

Original Research Article

A STUDY OF SERUM NON-HDL, HDL LEVELS AND MICROALBUMINURIA IN SUBJECTS WITH TYPE 2 DIABETES MELLITUS WITH ISCHEMIC HEART DISEASE

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Abstract

BACKGROUND

Microalbuminuria is a key risk factor for several cardiovascular diseases and renal impairment. This is particularly true for diabetics, in whom it is common and can be used to predict the development of complications.

MATERIALS AND METHODS

A case control study. Participants were divided into 2 different groups: Group I – Control (n = 140), Group II – Patients with type II diabetes mellitus with IHD (n = 140). Medical history, physical examination, complete blood count, ECG, chest X-ray and urine examination, tests for microalbuminuria, echocardiogram and fluorescein angiography were performed.

RESULTS

Mean age of patients in group I and II were 54.35 ± 9.45 and 53.87 ± 8.98 years respectively. 46% participants were taking oral anti diabetic agents. Out of 280 patients of type 2 DM– 64% were micral test negative and 36% were micral test positive. In group III, 32% were normoalbuminuric and 68% were microalbuminuric. Positive correlation was found between duration of DM and presence of microalbuminuria. Serum cholesterol and serum triglycerides level were more in microalbuminurics than normoalbuminurics and the difference was statistically significant while the difference in the levels of serum LDL and

serum HDL was statistically insignificant between two groups. 55.6% of the diabetics with microalbuminuria were hypertensive.

CONCLUSION

Microalbuminuria can be considered as one of the predictive factors for overt nephropathy and various complications of DM. Thus, detection of microalbuminuria at an early stage may help in preventing the diabetic complications.

KEYWORDS

Microalbuminuria, Diabetes Mellitus, Dyslipidemia, Hypertension.

INTRODUCTION

Type 2 diabetes mellitus is characterised by fluctuating levels of insulin resistance, reduced insulin secretion, and increased glucose synthesis. Diabetes, currently afflicting over sixty-two million persons in India, is increasingly being recognised as a potential epidemic.^[1] According to the most recent forecasts from the International Diabetes Federation, 592 million individuals, which is equivalent to one in ten people, are expected to develop diabetes by the year 2035.^[2]

Ischemic cardiovascular disease (IHD) or cardiomyopathy (CHD) occurs when there is insufficient circulation or oxygen delivery to a section of the myocardium, leading to an imbalance between oxygen demand and supply in the myocardium.^[3] Plaque accumulation in a coronary artery, namely the epicardial artery, is the primary factor leading to myocardial injury. This buildup causes a localised decrease in blood flow to the heart muscle and inadequate oxygen supply to the myocardium nourished by the affected artery.^[4]

Diabetes (DM) and ischemic cardiovascular disease (CHD) are intricately linked. Diabetes is a modifiable risk factor for the development of coronary heart disease. Within communities with a high prevalence of diabetes, coronary heart disease (CHD) is the primary factor leading to both mortality and morbidity.^[5] Adults above the age of 18 who have type 2 diabetes (DM) have a 1.7 times greater incidence of cardiovascular disease (CVD) mortality compared to individuals without this diagnosis. This is mainly associated with an increased susceptibility to strokes and heart attacks.^[6]

The primary objective of the present study was to investigate the relationship between HDL/Non-HDL lipid levels and microalbuminuria in individuals with diabetes, both with and without ischemic disease. This study was conducted in response to the existing gap in knowledge on this specific link. The objective of our study was to investigate the levels of serum non-HDL, HDL, and microalbuminuria in individuals with type 2 diabetes, comparing those with and without ischemic heart disease.^[7]

MATERIALS AND METHODS

A case control was undertaken at Raipur Institute of Medical Sciences, Raipur, Chhattisgarh, over a period of 2 years (May 2022 to May 2024). All patients with with type 2 diabetes mellitus with or without IHD who presented to the medicine department, either as an out-patient or following departmental referral, were included in the study. We include diabetic patients attending to medicine OPD, medical ward, medical ICU who met the inclusion and exclusion criteria after obtaining the written informed consent. Study included 280 diabetic cases, 140 controls i.e. diabetics without IHD and 140 cases i.e. diabetics with evidence of IHD.

