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M Perwaiz Iqbal

Aga Khan University, perwaiz.iqbal@aku.edu

Hasanat Mohammad Sharif

Aga Khan University, hasanat.sharif@aku.edu

Naseema Mehboobali

Aga Khan University, naseema.mehboobali@aku.edu

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Variability in lipid profile before and after coronary artery bypass grafting (CABG)

M. Perwaiz Iqbal, Hasanat Mohammad Sharif*, Naseema Mehboobali

Departments of Biological and Biomedical Sciences and Surgery*, The Aga Khan University, Karachi.

Abstract

Objective: To investigate changes in total cholesterol, low density lipoprotein (LDL) cholesterol, high density lipoprotein (HDL) cholesterol, and triglycerides in serum of Pakistani patients before, immediately after and 5 days post CABG.

Method: Serum samples from 31 consecutive Pakistani angina patients undergoing CABG at the Aga Khan University Hospital were analyzed for total cholesterol, LDL cholesterol, HDL cholesterol and triglycerides using kit methods.

Results: Immediately after CABG, there is a significant decline in the mean levels of serum cholesterol, LDL cholesterol, HDL cholesterol and triglycerides. However, 5 days post CABG, there is a significant increase in the concentrations of total cholesterol ($P=0.01$) and LDL cholesterol ($P=0.001$) in nondiabetic angina patients ($n=13$). Among the diabetic group of patients ($n=18$), the levels of total cholesterol, LDL cholesterol, HDL cholesterol and triglycerides went back to the pre-operative levels within 5 days post CABG. Compared to European patients, Pakistani patients tend to have very low levels of HDL cholesterol (24.9 ± 7.1 mg/dl) and high levels of triglycerides (185 ± 50 mg/dl) on day 5 post CABG.

Conclusion: Since risk of mortality following CABG increases with low level of HDL cholesterol and high level of triglycerides, close monitoring and treatment of high lipid levels of Pakistani patients following CABG is necessary to prevent further coronary events (JPMA 55:95;2005).

Introduction

Atherosclerotic changes have been shown to be associated with raised serum lipid levels.^{1,2} Therefore, determination of lipid status of angina patients before and following coronary artery bypass grafting (CABG) is extremely important. Few studies have been carried out to monitor changes in the lipid profile of angina patients undergoing CABG^{3,4}, but none on Pakistani population which has the highest rates of coronary artery disease.⁵ A recent study has shown that the mean serum HDL cholesterol level in Pakistani patients with acute myocardial infarction (35.7 ± 11.3 mg/dl) was well below the normal levels (40 mg/dl) recommended by the National Cholesterol Education Programme. Moreover, hypertriglyceridemia was also found to be quite prevalent (30.1%) in these patients.⁶ Since serum HDL cholesterol and triglyceride levels predict survival following CABG^{7,8}, it is important to monitor lipid levels in patients following CABG to prevent further cardiovascular events.

The present study was undertaken to investigate changes in lipid profile in Pakistani angina patients before, immediately after and 5 days post CABG. Another objective was to find out whether the changes in lipid profile at these three time intervals were different in diabetic and non-diabetic angina patients.

Patients and Methods

Thirty one consecutive Pakistani angina patients (25 males 6 females; mean age 57.7 ± 9.3 years) undergoing CABG at the Aga Khan University Hospital between January 2003 - July 2004 were included in this study. All patients had either acute coronary syndrome or a non ST elevation myocardial infarction before surgery. None had a recent major transmural myocardial infarction preoperatively. Their mean body mass index was 26 ± 4 . Eighteen among them were diabetics, while 23 were hypertensive. Mean angina duration was 3.2 ± 2.2 days. Mean time on cardio pulmonary bypass (CPB) was 121 ± 32 minutes, while the mean cross-clamp time was 74 ± 20 minutes. Mean serum creatinine concentration among them was found to be 1.2 ± 0.49 mg/dl. The study was approved by the Ethical Review Committee of the institution.

