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A STUDY OF LIPID PROFILE IN PATIENTS OF CHRONIC KIDNEY DISEASE-A PROSPECTIVE OBSERVATIONAL DESCRIPTIVE STUDY

General Medicine

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ABSTRACT

Background: Chronic kidney disease (CKD) is a progressive condition associated with significant metabolic disturbances, including dyslipidemia, which contributes to increased cardiovascular morbidity and mortality. Lipid abnormalities in CKD differ from those seen in the general population and tend to worsen with declining renal function. The present study was conducted to evaluate lipid profile abnormalities in patients with CKD and to assess their correlation with disease severity.**Materials and Methods:** This prospective observational descriptive study was conducted in the Department of General Medicine at a tertiary care center over a period of 18 months. A total of 91 patients aged 18–80 years with chronic kidney disease who met the inclusion criteria were enrolled. Detailed clinical history, physical examination, and laboratory investigations were performed. Fasting blood samples were collected for lipid profile estimation. Renal function was assessed using serum creatinine and estimated glomerular filtration rate (eGFR). Data were analyzed using appropriate statistical methods to determine the association between lipid parameters and CKD stages.**Results:** The mean age of the participants was 53.35 ± 13.58 years, with a male predominance (61.54%). Hypertension (78.02%) and diabetes mellitus (41.76%) were the most common comorbidities. The mean triglyceride level was 184.19 ± 52.95 mg/dL, total cholesterol 181.70 ± 33.71 mg/dL, HDL-C 37.39 ± 6.39 mg/dL, LDL-C 107.70 ± 29.61 mg/dL, and VLDL-C 37.01 ± 10.57 mg/dL. Lipid abnormalities worsened with advancing CKD stages ($p < 0.001$). eGFR showed a significant negative correlation with triglycerides, total cholesterol, LDL-C, and VLDL-C, while HDL-C showed a positive correlation ($p < 0.001$).**Conclusion:** Dyslipidemia is common in CKD patients and becomes more pronounced with disease progression. Early detection and management of lipid abnormalities are essential to reduce cardiovascular risk and improve outcomes in CKD patients.

KEYWORDS

Chronic kidney disease, Dyslipidemia, Lipid profile, eGFR, Cardiovascular risk.

INTRODUCTION

Chronic kidney disease (CKD) is a progressive disease in which structural or functional alterations in the kidneys persist for at least three months or more. It has been described as having evidence of damage to the kidneys or as having an estimated glomerular filtration rate (eGFR) of less than 60 mL/min/1.73 m², despite the cause of the disease.[1] The damage can be identified through the presence of abnormalities in the urine sediment, through the presence of abnormal findings in the imaging studies or through the presence of increased excretion of albumin in the urine. The progressive decrease in renal function can eventually cause end-stage renal disease (ESRD), necessitating dialysis or transplantation of the kidneys.[1]

The Kidney Disease: Improving Global Outcomes (KDIGO) 2012 guidelines classify CKD according to the underlying cause, level of kidney function, and degree of albuminuria. Based on glomerular filtration rate, CKD is categorized into stages G1 to G5, with stage G3 further subdivided into G3a and G3b. Stage G1 includes individuals with a GFR ≥90 mL/min/1.73 m² with evidence of kidney damage, while stage G5 represents severe kidney failure with GFR <15 mL/min/1.73 m² or patients requiring dialysis. Albuminuria is also classified into three categories based on urinary albumin-creatinine ratio (ACR): A1 (<30 mg/g), A2 (30–299 mg/g), and A3 (≥300 mg/g). This combined classification helps assess disease severity and predict progression.[1,2]

CKD has become a serious health problem in the world. It is estimated that about 10 to 14 percent of the world's population is affected with varying degrees of kidney disease.[3] There are hundreds of millions of people in the world who are affected with CKD, and the number is increasing with an increase in lifespan and an increase in the incidence of lifestyle diseases. Diabetes and hypertension are the most common causes of CKD. In India, the incidence of CKD is on the rise mainly due to an increase in the incidence of hypertension and diabetes in the population.[3-5]

