Dyslipidemia Associated with Hypertension Increases the Risks of CHD among cardiac patients: A Case-Control Study

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Abstract

Background: Coronary Heart Disease (CHD) is one of the largest contributors to mortality and morbidity worldwide. Globally, CHD accounts for 17.5 million deaths in 2012, with over 75% of deaths occurring in developing countries. By 2015, 16% of all female and male deaths were caused by CHD. Dyslipidemia is the most common risk factor of CHD for the excessive level of lipids in blood. Most dyslipidemias are hyperlipidemias in developing countries; that is, an accumulation in blood lipids. CHD was 18 times more likely to grow according to hypertension with dyslipidemia category than with non-dyslipidemias. The aim of this study was to assess the effect of dyslipidemia associated with hypertension for coronary heart disease and identify risk factors for CHD among cardiac patients. **Material & Methods:** This was a case control study and was conducted in the Department of Medicine, LABAID Specialized Hospital, Dhaka, Bangladesh during the period from May,2022 to March,2023. We included 170 cardiac patients in our study. The patients were divided into two groups – Case group (Patients diagnosed with CHD) & Control group. **Results:** In total 170 patients from both the groups completed the study. In our study we found most of our patients were male (58%) compared to female (42%). We found the mean age was 46.1±11.3 & 47.1±9.3 years in case & control group respectively. Family history of hypertension was significantly higher in case group (52%). Among all patients, BMI was higher in case group. Cholesterol, systolic & diastolic bp was found significantly higher in case group than control group. HDL was found lower & LDL was found higher in case group. Among 85 cases, majority (68%) had dyslipidemia associated with hypertension. We found dyslipidemia was 55% & 36% in case & control group respectively. Hypertension was also found significantly higher in case group. Age ≥ 60 years, family history of CHD, smoking, diabetes & obesity were also individual risk factors of CHD among cardiac patients. In dyslipidemia with hypertension group 68 patients were diagnosed with CHD which is higher than non-hypertension group. **Conclusion:** In our study, we found that dyslipidemia, hypertension, age ≥ 60 years, family history of CHD, smoking, diabetes & obesity are individual risk factors of CHD development. Relationship of dyslipidemia with coronary heart disease in hypertension is significant. We also found dyslipidemia with hypertension is an established risk factor of prime importance that increased the risks of CHD among cardiac patients.

Keywords:- CHD, Dyslipidemia, Hypertension.

