

Lipid abnormalities in patient with chronic kidney disease: a cross sectional study

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ABSTRACT

Introduction: Chronic Kidney disease (CKD) is a public health problem with an increasing incidence and prevalence, poor outcomes, and high cost. Renal disease, in early as well as advanced stages, is associated with abnormalities in lipoprotein metabolism. Dyslipidemia appears to be independently associated with increased progression rate of CKD in patients with kidney disease and with increased risk of graft loss after renal transplantation. This study was conducted to study the lipid abnormalities in CKD patients.

Methodology: A hospital-based, observational, cross-sectional study was conducted among 89 patients admitted in the ward of Bir Hospital with the diagnosis of CKD. Data was collected using the structured pro-forma. Data was analyzed using SPSS version 16. Descriptive statistics (Frequency, mean and percentage) was used.

Results: In this study the average value of total cholesterol (TC), triglyceride, low density lipoprotein (LDL) and high-density lipoprotein (HDL) were 246.66 ± 53.56 , 215.78 ± 80.70 , 168.61 ± 44.73 , 35.77 ± 5.26 respectively. In this study there is significant association between HDL, LDL, triglyceride (TG) & total cholesterol with smoking with p value of 0.001, 0.003, 0.001 & 0.003048 respectively. Similarly there is also significant relationship between HDL, LDL, TG & total cholesterol with age with p value of 0.001, 0.048, 0.010 & 0.048 respectively.

Conclusion: Hypertriglyceridemia and low HDL and LDL are the common lipid abnormalities in CKD patients.

ARTICLE INFORMATION	Source of Support: Nil	Conflict of Interest: None
Received: 13 July 2022	Accepted: 20 August 2022	Published Online: 30 August 2022
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INTRODUCTION

The National Kidney Foundation (NKF) proposes the following definition and categorization of chronic kidney disease CKD: kidney damage or a glomerular filtration rate (GFR) of less than 60 mL/min/1.73 m² for three months or more, regardless of etiology.¹ Individual's fasting serum contains three major classes of lipoproteins: low density lipoproteins (LDL), high density

lipoproteins (HDL), and very low density lipoproteins (VLDL).²

Renal illness is linked to changes in lipoprotein metabolism in both early and advanced stages. Dyslipidemia appears to be linked to a higher rate of CKD development in individuals with kidney disease, as well as a higher risk of graft loss after renal transplantation.^{3,4} Retention of a circulating inhibitor of lipoprotein lipase, such

as pre-beta-high density lipoprotein, is another proposed reason for hypertriglyceridemia in CKD.⁵

High triglyceride and low high-density lipoprotein (HDL) cholesterol levels, accumulation of remnant particles, a predominance of small dense low-density lipoprotein (LDL) particles, and increased levels of lipoprotein A are all symptoms of dyslipidemia, which is a common complication of progressive kidney disease. LDL and HDL particles undergo oxidative alteration in patients with advanced chronic kidney disease (CKD), resulting in the development of tiny lipoproteins and increased production of oxidized LDL.⁶

A hospital-based cross-sectional study was conducted in Kathmandu, Nepal, to determine the prevalence of dyslipidemia in patients with various stages of CKD. The findings revealed a significant difference in mean blood total cholesterol, HDL, LDL, and TG levels between CKD and non-CKD groups (*p* value 0.05). When compared to non-CKD controls, CKD patients had a greater prevalence of dyslipidemia. Dyslipidemia can also be detected in the early stages of CKD.⁷ Renal insufficiency is linked to abnormalities in lipoprotein metabolism in both early and advanced stages of chronic renal failure, according to a study conducted in the United States, which includes changes in Apo lipoprotein A and B containing lipoproteins, High-density lipoproteins and triglyceride. These lipid abnormalities are significant risk factors for cardiovascular disease.⁸ Lipid abnormalities in CKD patients are linked to an increased risk of cardiovascular death. In the patient with CKD, cardiovascular illness is the major cause of death.² In Nepal, there is a paucity of data. So, the researcher wants to conduct a study to detect specific type of lipid abnormality in

MATERIALS AND METHODS

Hospital-based, Observational, cross-sectional study was conducted in National Academy of Medical Sciences (NAMS), Bir Hospital, Medicine and Nephrology department among CKD patients.