Lipids are hydrophobic organic compounds which are insoluble in water but soluble in organic solvents. There are several types of lipids, which include triglycerides, phospholipids, steroids, and waxes. In the blood, lipids are transported in the form of lipoproteins.[6] Abnormalities in lipid metabolism may lead to increased levels of lipoproteins in the blood, which may cause hyperlipoproteinemia or hypolipoproteinemia. Hyperlipoproteinemia is caused by increased levels of total cholesterol, low-density lipoprotein, and triglycerides, which is a well-accepted cause of atherosclerosis.[7,8]

Dyslipidemia is a common finding among patients with chronic kidney disease. Lipid metabolism is deranged among patients with CKD. The lipid metabolism among patients with CKD is different from that among normal individuals.[9] The abnormalities in lipid metabolism among patients with CKD vary depending on the severity of renal disease. The derangement in lipid metabolism is not only a cause of cardiovascular complications but also a factor for worsening renal disease. Therefore, it is essential to study the lipid profile among patients with CKD to identify the complications of dyslipidemia early enough to take corrective measures.[10]

The present study has been undertaken to evaluate the lipid profile among patients with chronic kidney disease.

Aim of study

"To evaluate lipid profile abnormalities in patients with chronic kidney disease and to analyze their correlation with the severity of the disease."

Material & Method

This study was designed as a prospective observational descriptive study conducted in the Department of General Medicine at a tertiary care hospital over a period of 18 months. A total of 91 patients diagnosed with chronic kidney disease (CKD) and admitted to the medical ward were included in the study. Patients aged 18–80 years who had symptoms of uremia for more than three months, elevated blood urea and serum creatinine levels, decreased creatinine clearance, and ultrasound evidence suggestive of chronic renal failure (such as bilateral contracted kidneys and poor corticomedullary differentiation) were included after obtaining informed consent.

Supportive laboratory findings such as anemia, altered urine specific

gravity, and electrolyte abnormalities were also considered. Patients undergoing hemodialysis or peritoneal dialysis, those receiving drugs known to affect lipid metabolism (such as statins, beta-blockers, and oral contraceptive pills), pregnant women, and patients with acute renal failure or nephrotic syndrome were excluded from the study. After ethical committee approval, detailed clinical history and physical examination were performed for all eligible participants. Approximately 5 mL of venous blood was collected under aseptic precautions and sent for lipid profile analysis. The collected data were recorded in Microsoft Excel and analyzed using appropriate statistical software. Results were expressed in the form of percentages and proportions, and patient confidentiality was strictly maintained throughout the study.

Result & Observations

In this study, which was a prospective observational study, a total of 91 patients with chronic kidney disease who met the inclusion criteria were included. Clinical history, physical examination, and investigations such as renal function tests, ECG, ultrasonogram, fasting blood samples for lipid profile, etc., were done on all patients. The data collected were analyzed.

Table 1 Baseline Demographic and Clinical Characteristics of Study Participants (n = 91)

Variable	Category	Frequency(n)	Percentage (%)
Age Group (years)	18–20	1	1.1
	21–40	14	15.38
	41–60	46	50.55
	61–80	30	32.97
	Total	91	100
Mean Age ± SD	53.35 ± 13.58 years		
Gender	Male	56	61.54
	Female	35	38.46
	Total	91	100
BMI (kg/m²)	Mean ± SD	24.57 ± 2.91	
Smoking / Tobacco Abuse	Yes	27	29.67
Alcohol Consumption	Yes	36	39.56
P value (Smoking vs Alcohol)	0.213		
Diabetes Mellitus	Yes	38	41.76
	No	53	58.24
Hypertension	Yes	71	78.02
	No	20	21.98
P value (DM vs HTN)	<0.001		

In the basic demographic and clinical characteristics the majority of patients belonged to the 41-60 years age group, accounting for 50.55%, followed by 61-80 years, accounting for 32.97%, and 21-40 years, accounting for 15.38%. The mean age was 53.35 ± 13.58 years. Male patients outnumbered female patients, accounting for 61.54%, compared to 38.46% female patients. The mean BMI was 24.57 ± 2.91 kg/m². Among the patients, 29.67% of patients had a history of smoking or tobacco use, while 39.56% of patients were consuming alcohol. However, there was no statistically significant association, p = 0.213. Among the patients, 41.76% were suffering from diabetes mellitus, while a major proportion, 78.02%, of the patients were suffering from hypertension. There was a statistically significant association, p < 0.001. (Ref Table 1)

