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Original Research Article

A Cross-Sectional Study of Dyslipidemia in Chronic Kidney Disease and its Association with Cardiovascular Disease

Jay Prakash Himanshu[1], Vikash Kumar[2], P. Yugal[3]

[1]Senior Resident, Department of Medicine, Govt. Medical College and Hospital, Bettiah, W. Champaran, Bihar

[2]Senior Resident, Department of Medicine, Govt. Medical College and Hospital, Bettiah, W. Champaran, Bihar

[3]Professor and Head of Department, Department of Medicine, Govt. Medical College and Hospital, Bettiah, W. Champaran, Bihar

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Corresponding author: Dr. Vikash Kumar

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Abstract:

Background: Patients with chronic renal failure (CRF) frequently experience dyslipidemia. Dyslipidemia is linked to cardiovascular mortality in people with CRF. This study compared CRF patients to a matched age, sex, and body mass index (BMI) of a healthy control population to uncover lipid abnormalities and their importance.

Methods: From September 2021 to February 2022, this study was carried out at the Department of Medicine, Govt. Medical College and Hospital, Bettiah, Bihar. 28 cases of CRF were collected, three fasting lipid profiles were estimated, and 11 cases from a healthy population with matched age, sex, and BMI were collected as controls. Version 20.0 of IBM-SPSS was used for data analysis. Data are shown with this software as mean, standard deviation, percentages, or the total number of cases. The correlation was examined using the Pearson correlation test, and continuous data were compared using Independent student t-tests and One Way ANOVA. P values of <0.05 or lower were considered significant when performing a two-tailed test.

Results: Patients with CRF experience dyslipidemia. Even though the overall cholesterol levels in CRF cases were higher than in controls, the difference was statistically insignificant. In cases of CRF, triglycerides increased statistically significantly. LDL-C levels were higher in CRF instances, but statistically speaking, the difference was not statistically significant. On the other hand, as compared to controls, the high-density lipoprotein cholesterol (HDL-C) exhibited a statistically significant decrease. In CRF, lipid abnormalities are frequent. There are no statistically significant changes in total cholesterol. When compared to normal, triglycerides statistically significantly rise in CRF instances. Although LDL-C is higher in CRF patients than in controls, this difference is not statistically significant. Patients with CRF exhibit a statistically significant decline in HDL-C compared to controls. These lipid abnormalities may have a significant role in the cardiovascular mortality in CRF patients.

Keywords: Chronic kidney disease, Dyslipidemia, Lipid profile.

Introduction

The incidence and prevalence of chronic renal disease are rising in the current environment as a result of rising life expectancy and non-communicable disease

incidence. CKD is categorised according to aetiology, GFR category, and albuminuria category and is defined as abnormalities of kidney structure or function that have been present for 43 months and have an impact on health.[1]

Due to the numerous established risk factors for CKD, patients with the condition have an increased chance of developing cardiovascular disease. Age, male sex, smoking, dyslipidemia, obesity, hypertension, diabetes, mineral bone disease (CKD with hyperparathyroidism), hyperhomocysteinemia, anaemia, hypoalbuminemia, oxidative stress, and chronic inflammation are some of these risk factors. A CKD patient is more likely to pass away from cardiovascular illness before developing end-stage renal disease and needing renal replacement therapy[2,3].

One of the major side effects of chronic renal disease is dyslipidemia. Early on in the progression of chronic kidney disease, there may be changes in the metabolism of lipoproteins. Typically, these changes deteriorate over time, mirroring the decline in renal function.[5] The severe dyslipidemia that is seen in people with chronic renal disease is caused by the imbalance between the creation of lipoproteins and their breakdown. According to a number of studies that have just lately come out, dyslipidemia plays a significant role in the development of cardiovascular disease as well as the deterioration of renal function. The pattern of dyslipidemia that the various researchers observed, however, seems to show some significant differences [6].

Materials and Methods

28 patients with CKD who presented to the Department of Medicine at the Government Medical College and Hospital in Bettiah, Bihar during the course of six months (September 2021 to February 2022) were the subjects of the current cross-sectional study. Selected CKD patients who are between the ages of 18 and 80, have CKD regardless of the cause, are receiving conservative or dialysis treatment, and have signs of the disease that have been present for longer than three months either biochemically (elevated blood urea, elevated serum creatinine) or radiologically (bilateral kidney shrinkage/loss of corticomedullary differentiation). The study excluded patients with known hypothyroidism, acute renal failure, nephritic syndrome, lipid-altering medications such β blockers, statins, steroids, and oral contraceptives, as well as individuals who were pregnant in female patients. Routine tests such blood haemoglobin (HB)%, total count, differential count, blood sugar, and urine analysis, renal parameters like blood urea, serum creatinine, fasting lipid profile, and abdominal ultrasound were performed on all included patients.

