M. et al and M. Gupta et al [11-13]. 85.3% of the patients in our study were males, while females represented 14.7% of the population. Many studies involving CAD have reported that fewer females present with CAD as they tend to have less atherosclerotic coronary obstructive disease than their male counterparts, which supports the findings of the our study [14-16]. The ESC guideline along with other studies [17, 18] acknowledges low HDL-C levels as an independent risk predictor for ACS, and recognizes a strong inverse association between HDL-C levels and ACS rates. We found that the most frequent form of dyslipidemia, among angiographically proven CAD patients was low HDL-C, occurring in 86.3% of the patients, with a mean of 34.26 ± 7.234 mg/dL. This is similar to the findings of a number of studies in different regions of India, where all concluded that the different populations of CAD patients had low HDL-C levels as the commonest lipid abnormality with significantly low mean HDL-C level by Gupta R et al, Goel PK et al and Mohan V et al [19-21]. The low HDL-C level found in our study is further validated by other studies that have established that low HDL-C increases the risk of atherosclerotic progression, morbidity and mortality [22, 23]. High TG level was found to be the second most frequent form of lipid abnormality among our population, at 63.2%, with a high mean TG level of 207.64 mg/dL ± 151.20 mg/dL. Dali found raised TG levels among 75% of the CAD patients in Nepal, which is similar to our findings of high TG. Similar TG levels were found among Bangladeshi migrants in Newcastle with high risk of CVD, who had an average TG of around 181 mg/dL (2.04 mmol/L). Our findings are also congruent to the TG levels among Indian population by Goel PK et al [20]. It was also found that males had an increased propensity of having low HDL while females had a propensity of having high TG than the males. Similar observation was reported among Egyptian CAD population, among the 2 genders [24]. The blood lipid profile analysis showed that mean TC was 182.6 mg/dL (SD ± 54.4 mg/dL), with high TG prevailing among 31.6% of the patients. Similar observations were made among the Indian population [23, 25] with relatively lower average total cholesterol. Among young CAD patients in Delhi, prevalence of TC was found to be 29% [11]. The mean LDL-C was 105.46 mg/dL while frequency of high LDL-C was 27.4%. The mean LDL-C level and proportion of high LDL-C is even lower than the findings of The INTERHEART study, among South Asians (125.2 mg/dL and high LDL-C of 42.7% LDL-C),which was lower compared to non-Asians. Bangladeshis seem to have similar pattern of LDL-C levels prevailing with CAD. Different studies in the neighboring India, made similar inference, that among the populations of this region, it appears that CAD manifests at relatively lower levels of total Cholesterol and LDL-C [26].

CONCLUSIONS

We conclude from this study that among Bangladeshis, high triglyceride and low high-density lipoprotein levels are more of a universal phenomenon and coronary artery disease occurs at much lower levels of total cholesterol and low-density lipoprotein cholesterol than other populations. Low HDL-C and high TG levels seem to prevail significantly among our population and may play a major role in the occurrence of coronary artery disease. It is well known that controlling the risk factors in patients with CAD risk is equivalent to reducing the rates of CAD. Thus larger studies and development of guidelines are required, to address these factors among Bangladeshi population for therapeutic and preventive strategies.

CONFLICT OF INTEREST

None

SOURCE OF FUND

None

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Cite this article as: Md. Amir Hossain, Muhammed Akhtaruzzaman, Monir Uddin Ahmed, Mustafa Aolad Hossain, Arman Ibne Huq, Md. Rezaul Karim. Prevalence of lipid abnormalities (Low HDL, High TG) among angiographically proved CAD patients. Adv. Med. Dental Health Sci. 2022;5(3):20-23.