



Original Research Article

Comparison of apolipoprotein levels with conventional Lipid profile parameters in patients with coronary heart disease

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ABSTRACT

Introduction: Cardiovascular disease is the most common cause of death worldwide among which coronary heart disease (CHD) is the main culprit. Conventionally the estimation of serum lipids like cholesterol, triglycerides, LDL cholesterol (LDL-C) and HDL cholesterol (HDL-C) are used to assess the risk of CHD. However, the inaccuracies in the correlation between serum lipid profile and CHD, led to the development of better indicators. Among them the estimation of serum apolipoprotein is now increasingly used for risk assessment of CHD. In HDL-C main protein component is Apolipoprotein A-I. Apo A-I and HDL-C are protective; Apolipoprotein B (Apo B) and LDL-C are atherogenic. The current study is carried out to evaluate and compare the efficacy of Apo B and Apo A-I level with LDL-C and HDL-C level as risk factors of coronary heart disease.

Materials and Methods: Total 45 clinically diagnosed patients of coronary heart disease with age group of 30-65 years and 45 age and sex matched healthy individuals were included in study. Their serum levels of Apo A-I, Apo B, total cholesterol, HDL-C, LDL-C triglycerides and VLDL-C were measured and compared between CHD patients and healthy controls.

Results: No significant difference was found in total cholesterol (TC), HDL cholesterol and LDL cholesterol levels, only VLDL cholesterol was significantly higher in CHD patients compared to controls ($p < 0.05$). Apolipoprotein A-I was lower and Apolipoprotein B was higher in CHD patients compared to controls and the differences were highly significant ($p < 0.001$).

Conclusions: This study indicates ratio of Total Cholesterol to HDL-C and LDL-C to HDL-C can be helpful in assessing risk of CHD while raised Apo B to Apo A-I ratio is highly suggestive risk factor for CHD.

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1. Introduction

Cardiovascular disease is the most common cause of death worldwide accounts for approximately 30% deaths worldwide.¹ Among which Coronary artery disease due to atherosclerosis is the leading cause of mortality and morbidity in the world and its incidence has shown an upward trend in Indians in the last decade.^{2,3} In India, coronary heart disease (CHD) has increased about 6 fold in the last 50 years to reach 10% prevalence of among 35 to 65 years age group. An early assessment of risk predictors

CHD can decrease the morbidity and mortality related to CHD improve the life quality.²

Conventionally the estimation of serum lipids like cholesterol, triglycerides, LDL cholesterol (LDL-C) and HDL cholesterol (HDL-C) are used to assess the risk of CHD. However, the inaccuracies in the correlation between serum lipid profile and CHD, led to the development of better indicators. Among them the estimation of serum apolipoprotein is now increasingly used for risk assessment of CHD.³ Alaupovic found apolipoprotein A-I (Apo A - I), which is one of the components of HDL-C, is a better marker for coronary heart disease.³ Various subfractions of atherogenic LDL -C and protective HDL -C proved as better

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indicator of coronary heart disease.³

Apo A-I is the major protein constituent of HDL-C. Apo A-I and HDL-C are protective; apolipoprotein B (Apo B) and LDL-C are atherogenic. HDL-C has 2 molecules of Apo A-I, whereas cholesterol content varies in each of these lipoprotein particles. Therefore measuring Apo A-I is a determinant of the number of atherogenic particles in circulation, than the cholesterol content, which varies. The atherogenic lipoprotein particles LDL-C, VLDL-C remnants, or IDL-C, and chylomicron remnants each contain 1 molecule of Apo B as the structural protein. The plasma Apolipoprotein concentration reflects the number of atherogenic lipoproteins, and studies in men have demonstrated that Apolipoprotein can be a valuable predictor for CHD³. Increased Apo B /Apo A-I ratio was also seen in CHD patients⁴. With advent of newer assay techniques for these apolipoproteins, they can be accurately used for risk assessment of coronary heart disease. Assessment of apolipoprotein levels is an aid to risk prediction and can be useful in tailoring treatment.⁴

2. Aims and Objective

The current study is carried out to evaluate and compare the efficacy of Apo B and Apo A-I level with LDL-C and HDL-C level as risk factors of coronary heart disease.