Sample size was calculated using the formula, Sample size $n = Z^2pq/r^2$ where *n* = number of subject required, *Z* = value of normal deviation where the considered level of confidence = 1.96, *P* = prevalence = 35.58%, *q* = 1-*p* = 0.6442, *r* = margin of error at 10% and at 95% Confidence Interval, $Z_{0.05}$, $\alpha = 1.96$. So, sample of the study was 89.

Sample units were conveniently selected. Cases of CKD were diagnosed on the basis of history, clinical examination, USG abdomen and RFT. Lipid profile and CKD staging was categorization as per “the ATP III guideline recommendations” and also based on literature.^{9,10}

The established cases of CKD on conservative or dialysis treatment were taken as study participants. The patients on lipid-lowering agents, Beta-blockers, thiazide diuretics and corticosteroids, patients with a known history of familial hyperlipidemia, ARF and nephrotic syndrome and female patients who were pregnant were excluded from the study. The ethical clearance was taken from IRC of NAMS before the study was done. Confidentiality and anonymity was maintained.

Data was collected from the patients discharge sheet using the structured pro-forma including name, age, gender and any systemic illness. Descriptive analysis like mean, standard deviation and percentage were calculated to describe the characteristics of CKD patients. Similarly, the chi-square test was used to assess the statistical association between variables. The significance level was determined at a *p*-value less than 0.05.

RESULTS

In this study, the mean age (Mean $\pm$ SD) of the patients was 46.53 $\pm$ 16.4. In this study total of 89 patients were included among which none were in stage 1 CKD and the rest are in stage 2 to 5. (Table 1) It was found that the average value of the total cholesterol was 246.66 mg/dl, triglycerides were 215.78mg/dl, HDL was 35.77 and LDL was 168.61. (Table 2)

Table 1: Staging of CKD of the patients¹¹

Staging of CKD	Frequency (n)	Percentage (%)
Stage 2	1	1.1
Stage 3	15	16.9
Stage 4	21	23.6
Stage 5	52	58.4

Table 2: Mean of components of lipid parameters of patients with CKD

Lipid Components	Mean $\pm$ SD
Total Cholesterol	246.66 $\pm$ 53.56
Triglycerides	215.78 $\pm$ 80.70
LDL	168.61 $\pm$ 44.73
HDL	35.77 $\pm$ 5.26

Table 3: Association of HDL and LDL with Different Variables

Variables		HDL		p-value
		Low(<40mg/dl)	Normal ($\geq$ 40mg/dl)	
Diabetes	No	44(60.3%)	29(39.7%)	0.03
	Yes	14 (87.5%)	2(12.5%)	
Smoking	No	15(38.5%)	24(61.5%)	0.001
	Yes	43(86.0)	7(14.0%)	
Age	<Mean Age	19(44.2%)	24(55.8%)	0.001
	$\geq$ Mean Age	39 (84.8%)	7(15.2%)	
Variables		LDL		p-value
		Normal(<130mg/dl)	High ($\geq$ 130mg/dl)	
Age	<Mean Age	13 (30.2%)	30 (69.8%)	0.048
	$\geq$ Mean Age	6 (13.0%)	40 (87.0%)	
Smoking	No	14(35.9%)	25(64.1%)	0.003
	Yes	5(10.0%)	45(90.0%)	

The study revealed that diabetes, smoking, and age of the CKD patients had a statistically significant association with their HDL i.e. p -value=0.03, 0.001 & 0.001 respectively. Similarly, age and smoking had a statistically significant association

with LDL levels. (Table no.3). This study displayed that age and smoking had statistically significant associations with TG and total cholesterol levels. (Table 4)

Table 4: Association of TG and Total Cholesterol Level with Different Variables

Variables		TGL		p-value
		Normal(<150mg/dl)	High ($\geq$ 150mg/dl)	
Age	<Mean Age	13(30.2%)	30(69.8%)	0.010
	$\geq$ Mean Age	4(8.7%)	42(91.3%)	