INTRODUCTION

Coronary Heart Disease (CHD) is one of the largest contributors to mortality and morbidity worldwide. Globally, CHD accounts for 17.5 million deaths in 2012, with over 75% of deaths occurring in developing countries.[1,2] By 2015, 16% of all female and male deaths were caused by CHD.[3] Broadly speaking, the cause of CHD is multifactorial in which some of them can be modified.[4,5,6] One of the modifiable risk factors is dyslipidemia. Dyslipidemia is defined as a lipid metabolic disorder characterized by an increase or decrease in lipid fraction in plasma.[4] Low-density lipoprotein cholesterol, and triglyceride, and low levels of high-density lipoprotein cholesterol are major risk factors of atherosclerosis affecting arteries of large and medium size and consequently causing ischemia in the heart.[5] Dyslipidemia is thought to be a primary risk factor for CHD and may play a role before other risk factors appear.[6] It is characterized by an elevation of serum total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), or triglycerides (TG) and reduced serum high-density lipoprotein cholesterol (HDL-C) concentration and these are routinely assessed for the purpose of assessing cardiovascular risk.[7,8,9] The prevalence of dyslipidemia varies geographically; although, it has been estimated that more than 50% of the adult population has dyslipidemia worldwide.[10,11,12] Dyslipidemia is the most common risk factor of CHD for the excessive level of lipids in blood. Most dyslipidemias are hyperlipidemias in developing countries; that is, an accumulation in blood lipids. Sometimes because of diet and lifestyle. A longer rise in insulin concentrations can also contribute to dyslipidemia. The classification of dyslipidemia into primary and secondary forms. Primary dyslipidemia is normally inherited. Secondary dyslipidemia is acquired disease. It occurs because of other factors, for example obesity or diabetes. Dyslipidemia is the first major risk factor for coronary artery disease, which is generally accepted (CHD).[13,14,15,16] CHD was 18 times more likely to grow according to hypertension with dyslipidemia category than with non-dyslipidemias.[4] However, CVD is a chronic non-communicable disease and one of the most important causes of death and disability. The prevalence of CVD events is increasing globally.[17,18] The World Health Organization (WHO) definition of CVD includes: coronary heart disease, cerebrovascular disease, rheumatic heart disease, myocardial infarction (MI), stable angina (SA), unstable angina (UA), and other conditions.[11,19] Public health organizations globally have focused on reducing modifiable CVD risk factors to control the rising prevalence of CVD and its risk factors; such as hypertension (HTN), unhealthy diet, obesity and dyslipidemia.[9,18] A high-fat and high-calorie diet can cause dyslipidemia and thereafter endothelial dysfunction.[20] Serum TG, TC, LDL-C, HDL-C, TC/HDL-C, and LDL-C/HDL-C ratios are independent predictors of CVD risk. Currently, the principal objective in the management of dyslipidemia is to reduce serum LDL-C levels.[21] The world's leading cause of morbidity and mortality remains coronary heart disease (CHD), in particular myocardial infarction secondary to coronary artery atherosclerosis. The fibroproliferative condition of medium-sized and large arteries, primarily caused by cumulative lipid is a chronic multifocal immunocomorphic atherosclerosis. The major risk factors for CHD

include elevated concentrations of Total lipoprotein cholesterol (TC and LDL-C) as well as low concentrations of triglycerides (TG) and high-density (HDL-C) lipoprotein cholesterol. LDL-C is called 'bad cholesterol' because an elevated risk of coronary heart attack and stroke is linked with too much cholesterol content.[22] Dyslipidemia may also be a condition for CHD, before other significant threats arise. The predominant lipid disorders in Asians have been higher than those of non-Asians in research.[23]

In the present study we aimed to evaluate the effects of dyslipidemia associated with hypertension for coronary heart disease as a risk factor among cardiac patients.

Objective of the study

The main objective of the study was to assess the effect of dyslipidemia associated with hypertension for coronary heart disease and identify risk factors for CHD among cardiac patients.

MATERIAL AND METHODS

This was a case control study and was conducted in the Department of Medicine, LABAID Specialized Hospital, Dhaka, Bangladesh during the period from May, 2022 to March, 2023. We included 170 cardiac patients in our study. The patients were divided into two groups – Case group (Patients diagnosed with CHD) & Control group.

These are the following criteria to be eligible for the enrollment as our study participants: a) Patients aged up to 75 years old; b)Patients with dyslipidemia; c) Patients with hypertension ; d) Patients with cardiovascular diseases ; e)

Patients who were willing to participate were included in the study And a) Patients with no symptoms of CHD ; b) Patients with no symptoms of dyslipidemia; c) Patients with previous surgical history; d) Patients with pregnancy; e) Patients with any history of acute illness (e.g., renal failure or pancreatic diseases etc.) were excluded from our study.

Diagnosis of cardiovascular diseases: The occurrence of CVD among participants at follow-up was ascertained by taking a detailed medical history, followed by a physical examination by a specialist Cardiologist. Electrocardiograms were checked by the cardiologist for the evidence of alterations in P, Q, R,S, T and especially Q wave by using the Minnesota Code.[24,25] If the cardiologist suspected a diagnosis of CVD, further examinations were undertaken including angiography, echocardiography, stress echocardiography, Computed Tomography (CT) angiography, radioisotope and Exercise Tolerance Test (ETT).