Detailed history, clinical examination and the following investigations were carried

out in all subjects:

1. 12 Lead ECG
2. Spot urine albumin creatinine ratio
3. Lipid profile
4. FBS and PPBS and HbA1c
5. Blood urea and serum creatinine
6. TMT/ 2DECHO.

All subjects were followed up during the hospital stay and results of the investigations were recorded.

Microalbuminuria is defined as levels of albumin ranging from 30 to 300 mg in a 24-h urine collection. Overt albuminuria, macroalbuminuria, or proteinuria is defined as a urinary albumin excretion of ≥ 300 mg/24 h. In lipid profile, an HDL level of < 40 mg% for males and < 50 mg% for females is taken as low HDL while Non-HDL levels > 130 mg% was taken as high non- HDL [ref].

Statistical Analysis

All the data was noted down in a pre-designed study proforma. Qualitative data was represented in the form of frequency and percentage. Association between qualitative variables was assessed by Chi-Square test. Quantitative data was represented using Mean \pm SD. Analysis of Quantitative data between the two groups was done using unpaired t-test if data passed 'Normality test' and by Mann-Whitney Test if data failed 'Normality test'. A p-value < 0.05 was taken as level of significance. Results were graphically represented where deemed necessary. SPSS Version 26.0 was used for most analysis and Microsoft Excel 2021 for graphical representation.

RESULTS

Present study aimed to study the pattern of serum non-HDL, HDL levels and microalbuminuria in type 2 diabetes mellitus with ischemic heart disease. Study included 140 cases of type 2 diabetes and ischemic heart disease and 140 controls i.e. only diabetes cases with male predominance in both cases (56.4%) and controls (53.6%). Among 75 patients 61-70 age group with maximum number of patients being affected.

Mean duration of diabetes was 8.96 years among cases and 10.13 years among controls. The difference was statistically non-significant. Among blood sugar indices, mean fasting and post-prandial blood sugar levels were comparable among cases and controls ($p > 0.05$) while glycemic control was poor among diabetic cases with IHD (7.99 vs 5.61%; $p < 0.01$).

Mean HDL levels were significantly low (40.11 vs 52.48 mg%; $p < 0.01$) while mean non- HDL levels were significantly high (128.14 vs 103.54 mg%; $p < 0.01$) among diabetic cases with IHD as compared to diabetic controls. Mean 24-hour urinary albumin excretion (UAE) rate was also significantly higher among cases as compared to controls (58.46 vs 26.76 mg/ 24 hours; $p < 0.01$). Low HDL levels were observed among 56.4% cases as compared to 15% controls. The difference was statistically significant ($p < 0.01$). High non-HDL levels were observed among 45% cases as compared to 22.9% controls. The difference was statistically significant ($p < 0.01$).

Prevalence of microalbuminuria (UAE > 30 mg/ 24 hours) was observed to be significantly more among cases as compared to controls (35% vs 16.4%; $p < 0.01$). A significant positive correlation was observed among 24-hour urinary albumin excretion and non-HDL levels ($r = 0.49$; $p < 0.01$) while significantly inverse correlation was observed with HDL levels ($r = -0.63$; $p < 0.01$). (Table 1)