The first set of blood samples was collected from a central venous catheter placed at the time of surgery and collected before systemic heparinization. Post operatively, blood was collected from the same central catheter after administration of protamine. The samples were transported to the laboratory immediately or following brief storage at 4°C. The day 5 samples were collected from a peripheral vein prior to patient's discharge.

Total cholesterol, low density lipoprotein (LDL) cholesterol, high density lipoprotein (HDL) cholesterol and

total triglycerides in serum were analyzed using colorimetric kit methods (RANDOX, UK).

Mean values have been presented as mean \pm standard deviation (SD). Comparison of the two mean values at two different time intervals was carried out by paired samples t-test. One way ANOVA was used for comparison of mean values of more than two groups. A p-value <0.05 was considered significant.

Results and Discussion

Figure shows the mean \pm SD serum levels of total cholesterol, HDL cholesterol, LDL-cholesterol and total triglycerides before, immediately after and 5 days post CABG. The mean preoperative, immediately after and 5

respectively. When the mean concentration values in each group were compared using one way ANOVA, there was a significant decrease immediately post surgical procedure in the concentrations of total cholesterol ($P=0.0001$), HDL cholesterol ($P=0.006$), LDL cholesterol ($P=0.0001$) and triglycerides ($P=0.0003$). This dramatic fall in concentration of all of the above mentioned lipids immediately after surgery is consistent with the results by Figueroa et al who have also reported a similar drop in concentration of total serum cholesterol and attributed this fall to hemodilution.⁹

It is noteworthy that the baseline mean HDL cholesterol level (26.9 ± 8.2 mg/dl) in our patient population was well below the normal levels (≥ 40 mg/dl) recommended by the National Cholesterol Education Program¹⁰, indicating that low levels of HDL cholesterol in our angina population may have contributed to accelerated coronary atherosclerosis requiring CABG. Similar low levels of HDL cholesterol have also been reported in Pakistani patients with acute myocardial infarction.⁶ In fact, when the mean baseline HDL cholesterol levels in angina patients undergoing CABG were compared with the mean baseline levels in Pakistani AMI patients (35.7 ± 11.3 mg/dl) these were found to be significantly lower ($P= 0.0001$). This again points towards the significant role played by low HDL cholesterol in the development of coronary artery disease in our population.

Table 1 and Table 2 show mean serum levels of total cholesterol, LDL cholesterol, HDL-cholesterol and total triglycerides in diabetic and nondiabetic angina patients before, immediately after and 5 days post CABG.

A comparison of mean concentration values of the above mentioned lipids before surgery and 5 days post CABG using paired samples t-test revealed no statistically significant difference among diabetic angina patients indicating that within 5 days the values went back to their preoperative levels. This observation was not in conformity with the results reported by Ooi et al and Shaukat et al who have shown that the serum values of total cholesterol, HDL

Figure. Serum levels of total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides (TG) before, immediately after and 5 days post surgical procedure in patients undergoing coronary artery bypass grafting (CABG). Comparison of the mean concentration values at three different time intervals for each lipid was carried out using one way ANOVA.

days post CABG levels were: total cholesterol 148 ± 37 mg/dl, 101 ± 27 mg/dl, 176 ± 49 mg/dl; LDL cholesterol 85 ± 34 mg/dl, 63 ± 22 mg/dl, 113 ± 49 mg/dl; HDL cholesterol 26 ± 8.2 mg/dl, 20.7 ± 7.4 mg/dl, 24.9 ± 7.1 mg/dl; triglycerides 171 ± 92 mg/dl, 108 ± 84 mg/dl, 185 ± 50 mg/dl,

Table 1. Serum levels of total cholesterol, HDL cholesterol and LDL cholesterol in diabetic and nondiabetic angina patients before, immediately after, and 5 days post coronary artery bypass grafting (CABG) (Mean \pm SD).