Statistical Analysis: In our study the dependent variable was the incidence of coronary heart disease (CHD) and the main independent variable was dyslipidemia status associated with hypertension. The potential confounding variables were age, gender, family history of CHD, smoking habit, hypertension or history of hypertension, diabetes or history of diabetes, and obesity. All data were recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using SPSS (Statistical Package for Social Sciences) for windows version 10.

Probability value <0.05 was considered as level of significance. The study was approved by Ethical Review Committee of LABAID Specialized Hospital, Dhaka, Bangladesh.

RESULTS
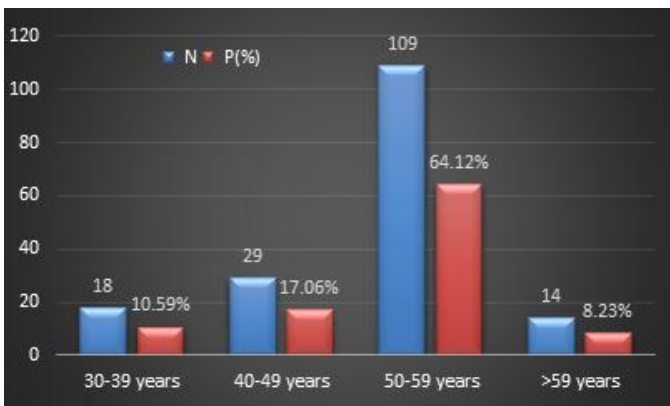
Figure 1: Age distribution of our study patients
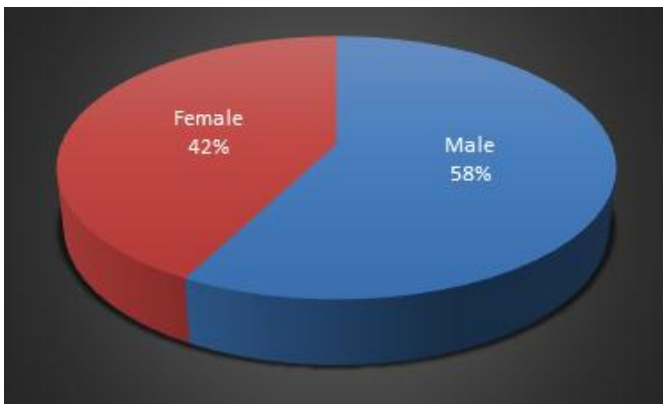
Figure 2: Gender distribution of our study subjects

[Figure 1] shows that majority (64%) of our patients were aged between 50-59 years, followed by 17% & 11% patients were 40-49 & 30-39 years old respectively. The least prevalence (8%) was found in patients aged more than 59 years old.

In [Figure 2] we showed the gender distribution of our study subjects. Most of our patients were male (58%) compared to female (42%).

[Table 1] shows the baseline characteristics of our study participants. We found the mean age was 46.1±11.3 & 47.1±9.3 years in case & control group respectively. Majority of patients were male (79%) in case group & female (64%) in control group. Family history of hypertension was significantly higher in case group (52%). History of CVD was higher in case group (51%) compared to control group (25%). DM duration was significantly higher in case group compared to control group. Among all patients, BMI was higher in case group. Heart rate was significantly lower in case group. Both systolic & diastolic BP was significantly higher in case group compared to control group. Cholesterol was found significantly higher in case group, HDL was found lower & LDL was found higher in case group. These findings were statically significant.

[Table 2] shows the risk factors for CHD. Among 85 cases, majority (68%) patients had dyslipidemia associated with hypertension. We found dyslipidemia was 55% & 36% in case & control group respectively. Hypertension was also found significantly higher in case group compared to control group. Age ≥ 60 years, family history of CHD, smoking, diabetes & obesity were also individual risk factors of CHD among cardiac patients.

[Table 3] shows that 68(40%) CHD patients were found in dyslipidemia with hypertension group and 47(27.65%) patients were in non-hypertension group which is significantly lower than another group.