Pearson co-relation		
UAR	r- value	p- value
HDL	-0.63	<0.01
Non-HDL	0.49	<0.01

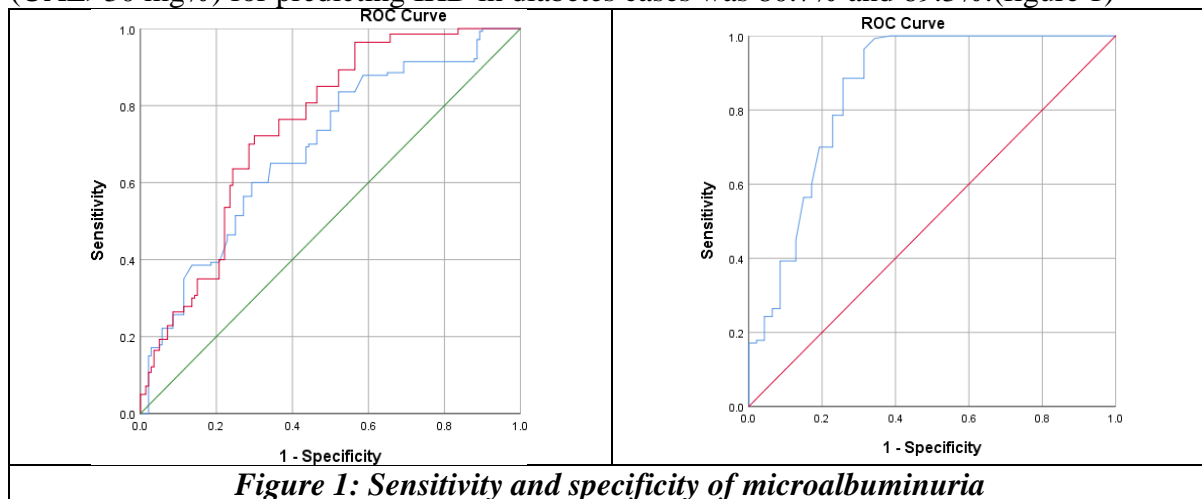
Table 1: 24-hour urinary albumin excretion and non-HDL levels

On regression analysis, HDL levels and micro-albuminuria, both were observed to be insignificant predictors for development of IHD in type 2 diabetic cases (p<0.01).

Logistic Regression: IHD in Diabetes (Y/N)								
Variables	B	S.E.	Wald	df	p- value	Odds Ratio	95% C.I. for EXP(B)	
							Lower	Upper
HDL	-0.226	0.031	53.404	1	<0.01	0.798	0.751	0.847
Non-HDL	-0.011	0.006	3.505	1	0.061	0.989	0.977	1.001
MAU	-1.097	0.37	8.804	1	<0.01	0.334	0.162	0.689

Table 2: HDL levels and micro-albuminuria

On ROC Curve analysis, all the three parameters i.e. HDL, non-HDL and MAU were observed to be significant predictors of development of IHD among diabetics. Among the three parameters, HDL cholesterol was observed to have the best area under ROC curve (AUROC – 0.855; 0.809-0.910; p<0.01). At levels >120 mg%, the sensitivity and specificity of non-HDL cholesterol for predicting IHD in diabetes cases was 61.3% and 56.7% while at cut-off <45 mg%, the sensitivity and specificity of HDL cholesterol for predicting IHD in diabetes cases was 88.6% and 74.3%. The sensitivity and specificity of microalbuminuria (UAE>30 mg%) for predicting IHD in diabetes cases was 80.7% and 69.3%.(figure 1)



DISCUSSION

Diabetes is strongly linked to the occurrence of coronary heart disease. Diabetes is a controllable factor that increases the likelihood of developing coronary heart disease (CHD). Coronary heart disease (CHD) is a prevalent cause of illness and mortality in those with diabetes.^[8]

Dyslipidaemia is the second most prevalent risk factor for coronary heart disease.^[9] Additionally, it is a significant factor contributing to coronary heart disease in those with diabetes mellitus. Diabetic dyslipidaemia is characterised by increased levels of triglycerides in the blood, lower levels of HDL cholesterol, and an increase in the concentration of tiny

and dense LDL lipid particles.^[10] Non-HDL cholesterol is the difference between the total cholesterol and HDL cholesterol. It represents the cholesterol carried by all potentially harmful Apo-B-containing particles, including VLDL, LDL, chylomicron remnants, and lipoprotein a. The measurement of urinary microalbumin has been extensively researched in individuals with diabetes mellitus and is currently recognised as an indicator of widespread atherosclerosis.^[11] According to a temporal model of biomarker association with nascent ischemic heart disease (IHD), urine microalbumin is positioned at the initial stage of the spectrum, suggesting the presence of preclinical illness.^[12,13]

The mean age of both patients and controls was similar (53.87 vs 54.35 years, $p = 0.664$). Both instances are mostly male, with a proportion of 56.4% and 54.35% respectively. Samdani TS et al.^[14] found that the patients had a median age of 55.42 ± 10.67 years and a male to female ratio of 1.8:1.