The distribution of chronic kidney disease (CKD) among the participants revealed a preponderance of mid to advanced stages of CKD. The largest number of patients, 35 (38.46%), had Stage 3 CKD, followed closely by 33 patients (36.26%) who had Stage 4 CKD. Stage 5, which is also referred to as end-stage renal disease, had 11 patients (12.09%). The number of patients with early-stage CKD was small, with only 8 patients (8.79%) having Stage 2 CKD, while 4 patients (4.40%) had Stage 1 CKD. (Ref Fig 1)

The renal function of the study subjects was measured using serum creatinine and eGFR. The mean serum creatinine was 2.75 ± 1.47 mg/dL, ranging from 1 to 8.6 mg/dL. The mean eGFR was 32.86 ± 19.85 mL/min/1.73 m², ranging from 7 to 98 mL/min/1.73 m². These values indicated that the subjects had varying degrees of renal impairment.

Figure 1 - Distribution of Chronic Kidney Disease (CKD) Stages Among Study Participants

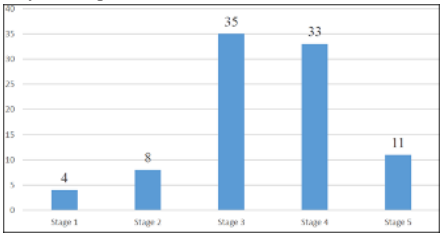

Table 2 Distribution of Serum Creatinine Levels Across Different Stages of CKD patients

Stages of CKD	N	Mean Serum Creatinine (mg/dL)	SD	P value
1	4	1	0.13	< 0.001
2	8	1.35	0.52	
3	35	1.9914	0.38	
4	33	3.0091	0.52	
5	11	6.0091	1.11	
Total	91	2.74	1.4	

The patients in stage 1 had a mean serum creatinine level of 1.00 ± 0.13 mg/dL, while the patients in stage 2 had 1.35 ± 0.52 mg/dL. The values increased in stage 3 (1.99 ± 0.38 mg/dL) and stage 4 (3.00 ± 0.52 mg/dL), while the highest value was recorded in stage 5 (6.00 ± 1.11 mg/dL). The overall mean serum creatinine in the patients was 2.74 ± 1.4 mg/dL. The values were statistically significant (p < 0.001), indicating the progression of the disease and the worsening renal function in the patients. (Ref Table 2)

In the study of the lipid profile parameters of the study participants. The mean value of triglyceride was 184.19 ± 52.95 mg/dL, ranging from 105 to 320 mg/dL. The mean value of total cholesterol was 181.7 ± 33.53 mg/dL, ranging from 130 to 180 mg/dL. The mean value of HDL-C was 37.4 ± 6.36 mg/dL, ranging from 24 to 53 mg/dL. The mean value of LDL-C was 107.70 ± 29.61 mg/dL, ranging from 50 to 192 mg/dL. The mean value of VLDL-C was 37.02 ± 10.52 mg/dL, ranging from 21 to 64 mg/dL. The results revealed abnormalities in lipid levels among patients with chronic kidney disease.

The mean values of the lipid profiles at various stages of CKD. With the progression of CKD stages, the values of triglycerides, total cholesterol, LDL cholesterol, and VLDL cholesterol increased, while the values of HDL cholesterol showed a gradual decline. The patients with CKD at stage 1 had nearly normal values of the lipid profiles. The patients with CKD at stage 5 showed significantly increased values of triglycerides (275.90 ± 36.38 mg/dL), total cholesterol (219.90 ± 12.37 mg/dL), LDL cholesterol (138.25 ± 9.10 mg/dL), and VLDL cholesterol (55.18 ± 7.27 mg/dL), along with significantly decreased values of HDL cholesterol (29.90 ± 4.34 mg/dL). The mean values of the lipid profiles were triglycerides 184.18 ± 53.24 mg/dL, total cholesterol 181.70 ± 33.71 mg/dL, HDL cholesterol 37.39 ± 6.39 mg/dL, LDL cholesterol 107.70 ± 29.61 mg/dL, and VLDL cholesterol 37.01 ± 10.57 mg/dL. The relationship between the stages of CKD.