3. Materials and methods

3.1. Study design

The study was conducted at the Clinical Chemistry Laboratory of Biochemistry Department at Medical College and S.S.G. Hospital, Baroda after ethical Clearance obtained from the Institutional Ethics Committee for Human Research, Medical College and S.S.G. Hospital, Baroda. Period of data collection was July 2013 to June 2014.

The subjects selected for the study were grouped as follows:

3.2. Inclusion criteria

Group I – Control group (n=45)

This group consisted of age and sex matched healthy subjects. They were from medical or paramedical staff and persons coming to hospital for fitness purpose & for routine health check up.

Group II – Patients with Coronary Heart Disease (n=45)

Clinically diagnosed patients of coronary heart disease with age group of 30-65 years with electrocardiographic changes and elevated cardiac biomarkers.

3.3. Exclusion criteria

The following patients were excluded from the study:

1. Patients with coronary artery disease with atrial fibrillation or pacemaker.
2. Patients with history of stroke, intermittent claudication, peripheral vascular disease, carotid surgery, coronary artery bypasses graft surgery or PTCA.
3. Patient having H/O chronic alcohol consumption, hepatobiliary disorders or any other acute liver diseases and diabetes mellitus.

After taking informed consent, detailed present and past history was recorded which includes name, age, sex, education, occupation, economic status, nutritional and personal habits, medication and systemic illness. 4 ml venous blood was collected from each case, in plain vacutainer after overnight fast and was subjected for following estimations.

Estimation of serum Apo A-I and Apo B were done by Turbidimetric Immunoassay, serum cholesterol by cholesterol oxidase- peroxidase (CHOD-PAP) enzymatic colorimetric end point method, HDL cholesterol and LDL cholesterol by direct enzymatic method and serum triglycerides by glycerol phosphate oxidase peroxidase (GPO-PAP) enzymatic end point method. All estimations were carried out on fully automated biochemistry analyzer Miura-300.

3.4. Statistical analysis

Data analysis was performed with the Microsoft Excel 2010. Comparisons between two groups were made using Student's t-tests. For all analysis, $p < 0.05$ was taken as statistically significant and $p < 0.001$ as statistically highly significant. To compare different parameters as risk factor for CHD, Receiver Operating Characteristic (ROC) curve analysis was carried out using MedCalc version 19.1 (free trial version).

4. Results

Table 1 summarizes results of conventional lipid profile parameters and apolipoproteins in controls and CHD patients. No significant difference was found in total cholesterol (TC), HDL cholesterol and LDL cholesterol levels, only VLDL cholesterol was significantly higher in CHD patients compared to controls ($p < 0.05$). Apolipoprotein A-I was lower and Apolipoprotein B was higher in CHD patients compared to controls and the differences were highly significant ($p < 0.001$).

In Table 2, different ratios of lipid profile parameters and apolipoproteins are compared between controls and CHD patients. TC/HDL-C ratio and LDL/HDL-C ratio shows significant difference ($p < 0.05$) while difference in Apo B/Apo A-I ratio is highly significant ($p < 0.001$).

To compare different parameters as risk factor for CHD, ROC curve analysis was carried out (Table 3).

