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RELATIONSHIP OF CORONARY ARTERY DISEASE (CAD) WITH TOTAL CHOLESTEROL & LDL - CHOLESTEROL/HDL-CHOLESTEROL RATIO

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ABSTRACT

Objectives: The purpose of this descriptive study is to determine the significance of measurement of total cholesterol and low density lipoprotein(LDL)-cholesterol / high density lipoprotein(HDL)-cholesterol ratio and their association with patients of coronary artery disease(CAD).Methods: The lipid profile of 589 cases including patients aged 20-70 years with coronary artery disease, MI, hypercholesterolaemia and normal healthy subjects were investigated to determine the changes in total cholesterol, triglycerides, high density lipoprotein-C(HDL-C),low density lipoprotein-C(LDL-C) and LDL-C/HDL-C ratio.Enzymatic analysis was done within 24 hours using Hitachi 704 and 911 auto-analyzer. **Results:** As expected, LDL-C/HDL-C ratio was higher in the patient group 4(48% in females, 58.8% in males) than that in healthy group, whereas the HDL-C was lower. Moreover, the mean value of HDL-C, LDL-C and cholesterol in males was greater than that of females. The LDL-C/HDL-C ratio in hypercholesterolaemic patients(3.1, 34.7%) as less than in CAD/MI patients(4.49, 73.4%). Also this ratio in MI group(4.9,93%) was greater than that of CAD and hypercholesterolaemic group.The mean value of HDL-C in CAD, MI and hypercholesterolaemic patients was less than that of control group but LDL-C was opposite. **Conclusion:** We found that LDL-C/HDL-C ratio is an effective indicator of high risk factor of CAD and in the management of patients suffering from hypercholesterolaemia. Also it is useful to the clinician when combined with detailed knowledge of the patient's other risk factors. The effect of disturbances of lipids and lipoproteins on the development of CAD and hypercholesterolaemia patients may also depend on the presence of other non-lipid risk factors.

Key words: Cholesterol, LDL, HDL, Ratio and CAD

INTRODUCTION

Hypercholesterolaemia is recognized as an important risk factor in the development of coronary artery disease. Other lipid-related risk factors, which have also been implicated in the development of CAD, include raised serum triglycerides, lipoprotein concentration, low density lipoprotein-cholesterol and low level of high density lipoprotein-cholesterol[1,2].

Several clinical trials have demonstrated that elevated serum LDL-C level reduces the likelihood of new coronary events and associated mortality[3].

Elevated total cholesterol and LDL-C have been well established as a risk factor for CAD. Several large clinical trials have demonstrated that lipid lowering decreases the incidence and mortality that results from CAD[4].

Low plasma HDL-C is encountered in clinical practice as

part of mixed hyperlipidaemia, hypertriglyceridaemia or as an isolated abnormality. Low HDL-C is common among patients with premature coronary artery disease(5). The cardio-protective effect of HDL-C is well supported by both observation and experimental studies[6].

Although favourable effect of lowering elevated plasma LDL-C has been well emphasized, the therapeutic benefit of raising low levels of HDL-C has only recently been demonstrated in clinical trial[7].

Evaluation of hyperlipidaemia as an index to CAD, investigation of serum lipids is indicated in those with coronary and other arterial disease, especially when it is premature, and in those with family history of atherosclerosis or hyperlipidaemia.

LDL-C/HDL-C ratios are useful. If the patient has low LDL-C but very low HDL-C, he/she may still be in jeopardy(Custelli of Framingham study); therefore, LDL-C/HDL-C ratios are a good indicator of risk factor for CAD[8].

METHODS

This study was conducted on 589 patients of CAD, MI or hypercholesterolaemia.In all 589 patients included for this study had either CAD(n= 210, 155 males, 55 females), MI(n=125, 90 males, 35 females) or hypercholesterolaemic patients" smokers and hypertensives"(n=254, 150 males, 104 females), some of them were admitted to hospital while others were treated as outpatients in clinics.