Smoking	No	15(38.5%)	24(61.5%)	0.001
	Yes	2(4.0%)	48(96.0%)	
Variables		Total Cholesterol Level		p-value
		Normal (<200mg/dl)	High (≥200mg/dl)	
Age	<Mean Age	13(30.20%)	30(69.8%)	0.048
	≥Mean Age	6(13.0%)	40(87.0%)	
Smoking	No	14(35.9%)	25(64.1%)	0.003
	Yes	5(10.0%)	45(90.0%)	

DISCUSSION

This study shows that the mean age of the participants was 46.53 ± 16 which is similar with the study conducted by Shah B et al. where the mean age of participants was 45 ± 17 years.¹²

There are 5 stages of CKD but in this study most of the patients were detected late in the course of the disease. Out of 89 patients, 1.1% patients were in stage II, 16.9% patient was in stage III, 23.6% were in stage IV and 58.4% were in stage V respectively. This shows that CKD is not usually recognized until it is moderately severe, at least in this part of the country. The finding of study dispute with the finding of study done in US population¹³ showed that prevalence of CKD 6% at stages 1st and 2nd and only 4.5% on stages 3rd and 4th. This is due to a more careful healthcare seeking behavior of the developed countries patients.

CKD results in profound lipid disorders, due to dysregulation of HDL and TG rich lipoprotein metabolism resulting in alteration of clearance of triglyceride-rich lipoproteins and their atherogenic remnants causing increase concentrations in CRF.¹⁴ Patients with CKD have decreased HDL in comparison with individuals with preserved kidney function. This state places them at higher risk for atherosclerosis development.¹⁵ Similarly in our study; TG was found to be in higher side 215.78 ± 80.70 mg/dl with mean value of HDL was 35.77 ± 5.26 mg/dl which was accord with the study conducted by Mikolasevic I et al. and Poudel B et al..^{15,7} Similarly study done by Ravichandran et al. showed serum triglycerides to be elevated in all

renal failure patients ($p < 0.02$).¹⁶ Study done by Shah et al. also showed that TG level was higher among CKD patients who are on conservative treatment rather than patients on dialysis or post-transplant which has not been explored in our study. Whereas TC, HDL and LDL levels in CKD patients were not different than control groups.¹²

In our study the average value of the TC observed was 246.66 ± 53.56 mg/dl, while that of the LDL was 168.61 ± 44.73 mg/dl. The finding of the study was dispute with the finding of study conducted in USA and India.^{12,13} Whereas, similar finding was seen in study conducted by Poudel et al. among Nepalese population which showed TC levels > 240 mg/dl and LDL > 130 mg/dl among CKD patients.⁷

This study shows that TG and TC were high among smokers whereas HDL level was low among smokers which was similar to study done by Mouhamed et al. which showed significant increase in TG and TC in smokers compared to non-smokers, whereas HDL appeared to be low.¹⁷ Similar finding was also seen in study done by Tan et al. among Chinese population where levels of TGs were shown to be significantly higher and HDL was lower among smokers.¹⁸ In this study there was a significant association between age more than and less than mean value with HDL level being low in above mean age whereas LDL, TG and TC level appeared to be higher above mean age. This finding was similar other studies.¹⁹⁻²¹ Thus; hyperlipidemia seems to be present in patients with CKD.

The limited number of patients under a limited time duration was major limitation of our study. Apart from this, we could not have control

group and the genetic association was studied in our study.

CONCLUSION

CKD results in profound lipid disorders, due to dysregulation of HDL and TG rich lipoprotein metabolism resulting in alteration of clearance of triglyceride-rich lipoproteins and their atherogenic remnants causing increase concentrations in CKD patients. Thus, causing high triglycerides and low HDL levels with normal or slightly reduced

cholesterol and LDL. Whereas in our study Hypertriglyceridemia, high LDL and high TC with low HDL were seen. This might be due to various stages of CKD patients with variable amount of proteinuria. It is recommended to conduct the study in larger scale with larger sample size and for longer duration.

Acknowledgement: I would like to acknowledge Prof. Dr. Manen Prasad Gorkhal for his constant support and guidance for the completion of this research work.

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