Table 3 Correlation Between Lipid Profile Parameters and Estimated Glomerular Filtration Rate (eGFR)

eGFR	Triglycerides	Total Cholesterol	HDL	LDL	VLDL
Pearson Correlation	-0.501	-0.513	0.693	-0.399	-0.501
P value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
N	91	91	91	91	91

Table 3 indicates the correlation between estimated glomerular filtration rate (eGFR) and lipid profile parameters. There was a significant negative correlation between eGFR and triglycerides, total cholesterol, LDL, and VLDL. This indicates that these levels of lipids increase with a reduction in eGFR. However, a significant positive correlation was noted between HDL and eGFR. This indicates that HDL reduces with a reduction in eGFR. All these values were statistically significant (p < 0.001). This indicates a strong correlation between a reduction in eGFR and dyslipidemia in patients with chronic kidney disease.

Table 4 Comparison of Lipid profile parameters at baseline and after 3-month follow-up

Lipid Parameter	Baseline (Mean ± SD)	3 Months (Mean ± SD)	P-value
HDL-C (mg/dL)	37.39 ± 6.39	35.38 ± 7.13	< 0.001
Triglycerides (mg/dL)	184.18 ± 53.24	189.43 ± 51.69	< 0.001
VLDL-C (mg/dL)	37.01 ± 10.57	38.04 ± 10.37	< 0.001
Total Cholesterol (mg/dL)	181.70 ± 33.71	184.25 ± 28.45	< 0.001
LDL-C (mg/dL)	107.70 ± 29.61	111.02 ± 25.53	< 0.001

Table 4 illustrates a comparison of lipid profile levels at baseline and after 3 months in patients with chronic kidney disease. There was a decrease in HDL-C levels, while an increase was observed in triglycerides, VLDL-C, total cholesterol, and LDL-C levels after 3 months. However, all these changes were significant at $p < 0.001$.

DISCUSSION

Chronic kidney disease (CKD) is a progressive disorder associated with multiple metabolic abnormalities, among which dyslipidemia plays a significant role in increasing cardiovascular morbidity and mortality. The present study was conducted to evaluate lipid profile abnormalities in patients with CKD and to assess their correlation with disease severity.

In the present study of 91 CKD patients, the mean age was 53.35 ± 13.58 years, with most patients belonging to the 41–60 years age group, indicating that CKD predominantly affects middle-aged and elderly individuals. Similar findings were reported by Saini M et al. (2022) , although their cohorts had slightly lower mean ages.[11] A male predominance (61.54%) was observed in our study, which is consistent with the reports of Singh P et al. (2015) and Bhushan et al. (2021).[12,13] The mean BMI was 24.57 ± 2.91 kg/m², comparable to the findings of Saini M et al. (2022) and Bhushan et al. (2021), suggesting that most CKD patients fall within the normal to mildly overweight range.[11,13]

Regarding lifestyle habits, 29.67% of patients had a history of smoking or tobacco use, while 39.56% reported alcohol consumption. The association between these habits and CKD severity was not statistically significant ($p = 0.213$). Similar findings were reported by Saini M et al. (2022) and Bhushan et al. (2021), who also observed no significant association between smoking or alcohol intake and CKD progression in their cohorts.[11,13]

Comorbid conditions were highly prevalent in the present study. Hypertension was observed in 78.02% of patients, while diabetes mellitus was present in 41.76%. The association between these comorbidities and CKD was statistically significant ($p < 0.001$). These findings are consistent with previous studies, including Bhushan et al. (2021) and Saini M et al. (2022), which also reported hypertension and diabetes as the most common comorbidities among CKD patients. Hypertension plays a dual role as both a cause and consequence of CKD, while diabetes contributes significantly to diabetic nephropathy, one of the leading causes of renal failure.[11,13]