CLINICAL EVIDENCE OF CAD

Patients files were studied for age, sex, blood pressure(BP) and smoking habit. All patients have had history of hypertension.

Healthy individuals included in this study were choosen from blood bank donors(n=200, 180 males, 20 females).They were already examined for blood pressure and other vital signs.

Random blood samples were collected from these individuals; serum was separated and stored at 2-8 C. Analysis was done within 24 hours of samples collection. Serum total cholesterol and triglycerides were done by enzymatic method using Hitachi(704 and 911) auto-analyzer, HDL-C was measured by using the precipitation technique and LDL-C was calculated using Friedewald calculation.

RESULTS

Table-I shows the results obtained from patients and control group regarding age, sex, total cholesterol level, HDL-C, LDL-C, HDL-C/LDL-C ratio, CAD, MI, hypercholesterolaemia and normal group.

As can be seen, the mean value of cholesterol, LDL-C/HDL-C ratio in CAD/MI group and hypercholesterolaemic group was greater than that of the healthy individuals(4 and 2.3 respectively, 48% in females and 50.8% males), however, the mean value of HDL-C, LDL-C and toral cholesterol in males was greater than in females. The LDL-C/HDL-C ratio in hypercholesterolaemia patients was less than that of the CAD/MI patients, males and females(3.1, 34.7% and 4.49, 73.4% respectively). Similarly the mean value of total cholesterol in MI patients was greater than that of CAD and hypercholesterolaemia patients.

The mean value of HDL-C in CAD, MI and hypercholesterolaemia patients(males and females) was less than that of control group but LDL-C was opposite. The mean value of LDL-C/HDL-C ratio in CAD, MI and hypercholesterolaemia patients(males and females) was greater than that of control group but this ratio in MI group was greater than that of CAD and hypercholesterolaemic group.

Table-II shows the percentage of LDL-C/HDL-C in CAD/MI and hypercholesterolaemia group. The LDL-C/HDL-C ratio risk was calculated from control group as well as for CAD, MI and hypercholesterolaemic patients. Details are illustrated in the before mentioned tables. All patients in CAD, MI and hypercholesterolaemia group have LDL-C/HDL-C ratio risk of > 2.6%(47.2%, 47.1%,

49.6% for males and 55.9%, 43.5%, 53% for females respectively) as shown in table(2). In the same table is shown the percentage of LDL-C/HDL-C ratio in both sexes, 32.3% of males and 30.1% of females had ratio < 2.3%. Also 67.7% of males and 69.9% of females had ratio risk > 2.3%. Also the percentage of <2.3 in females is greater than that in males but ratio > 2.3 was opposite.

Table-I. Distribution of total cholesterol, HDL-C, LDL-C and LDL-C/HDL-C ratio among and study groups.

Age-years (mean)	No. of Pts group	Cholesterol mg/dl	Triglycerides mg/dl	HDL-C mg/dl	LDL-C mg/dl	LDL-C/HDL-C Ratio
20-75 (65) 30-70 (55)	CAD 155 (M) 55 (F)	215 (125-375) 205 (95-320)	199 (150-350) 146 (100-280)	35 (21-50) 33 (20-40)	140 (165-295) 145 (60-235)	4 (3.1-4.9) 4.4 (2-5.9)
20-70 (45) 20-70 (55)	MI 90 (M) 35 (F)	220 (120-390) 323 (130-280)	255 (85-340) 200 (100-250)	32 (23-50) 36 (22-51)	150 (70-300) 160 (106-210)	4.6 (4.1-4.8) 4.6 (4.1-4.8)
20-78 (45) 20-75 (45)	Hypercol. 150 (M) 100 (F)	213 (187-250) 180 (160-200)	159 (90-220) 177 (93-280)	40 (32-45) 56 (43-79)	119 (107-190) 133 (128-195)	3.1 (2.6-4) 2.5 (1.6-3.2)
20-45(30) 22-45 (30)	Healthy 180 (M) 20 (F)	185 (145-220) 180 (140-210)	120 (50-165) 110 (60-75)	50 (36-72) 52 (40-75)	115 (50-170) 122 (80-165)	2.3 (1.4-2.6) 2.2 (1.9-2.4)