In the current study, 56.4% of the patients had low HDL levels, compared to 15% of the control group. A statistically significant difference was observed, with a p-value of less than 0.01. Non-HDL levels were found to be higher in 45% of cases, compared to 22.9% in the control group. A statistically significant difference was observed, with a p-value of less than 0.01. Diabetes patients with ischemic heart disease (IHD) had significantly lower average levels of high-density lipoprotein (HDL) (40.11 vs 52.48 mg%; $p < 0.01$) and higher average values of non-HDL (128.14 vs 103.54 mg%; $p < 0.01$) compared to diabetes controls. Kayode et al.^[15] found that 57 out of 113 participants in their diabetes research study had several cholesterol tests that exceeded the desired treatment goal, indicating a prevalence of 50.4%. Patients diagnosed with Type 2 diabetes mellitus (DM) and ischemic heart disease (IHD) had higher levels of total cholesterol and non-HDL cholesterol, but lower levels of HDL cholesterol compared to individuals without IHD. In the Strong Heart Study, those with diabetes who had high levels of non-HDL cholesterol in the top third had a greater risk ratio (3.17) for coronary artery disease compared to other cholesterol measures (1.96 for LDL cholesterol and 2.04 for triglycerides) when compared to individuals in the lowest third. In addition, they exhibited the second-highest risk ratios for coronary heart disease, with values of 2.75 for LDL, 2.12 for fatty acids, and 3.06 for the total/HDL cholesterol ratio, as compared to a value of 1.90 for LDL.^[16]

Present study found that patients had a considerably higher occurrence of microscopic albumin (UAE > 30 mg/24 hours) compared to the control group (35% vs 16.4%; $p < 0.01$). The cases exhibited a substantial rise in the average amount of albumin excreted in urine during a 24-hour period, compared to the control group (58.46 vs 26.76 mg/24 hours; $p < 0.01$).

In summary, the present investigation established a significant correlation between microscopic albumin, non-HDL cholesterol, and HDL cholesterol levels in individuals with type 2 diabetes and ischemic heart disease (IHD). Individuals with both type 2 diabetes and IHD demonstrated significantly higher rates of microscopic albumin, low HDL, and increased non-HDL compared to those with type 2 diabetes alone. A regression analysis found that both HDL and microscopic albumin were significant predictors of IHD in individuals with type 2 diabetes. Individuals with microalbuminuria demonstrated reduced levels of HDL cholesterol but higher levels of non-HDL cholesterol. Our study concluded that microalbuminuria and cholesterol levels, particularly HDL levels, serve as reliable predictors of the advancement of atherosclerosis. Consequently, it is imperative for all individuals with any form of diabetes to regularly undergo screening for these symptoms in order to facilitate early identification.

CONCLUSION

Present study observed that micro-albuminuria, HDL and Non-HDL cholesterol were all significantly associated with IHD in type 2 diabetic cases. A significantly higher number of cases had micro-albuminuria, low HDL and high non-HDL among cases with Type 2 DM and IHD as compared to only type 2 DM subjects. On regression analysis, both HDL and microalbuminuria were observed to be significant predictors of presence of IHD in type 2 diabetes cases. When HDL and non-HDL cholesterol levels were correlated with microalbuminuria, it was found that patients exhibiting microalbuminuria showed higher levels of non-HDL cholesterol and lower levels of HDL cholesterol. Thus, to conclude, present study observed that micro-albuminuria and lipid profile, especially HDL levels, are markers for developing atherosclerosis and all type 2 diabetic cases should undergo routine screening for their presence for early diagnosis of impending IHD events.

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