Table 1: Baseline characteristics of our study subjects

Baseline	Case		Control		P-value
	N=85	P(%)	N=85	P(%)	
Mean age (years)	46.1±11.3		47.1±9.3		0.186
Male	67	78.82	31	36.47	0.241
Female	18	21.18	54	63.53	
History of hypertension	44	51.76	32	37.65	0.056
History of CVD	43	50.59	21	24.71	0.043
DM duration	7.29±4.41		7.31±2.34		0.421
BMI (kg/m2)	28.97±4.24		27.86±3.64		0.614
Heart Rate (per minute)	86 ± 17		88 ± 19		0.214
Systolic blood pressure (mm Hg)	135.24 ± 20.78		121.46 ± 18.22		0.041
Diastolic blood pressure (mm Hg)	83.94 ± 10.69		78.81 ± 11.74		0.062
Mean FBG (mg/dL)	119.45 ± 63.10		91.45 ± 36.92		0.015
Triglycerides (mg/dL)	187.85±55.04		168.85±47.04		0.046
Total cholesterol (mg/dL)	199.83 ± 42.16		190.56 ± 38.56		0.015
HDL (mg/dL)	40.21 ± 9.05		42.82 ± 9.87		0.131
LDL (mg/dL)	122.35 ± 35.59		115.89 ± 34.96		0.024

DM= diabetes mellitus, BMI = body mass index, FBS = fasting blood glucose, HDL=high-density lipoprotein, LDL=low-density lipoprotein

Table 2: Risk factors for CHD among cardiac patients.

Risk factors	Case		Control		P-value
	N=85	P(%)	N=85	P(%)	
Dyslipidemia	47	55.29	31	36.47	0.023
Hypertension	52	61.18	24	28.24	0.041
Dyslipidemia with hypertension	58	68.24	12	14.12	0.034
Age ≥ 60 years	12	14.12	2	2.35	0.157
Family history of CHD	44	51.76	21	24.71	0.241
Smoking	49	57.65	28	32.94	0.413
Diabetes	62	72.94	43	50.59	0.154
Obesity	38	44.71	18	21.18	0.147

Table 3: Relationship of dyslipidemia with coronary heart disease according to hypertension.

	Dyslipidemia in hypertension group		Dyslipidemia in non-hypertension group		P-value
CHD	68	40%	47	27.65%	0.041

DISCUSSION

In our study we found the mean age was 46.1±11.3 & 47.1±9.3 years in case & control group respectively. The mean of SBP was higher in case group 135.24 ± 20.78 mmHg . The mean of DBP was 83.94 ± 10.69 mmHg which was significantly higher in case group. The Ariyanti

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R & Besral B found the mean of age in CHD group was older than non-CHD group, which was 56.5 years. The mean of SBP in CHD group was higher than non-CHD group, which was 126.2 mmHg. The average of DBP in CHD group was higher than non-CHD group, which was 85.6 mmHg.[26] Lin et al found the mean of SBP in CHD group was higher than non-CHD group, which was 126.2 mmHg with standard deviation of 21.0, where the lowest SBP was 100 mmHg and the highest was 200 mmHg. The average of DBP in CHD group was higher than non-CHD group, which was 85.6 mmHg with standard deviation of 15.5, where the lowest DBP was 60 mmHg and the highest was 120 mmHg.[5] Where Alam et al found the mean ± SD of systolic blood pressure was 134.75 ± 19.25 mmHg in case group and random blood sugar was found in 223.81 ± 72.18 mg/dl.[22]