All samples were examined 4 to 6 hours after collection. Enzymatic measurements of the plasma's total cholesterol and triglycerides were followed by a measurement of the cholesterol in the supernatant following the precipitation of lipoproteins carrying apolipoprotein B (Apo-B), which was done to ascertain the HDL-C. The Friedewald formula is used to estimate the LDL-C.

Friedewald formula appears to be the most practical and reliable method for determining LDL-C in clinical practice.

LDL-C = Total cholesterol-[HDL-C + (Triglycerides/5)]

By multiplying the plasma triglycerides by 5, which represents the ratio of cholesterol to triglycerides in VLDL particles, the amount of very-low-density lipoprotein (VLDL) is calculated. If the test resolution is acquired on fasting plasma and the triglyceride level is less than 350 mg/dL, then this formula is reasonably reliable. Ultra centrifugation techniques (Beta quantification) must be used in situations with triglyceride levels above this to

accurately determine the level of LDL-C.Version 20.0 of IBM-SPSS was used for data analysis. Data are shown with this software as mean, standard deviation, percentages, or the total number of cases. The correlation was examined using the Pearson correlation test, and continuous data were compared using Independent student t-tests and One Way ANOVA. P values < 0.05 or lower were considered significant when performing a two-tailed test.

Results

The results are tabulated in Tables 1 to 5.

Table 1: Age distribution of both cases and control groups

Age group (years)	Cases		Control	
	Number	Percentage	Number	Percentage
41-45	1	3.57%	2	18.18%
46-50	14	50.00%	6	54.55%
51-55	8	28.57%	2	18.18%
55-59	5	17.86%	1	9.09%
Total	28		11	
Range	44-56		40-58	
Mean	50.9		49.7	
SD	2.99		5.0	
p-value	0.1529			

According to Table 1, the average age of the 28 patients was 50.9 years old, with a range of 44 to 56 years. The range of controls' ages was 40–58 years, with a mean age of 49.7 years. Regarding age, there was no discernible difference between patients and controls (p-value 0.1529). They can so be contrasted.

Table 2: Sex distribution of both cases and control groups

Sex	Cases		Control	
	Number	Percentage	Number	Percentage
Male	14	50.00%	4	36.36%
Female	14	50.00%	7	63.64%
P-value	0.6844 (Not Significant)			

In the study group, there were equal numbers of men and women, 14 men and 14 women, according to Table 2. Four of the 11 controls were men and seven were women. Regarding sex, there was no discernible difference between the patients and controls (p-value 0.6844). The cases' average BMI was 23.79 kg/m^2.

Table 3: BMI of both cases and control groups

BMI	Cases	Control
Range	21-25	21-25
Mean	23.79	23.98
Standard Deviation (SD)	1.06	1.07
P-value	0.4195	

The average BMI of the controls, as shown in Table 3, was 23.98 kg/m^2. Regarding BMI, there was no discernible difference between the patients and controls.

Table 4: Lipid Profile of Cases Group

Lipid	Range	Mean	SD	p-value
Total cholesterol (TC)	156-267	212.5	13.7	0.1699 NS
Triglyceride (TG)	108-262	203.7	43.8	0.0001 S
High density lipoprotein (HDL)	14-73	38.9	17.4	0.0001 S
Low density lipoprotein (LDL)	108-169	137.2	15.3	0.1129 NS

Table 5: Lipid Profile of Control Group

Lipid	Range	Mean	SD	p-value
Total cholesterol (TC)	130-243	206.9	21.9	0.1699 NS
Triglyceride (TG)	110-178	147.9	15.8	0.0001 S
High density lipoprotein (HDL)	36-84	59.6	13.2	0.0001 S
Low density lipoprotein (LDL)	108-170	126.8	14.5	0.1129 NS

NS: Not significant; S: Significant

According to Tables 4 and 5, the mean total cholesterol in CRF patients was 212.5 mg/dL, compared to 206.9 mg/dL in controls. This parameter showed no statistically significant variation (p=0.1699). Comparing patients to controls revealed a significant increase in serum triglycerides. Mean triglyceride levels in patients were 203.7 mg/dL and controls were 147.9 mg/dL (p-value = 0.0001). In this investigation, it was discovered that there was a significantly lower level of HDL in CRF cases than in controls (38.9 vs 59.6 mg/dL, p-value= 0.001). Between patients and controls in this study, there was an increase in LDL-C (137.2 vs. 126.8 mg/dL). With a p-value of 0.1129, this was statistically insignificant.