Patients	No.	Total cholesterol conc. (mg/dl)			*P-value	HDL concentration (mg/dl)			*P-value	LDL concentration (mg/dl)			*P-value
		Before CABG	Immediately after CABG	5 days post CABG		Before CABG	Immediately after CABG	5 days post CABG		Before CABG	Immediately after CABG	5 days post CABG	
Diabetic	18	152 \pm 39	109 \pm 29	174 \pm 52	0.146	25 \pm 5.7	22.1 \pm 6.8	23.7 \pm 4.6	0.394	92 \pm 39	66 \pm 25	110 \pm 49	0.23
Non-diabetic	13	143 \pm 33	91 \pm 22	178 \pm 47	0.01	29.3 \pm 10.4	20.1 \pm 6.5	26.5 \pm 9.5	0.418	76 \pm 23	58 \pm 17	120 \pm 52	0.001

*P-value compares mean values of concentration before CABG and 5 days post CABG using paired samples t test.

Table 2. Serum levels of total triglycerides in diabetic and nondiabetic angina patients before, immediately after and 5 days post coronary artery bypass grafting (CABG) (Mean±SD) .

Patients	No.	Total triglycerides concentration (mg/dl)			P-value
		Before CABG	Immediately after CABG	5 days post CABG	
		Diabetic	18	178±85	
Nondiabetic	13	160±104	73±40	167±55	0.819

*P-value compares mean values of concentration before CABG and 5 days post CABG using paired samples t test.

have shown that the serum values of total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides go back to the preoperative levels in 4 weeks and 6 weeks time, respectively.^{3,11} Genetic differences between the Pakistani population and the Western population may have been the cause for rapid rise in the concentration of these lipids in the Pakistani population compared to the Western population.

Another noteworthy observation was that the mean base line levels of serum cholesterol, triglycerides and LDL cholesterol appear to be higher (though not significantly) in the diabetic group of patients compared to nondiabetic ones. This is in line with poor lipid homeostasis observed in diabetes mellitus. HDL cholesterol, however, was lower in the diabetic groups. In the nondiabetic group of angina patients there was a significant increase in concentrations of total cholesterol and LDL cholesterol on day 5 post CABG (Table 1). This is indicative of the need to intervene within one week of CABG to lower blood cholesterol, as through the Cholesterol Lowering Atherosclerosis Study it has been shown that a 38% net reduction in LDL cholesterol is associated with a 36% reduction in coronary global score progression.¹²

Pakistanis belong to an ethnic group in which coronary heart disease starts relatively at a younger age.^{13,14} Moreover, among people in South Asia coronary heart disease occurs at lower lipid concentrations compared with Europeans.¹⁵

Another case controlled study done in Bangalore, India showed that Indians usually have lower HDL cholesterol and higher triglycerides concentrations.¹⁶ Our results conform well to these reports and angina patients in our study were also found to have significantly low levels of HDL cholesterol (<35 mg/dl) and higher levels of triglycerides (>150 mg/dl), especially 5 days after CABG.

Recent reports have shown that HDL cholesterol level predicts survival in men after CABG.⁷ Similarly, Sprecher et al have also reported that serum triglycerides in the highest quartile after CABG were associated with 20% greater risk of mortality.⁸ Therefore, the risk of further coronary events can be reduced if there is effective control of cholesterol and triglycerides concentrations following CABG.¹⁷

Significantly low levels of HDL cholesterol observed in this study merit some discussion. In two recently conducted studies in our laboratory on hospital-based populations, we have shown that low levels of HDL cholesterol appear to be among the most significant risk factors in Pakistani population.^{6,18} These very low levels of HDL cholesterol point towards urgently needed measures in patients who have undergone CABG to raise their HDL cholesterol. These include niacin treatment¹⁹, cessation of smoking²⁰, engagement in moderate physical activity²¹ and institution of statin therapy²² to reduce future coronary events in them.

Data in this study show that lipid profile following CABG in our patients rapidly (in 5 days) goes back to the preoperative levels. This necessitates regular monitoring of lipid status of the patients and an early intervention in terms of preventive and therapeutic measures.

Traditionally HMG CoA reductase inhibitors (statins) are used/restarted at six weeks following surgery. This study emphasizes the need for early reinstatement of statin therapy after CABG.

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