In the present study we found majority (68%) patients had dyslipidemia associated with hypertension. We found dyslipidemia was 55% & 36% in case & control group respectively. Hypertension was also found significantly higher in case group compared to control group. The Ariyanti R & Besral B analysis found that the CHD group was at 50 percent of people reacting with dyslipidemia, while the non-CHD group was at 17.3 percent.[26] The results of their study were in accordance with the results of previous studies.[27] Alam et al found that among the evaluation of risk factors of CAD, dyslipidemia was present in 77% hypertension was found in 62.5%, smoker was 53%, DM was found in 33%.[22] The results of their study with reference to risk factors were similar to previous published papers.[28] In one article by Lin et al reported that, 75.6% did not have family history of CHD, did not have smoking habit (53.7%),

did not have hypertension or hypertension history (62.2%), having diabetes or history of diabetes (53.7%, and nonobese (62.2%).[5]

Cardiovascular events, particularly CHD, are thought to be significantly influenced by dyslipidemia.[29,30] Depending on hypertensive condition, the association between dyslipidemia and CHD varied. Once controlled forage, in hypertensive respondents or having a history of hypertension, respondents with dyslipidemia are 18 times higher to develop CHD than non-dyslipidemic respondents. Although respondents with dyslipidemia are 2.5 times higher to experience CHDs than non-dyslipidemics for respondents who are not hypertensive or have a history of hypertension.[22]

The Ariyanti R & Besral B showed that the relationship of dyslipidemia and the incidence of CHD was different according to hypertension status. At the same age, respondents with hypertension or history of hypertension and dyslipidemia had 18 times higher to develop CHD than nondyslipidemic respondents, whereas in nonhypertensive patients, respondents with dyslipidemia were 2.5 times higher to develop CHD compared to nondyslipidemic respondents.[26] This study is in line with previous studies that stated that dyslipidemia interacts with high blood pressure (hypertension) in causing CHD.[31,32] The risk of CHD in patients with dyslipidemia will increase if dyslipidemia is accompanied by one or more other CHD risk factors.[33] Various studies showed that other factors that can cause cardiovascular disease as hypertension. Dyslipidemia and hypertension are established risk factors of prime importance in cardiovascular disease.[34] If these two factors

(dyslipidemia and hypertension) are present together, this will accelerate the process of atherosclerosis, thus increasing the risk of CHD.[26]

Cholesterol is a risk factor that can be changed from hypertension, so the higher the total cholesterol level, the higher the likelihood of hypertension.[35] The constriction and the rigidity of the blood vessel walls resulting from the buildup of cholesterol in the blood vessels that can cause increased blood pressure will have an impact on the increased risk of CHD.[26] Previous research conducted in Korea showed that there was a strong relationship between LDL cholesterol and increased risk of CHD.[36] Previous research conducted in Cameroon, Central Africa, showed that decreased HDL levels are the most common lipid lesions in causing CHD.[37] HDL plays an important role in reverse cholesterol traction (RCT), a process whereby excess cholesterol in peripheral tissue is returned to the liver for excretion. If the process continues on coronary arteries, it will cause coronary heart disease.[38] The results of this study indicated that there was a significant relationship between age and the incidence of CHD. The results of this study were similar to previous studies which stated that age is significantly associated with the incidence of CHD.[39]

In our study we found that relationship of dyslipidemia with CHD according to

hypertension status, those with dyslipidemia were more likely to develop CHD compared to those non-dyslipidemic.

Limitations of the study

Our study was a single centre study. We only found a few risk factors for CHD because of our short study period & limited resources. Our small sample size was one of our limitations. After evaluating once those patients we did not follow them up for a long period and have not known other possible interference that may happen in the long term with these patients.

CONCLUSIONS

In our study, we found that dyslipidemia, hypertension, age ≥ 60 years, family history of CHD, smoking, diabetes & obesity are individual risk factors of CHD development. Relationship of dyslipidemia with coronary heart disease in hypertension is significant. We also found dyslipidemia with hypertension is an established risk factor of prime importance that increased the risks of CHD among cardiac patients.

So further study with a prospective and longitudinal study design including larger sample size needs to be done to assess the effects of dyslipidemia with hypertension and identify more risk factors for CHD in cardiac patients.

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