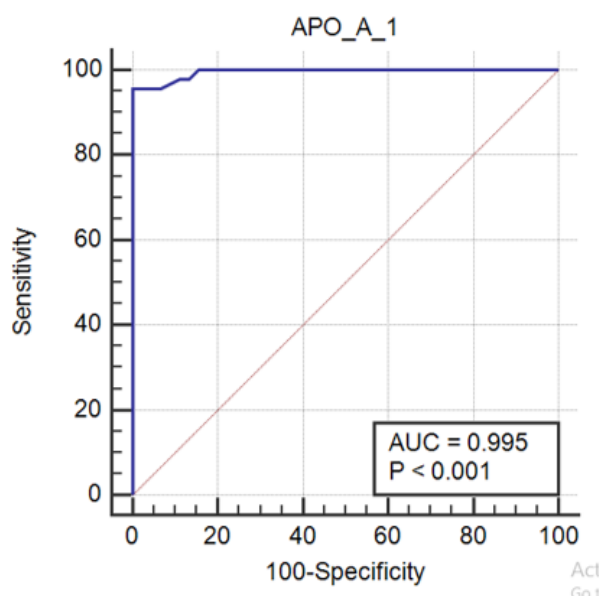
Table 1: Comparison of serum lipid profile and apolipoproteins between group I and group II

Parameters	Group I (Controls) (Mean±SD) n=45	Group II (CHD) (Mean±SD) n=45	p value
S. Total Cholesterol (mg/dl)	166.27 ± 20.23	176.31 ± 32.47	0.082
S. HDL Cholesterol (mg/dl)	47.22 ± 5.84	45 ± 8.15	0.140
S. LDL Cholesterol (mg/dl)	98.42 ± 15.94	105.58 ± 24.33	0.102
S. VLDL Cholesterol (mg/dl)	19.96 ± 7.68	25.73 ± 12.05	p < 0.05
S. Triglyceride (mg/dl)	115.62 ± 51.29	136.22 ± 41.1	0.115
S. Apolipoprotein A-I (mg/dl)	130.71 ± 14.24	83.1 ± 12.75	p < 0.001
S. Apolipoprotein B (mg/dl)	102.87 ± 16.39	136.56 ± 21.91	p < 0.001

Table 2: Comparison of ratio of serum lipid profile and apolipoproteins between group I and group II

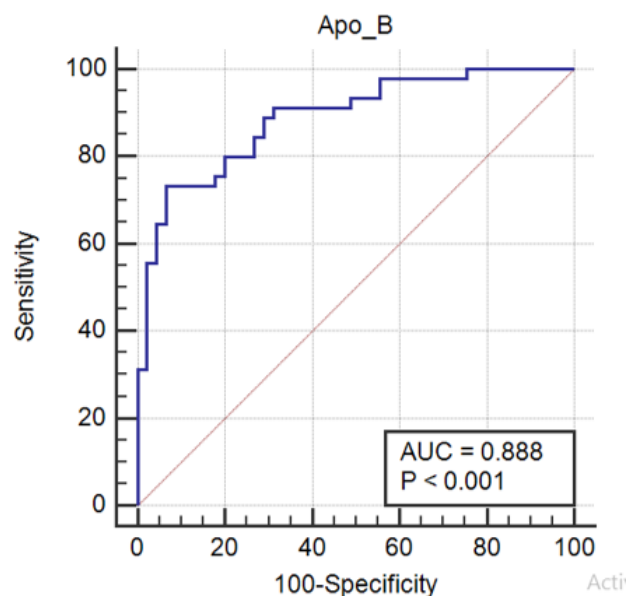
Parameters	Group I (Controls) (Mean±SD) n=45	Group II (CHD) (Mean±SD) n=45	p value
Apo B/Apo A-I ratio	0.8 ± 0.17	1.68 ± 0.38	p < 0.001
TC/HDL ratio	3.55 ± 0.47	3.98 ± 0.75	p < 0.05
LDL/HDL ratio	2.11 ± 0.41	2.4 ± 0.64	p < 0.05

For S. Apolipoprotein A-I highest area under curve (AUC = 0.995) was found (Figure 1). AUC for apolipoprotein B (0.888) was also highly significant (p < 0.0001)

**Fig. 1:** ROC curve with regard to occurrence of CHD for apolipoprotein A1

5. Discussion

Coronary heart disease has become very prevalent world wide.⁵ Early identification of risk factors of CHD can help in reducing mortality and morbidity due to CHD.⁶ In this study an attempt has been made to compare the efficacy of Apo B and Apo A-I level with LDL-C and HDL-C level as risk factors of coronary heart disease. In controls we