In terms of disease severity, most patients in the present study were in stage 3 (38.46%) and stage 4 (36.26%) CKD, with fewer patients in the earlier stages. Similar stage distributions were reported by Ganta V et al. (2016) and Bhushan et al. (2021), where a large proportion of patients presented in advanced stages of CKD. This pattern suggests that CKD is often diagnosed late, emphasizing the need for early screening and timely intervention.[14,13]

The assessment of renal function showed that the mean serum creatinine level was 2.75 ± 1.47 mg/dL, while the mean eGFR was 32.86 ± 19.85 mL/min/1.73 m², indicating moderate to severe renal impairment in many participants. Serum creatinine levels increased progressively across CKD stages, reaching 6.00 ± 1.11 mg/dL in stage 5, with a statistically significant difference ($p < 0.001$). Similar observations were reported by Phukan RR et al. (2017), who also noted higher creatinine levels in advanced CKD stages.[15]

The lipid profile analysis in the present study demonstrated significant dyslipidemia among CKD patients. The mean triglyceride level was 184.19 ± 52.95 mg/dL, total cholesterol was 181.7 ± 33.53 mg/dL, HDL-C was 37.4 ± 6.36 mg/dL, LDL-C was 107.70 ± 29.61 mg/dL, and VLDL-C was 37.02 ± 10.52 mg/dL. This pattern of elevated triglycerides and VLDL-C with reduced HDL-C is typical of CKD-associated dyslipidemia. Similar findings were reported by Bhushan et al. (2021) and Panesar S et al. (2012), who also observed hypertriglyceridemia and reduced HDL levels in CKD patients.[13,16]

Further analysis showed that lipid abnormalities worsened with advancing CKD stages. Triglycerides, total cholesterol, LDL-C, and VLDL-C increased progressively, while HDL-C decreased significantly as CKD severity increased ($p < 0.001$). These findings are consistent with the results reported by Ganta V et al. (2016) and Bhushan et al. (2021), who also demonstrated worsening dyslipidemia in advanced CKD stages.[14,13]

Correlation analysis revealed that eGFR had a significant negative correlation with triglycerides, total cholesterol, LDL-C, and VLDL-C, while HDL-C showed a positive correlation with eGFR. This indicates that lipid abnormalities worsen as renal function declines. Similar correlations were reported by Karma KS et al. (2024) and Moorhead et al., who demonstrated that impaired renal function leads to disturbances in lipid metabolism.[17,18]

A follow-up comparison between baseline and 3-month lipid profiles in the present study revealed a significant decline in HDL-C and slight increases in triglycerides, LDL-C, VLDL-C, and total cholesterol ($p < 0.001$). These findings suggest a progressive shift toward an atherogenic lipid profile in CKD patients over time. Similar observations were made by Karma KS et al. (2024), who reported worsening lipid abnormalities during follow-up in CKD patients.[17]

Overall, the findings of the present study demonstrate that dyslipidemia is common in CKD patients and becomes more pronounced with declining renal function. These lipid abnormalities significantly increase the risk of cardiovascular disease, which is the leading cause of mortality in CKD patients. Therefore, early detection and management of dyslipidemia are essential to reduce cardiovascular complications and slow the progression of renal disease.

CONCLUSION

The present prospective observational study concludes that lipid profile abnormalities are highly prevalent among patients with chronic kidney disease (CKD) and their severity increases with the progression of the disease. The most common lipid abnormalities observed were elevated triglycerides, increased VLDL and LDL levels, along with reduced HDL-C levels, forming an atherogenic lipid profile. A significant association was found between declining renal function and worsening dyslipidemia, indicating that lipid metabolism disturbances become more pronounced as CKD advances.

These lipid abnormalities play an important role in increasing the risk of cardiovascular morbidity and mortality, which remains the leading cause of death in CKD patients. Therefore, early detection, regular monitoring of lipid profile, and timely management of dyslipidemia through lifestyle modification and appropriate pharmacological therapy are essential. Addressing these abnormalities may help reduce cardiovascular complications and improve the overall prognosis and quality of life of patients with chronic kidney disease.

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