Table-II. The percentage of LDL-C/HDL-C ratio among the study group according to healthy group

Group	<2.3		2.3 - 2.6		> 2.6	
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)
CAD	33.7 (52)	20.7 (12)	66.3 (103)	79.3 (43)	47.2 (73)	55.9 (31)
MI	26.6 (24)	40.5 (14)	73.4 (66)	59.5 (21)	47.1 (42)	43.5 (15)
Hyperchol. (OPD)	36.5 (55)	29.1 (30)	65.5 (95)	70.9 (74)	49.6 (74)	53 (55)
Healthy Group	61 (109)	86.4 (17)	39 (70)	13.6 (3)		

DISCUSSION

The increased level of total cholesterol, LDL-C, decreased HDL-C and LDL-C/HDL-C ratio has been associated with increased risk of CAD. There was a significant difference in the value of these risk factors, found in either men or women, with established CAD, MI or hypercholesterolaemia patients and the values found in sample from healthy control group. This indicates the importance of lipid risk factors in the development of CAD, MI and hypercholesterolaemia patients.

The European Atherosclerosis Society suggests a target cholesterol level of 200 mg/dl to reduce the incidence of CAD(9). Cholesterol level alone is not a good way of identifying substantial population at risk of CAD. Moreover, the ratio can be used to determine the percentage risk from the Sheffield table[10].

The concentration of HDL-C, LDL-C/HDL-C ratio are variable and differ from other studies depending on the genetic inheritance and regional habits of population studied. According to the recommendations of the European Atherosclerosis Society there is no lipid disorder in given individuals if the concentration of cholesterol is less than 200 mg/dl and HDL-C less than 35, but the range of normal in our study was 140 - 220 mg/dl, LDL-C less than-170 mg/dl and HDL-C less than 35 mg/dl.

As shown in this study, the concentration of cholesterol, HDL-C, LDL-C/HDL-C ratio with CAD, MI in males or females was greater than the normal in the young age group. Evaluation of hyperlipidaemia as an index to CAD, investigation of serum lipids, is indicated in those with coronary and other arterial disease, especially when it is premature, and in those with family history of atherosclerosis or hyperlipidaemia. If the patient has low

LDL-C, but very low HDL-C he/she may still be in jeopardy (Custelli of Framingham study); therefore, LDL-C/HDL-C ratios are useful[8].

The Framingham heart study found that HDL-C was the most potent lipid predictor of CAD risk in men and women above the age of 49(12). In our study, we found that the total cholesterol, HDL-C, LDL-C and LDL-C/HDL-C ratio are the most important risk factors of coronary artery disease in different ages.

CONCLUSION

The LDL-C/HDL-C is a good practical way for the management of patients suffering from hypercholesterolaemia and it is useful to the clinician when combined with detailed knowledge of the patient's other risk factors.

Elevated total cholesterol, LDL-C, low HDL-C are proven risk factors of CAD. For those with two or more other risk factors, or presence of atherosclerosis, treatment should be initiated to achieve a target level of LDL-C, HDL-C, and LDL-C/HDL-C ratio. Physicians differ in professional opinion about when a patient with persistently high total cholesterol or high risk LDL-C/HDL-C ratio should be treated with medications.

The effects of disturbances of lipids and lipoproteins on the development of CAD and hypercholesterolaemia may also depend on the presence of other non-lipid risk factors.

RECOMMENDATIONS

One must understand risk factors coronary artery disease more than the total cholesterol. Also needs to know how much good and bad cholesterol he has. The ratio of good and bad cholesterol is very helpful to understand the risk for CAD. To measure cholesterol, blood samples should be drawn after a fasting period of 14 - 16 hours. We recommend that patient should follow a dietary/exercise and medical treatment when the LDL-C/HDL-C ratio is more than 2.6.

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