Discussion

When a disease process compromises the kidneys' structural or functional integrity, chronic kidney disease is the result. Chronic kidney disease (CKD) leads to renal failure. The leading cause of death in persons with mild to moderate CKD and ESRD is cardiovascular disease. It is well known that patients with CKD exhibit significant changes in lipoprotein metabolism, which, in their most severe form, may lead to the development of severe dyslipidemia. Dyslipidemia has been established as a well-known traditional risk factor for cardiovascular disease in the general population.

The purpose of this study was to pinpoint the lipid abnormalities that CRF patients admitted to GMCH experience. The study comprised a total of 28 cases that met the diagnostic standards for CRF. Seven healthy controls who met the inclusion and exclusion criteria and matched in terms of age, sex, and BMI were used to compare the lipid profiles.

The average age of the 28 cases was 50.9 years, with a range of 44 to 56. The range of controls' ages was 40–58 years, with a mean age of 49.7 years. Regarding age, there was no discernible difference between patients and controls (p-value 0.1529). They can so be contrasted.

The study group consisted of 14 males and 14 females, an equal number of each gender. Four of the 11 controls were men and seven were women. Regarding sex, there was no discernible difference between the patients and controls (p-value 0.6844). The cases' average BMI was 23.79 kg/m^2.

The controls' average BMI was 23.98 kg/m^2. Regarding BMI, there was no discernible difference between the patients and controls.

We discovered that there is a large increase in triglycerides and a significant drop in HDL-C after analysing the lipid profile and comparing the CRF cases with controls. Between the patients and the

controls, there was no appreciable difference in total cholesterol or LDL-C.

The mean total cholesterol in the CRF patients was 212.5 mg/dL, compared to 206.9 mg/dL in the controls. This parameter's difference was not statistically different (p-value 0.1699).

This finding was in line with what Kimak et al. discovered while studying the plasma lipoproteins of CRF patients. They came to the conclusion that people with CRF do not have significantly higher total cholesterol.[6] Comparing patients to controls revealed a significant increase in serum triglycerides. Mean triglyceride levels in patients were 203.7 mg/dL and controls were 147.9 mg/dL (p-value = 0.0001). This outcome agrees with the findings of Kimak et al., who showed a considerable rise in triglyceride, LDL, and Apo-B contents.[6]

According to Bhagwat et al. findings from a different study[7], CRF patients had a substantial triglyceridemia of 232 mg/dL in comparison to controls (p-value <0.01). Another Indian study on dyslipidemia in patients with CRF and kidney transplantation by Shah et al.[12] showed that individuals with CRF receiving conservative therapy had significantly higher triglyceride levels. These findings demonstrate that hypertriglyceridemia is a significant lipid anomaly in CRF patients.

In contrast to controls, CRF sufferers had significantly lower levels of HDL in our study (38.9 vs 59.6 mg/dL, p-value 0.001).

This was consistent with the findings of Bhagwat et al., who discovered that HDL-C levels in CRF groups were considerably low (20±11) mg/dL (p-value less than 0.001).When compared to nonuremic people, patients with CKD often have lower plasma HDL-C concentrations.

According to our study, there was a rise in LDL-C levels between patients and controls (137.2 vs. 126.8 mg/dL). With a p-value of 0.1129, this was statistically insignificant.

This was comparable to the Bhagwat study, which discovered that LDL-C increased in CRF patients compared to controls but did not significantly differ from controls. Results from the study by Kimak et al did not match those of ours. In their study, the LDL-C significantly increased in CRF patients compared to controls.[6] In CRF, tiny compact particles that are highly vulnerable to oxidation predominate despite the fact that the total amounts of LDL are not much higher. Compared to bigger LDL substrates, these tiny particles are hypothesised to be more atherogenic.[8]

Conclusion

In CRF, lipid abnormalities are frequent. There are no statistically significant changes in total cholesterol. When compared to normal, triglycerides statistically significantly rise in CRF instances. Although LDL-C is higher in CRF patients than in controls, this difference is not statistically significant. Patients with CRF exhibit a statistically significant decline in HDL-C compared to controls.

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