**Fig. 2:** ROC curve with regard to occurrence of CHD for apolipoprotein B

found mean LDL -C 98.42 ± 15.94 and in CHD patients it was 105.58 ± 24.33 (p=0.102). While apolipoprotein B level was 102.87 ± 16.39 in controls compared to 136.56 ± 21.91 in CHD patients (p<0.001). This indicates increased in apolipoprotein B is better marker for risk of CHD than increased in LDL cholesterol. Similarly we found apolipoprotein AI is better indicator HDL cholesterol for risk prediction of CHD. In similar type of study, Hong LF. et al found Apo B/Apo A-I ratio significantly correlated with severity of coronary artery disease in diabetic people but it does not act as independent risk factor.⁷ Tamang H et al. concluded Apo B/Apo A-I as better predictor of cardio

Table 3: Results of Receiver Operating Characteristic (ROC) curve analysis of conventional lipid profile parameters and Apolipoproteins as CHD risk factor

Parameters	Sensitivity	Specificity	AUC	P value
S. Total Cholesterol	33.33	97.78	0.603	0.0934
S. HDL Cholesterol	28.89	95.56	0.599	0.1086
S. LDL Cholesterol	57.78	68.89	0.614	0.0615
S. VLDL Cholesterol	60.00	73.33	0.646	0.014
S. Triglyceride	71.11	62.22	0.625	0.0388
S. Apolipoprotein A-I	95.56	100	0.995	<0.0001
S. Apolipoprotein B	73.33	93.33	0.888	<0.0001

vascular risk in their study, which is similar to findings of our study.⁸

6. Conclusion

In this study we found conventional lipid profile parameters like ratio of Total Cholesterol to HDLc and LDLc to HDLc can be helpful in assessing risk of CHD ($p < 0.05$) and can be used for assessing risk profile of CHD in smaller setups where facilities for apolipoprotein testing are not available. While apolipoprotein levels and Apo B to Apo A-I ratio are definitely of more importance for risk assessment and highly suggestive risk factors for CHD.

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8. Funding

Nil

9. Conflict of interest

Nil

References

- Gaziano TA, Gaziano JM. Epidemiology of Cardiovascular Disease. Harrison's Principles of Internal Medicine. 19th edition. and others, editor. Mc Graw Hill ; 2015..
- Philip S, Abraham P, Sheriff DS. Apo B/Apo A-I Ratio A Better Predictor of Coronary Artery Disease in Patients with or Without Type II Diabetes Mellitus. *Int J Appl Biol Pharm Technol*. 2011;2(3):153–158.
- Dange NS, Nagdeote A, Deshpande K. Serum Apolipoprotein A1 & B, lipoproteins, lipids levels in Indian patients with angiographically defined coronary artery disease. *IJPBS*. 2011;1(3):255–264.
- Sreenivasan RS, Kavitha A, Anusa AR, Krishna MP, Renganathan NG. Identification and prediction of coronary heart disease in patients with apolipoprotein levels. *IJPBS*. 2011;1(2):31–41.
- World Health Organization. Prevention of Cardiovascular Disease Guidelines for assessment and management of cardiovascular risk. Geneva, Switzerland: World Health Organization; 2007 ;. .
- World Health Organization. Global Status Report on Non-Communicable Diseases 2014. Geneva, Switzerland: World Health Organization; 2014 ;. .
- Hong LF, Yan XN, Fan Y, Wu Q, Luo SH, et al. Is the ratio of apoB/apoA-1 the best predictor for the severity of coronary artery lesions in Chinese diabetics with stable angina pectoris? An assessment based on Gensini scores. *J Geriatr Cardiol*. 2015;12:402–409.
- Tamang HK, Timilsina U, Singh KP, Shrestha S, Raman RK, et al. Apo B/Apo AI ratio is statistically a better predictor of cardiovascular disease (CVD) than conventional lipid profile: a study from Kathmandu Valley. *J Clin Diagn Res*. 2014;8(2):34–36.

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