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Lipid Profile in Different Stages of CKD: A Cross-Sectional Study

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Abstract
Cardiovascular disease is a major cause of morbidity and mortality among patients with chronic kidney disease. Dyslipidemia is a common complication in CKD patients and is associated with the decline in GFR. A cross-sectional, observational study was conducted in 60 CKD patients in different stages and 50 healthy population. Total cholesterol, HDL, LDL and Triglyceride were analysed in all the subjects. Triglyceride, total cholesterol and LDL were significantly increased while, HDL was significantly decreased in the CKD patients. Early diagnosis and management of dyslipidemia in CKD patients is important for positive outcome.

Keywords: *Chronic kidney disease, HDL, LDL, total cholesterol, triglyceride.*

Introduction

Chronic kidney disease (CKD) is one of the leading public health problems today, with increasing frequency and prevalence. It is characterized by an irreversible deterioration of renal function, which results from diminished effective functioning of the renal tissue. According to the Kidney Disease Outcomes Quality Initiative (K/DOQI), CKD is defined as kidney damage or a decreased kidney glomerular filtration rate (GFR) of <60 mL/min/1.73m^2 for at least 3 months[1,2].

Cardiovascular disease is a major cause of morbidity and mortality among patients with chronic kidney disease[3]. These patients of CKD are more likely to die because of CVD than develop ESRD[4,5]. It has been recognized that dyslipidemia is a major risk factor for coronary heart disease and all these findings has prompted interest in the identification and management of abnormalities in plasma lipids and lipoproteins.

Lipids are heterogeneous and fundamental biological molecules. These have energetic roles, are involved in cellular membrane function and synthesis of so many important biomolecules like bile acids, steroid hormones and vitamin D. These circulating lipids being non-polar, are transported by lipoproteins. Lipoproteins are hydrophilic particles composed of a lipid nonpolar core of triglycerides and esterified cholesterol, enveloped by apolipoproteins, phospholipids and others polar lipids[6].

Dyslipidemia is a common complication in CKD patients and is associated with the decline in GFR; hence, lipid profile depends on the level of kidney function and the degree of proteinuria[7,8] Patients with non-dialysis-dependent CKD and without nephrotic syndrome have low HDL and high

triglycerides and normal or even low total cholesterol and LDL cholesterol. This spectrum holds behind itself a more atherogenic profile which includes increased apolipoprotein B (apoB), lipoprotein (a) (Lp (a)), intermediate- and very-low-density lipoprotein (IDL cholesterol, VLDL cholesterol; "remnant particles"), and small dense LDL particles. Also, in patients with more severe CKD, LDL, and HDL particles are often modified by the oxidative process, that further leads to the formation of small lipoproteins and increased formation of oxidized LDL[9,10].

Material & Methods

A cross-sectional, observational study was conducted in the Department of General Medicine, NMCH, Patna. For this study, 60 patients in different stages of CKD were selected between 25 -75 years of age. As control group, 50 age and gender matched healthy volunteers were enrolled. Patients on dialysis or with any congenital renal anomaly were excluded from the study. Blood samples were collected from the participants after an overnight fast .Serum lipid profile was estimated by enzymatic method on automated analyzer. Estimated glomerular filtration rate (eGFR) was calculated as 175× (Scr)−1.234 × (Age)−0.179 × (if female, × 0.79). Physical examination included blood pressure measurement and anthropometric measurements like body weight, waist circumference and BMI. Written informed consent was taken from all the participants.

All the statistical data are expessed as mean ± 1SD. SPSS software was used for data analysis. P value <0.05 is considered statistically significant.

Results

The number of male and female in control group were 29 and 21 respectively. There were 22 females and 38 males in the CKD patients. The mean age of the CKD patients was 54.6 years and that of the control group was 55.8 years.15 patients were found to be in CKD stage 1. Similarly, the number of patients in other stages of CKD were 5, 27, 6 and 7 in stage 2, stage 3, stage 4 and stage 5 respectively.

The mean value of total cholesterol in CKD cases and control were 186 ± 37 and 136 ± 24 mg/dl respectively. HDL, LDL and Triglyceride in CKD subjects were 31± 8 mg/dl,118 ±34 mg/dl and 166± 45 mg/dl respectively.LDL and TG were significantly increased while the value of HDL was found to be decreased significantly in the CKD cases.

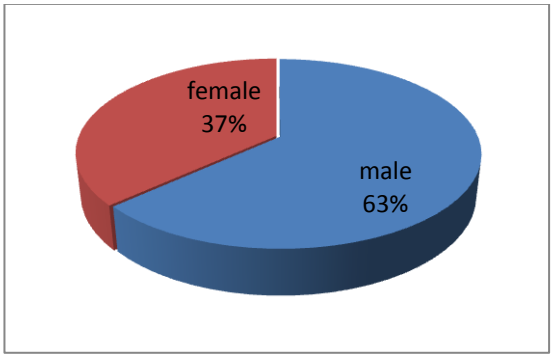

Fig 1 Gender wise distribution of cases

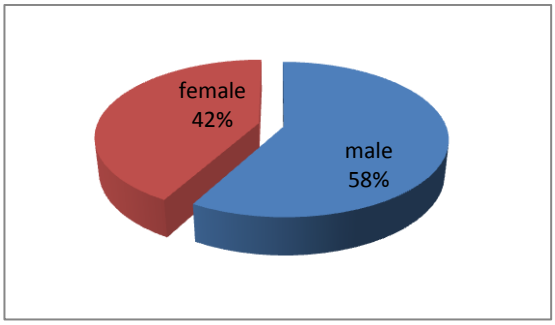

Fig 2 Gender wise distribution of control

Table 1 Distribution of cases in different stages of CKD

stages	Male	female	total
I	9	6	15
II	2	3	5
III	19	8	27
IV	2	4	6
V	3	4	7

Table 2 Different lipid parameters (mg/dl) in case and control group

Lipid parameters	Cases	control	p value
TC	186 ± 37	156 ± 24	<0.01
HDL-C	31 ± 8	42 ± 12	<0.01
LDL-C	118 ± 34	97 ± 23	0.003
TG	166 ± 45	124 ± 32	<0.001

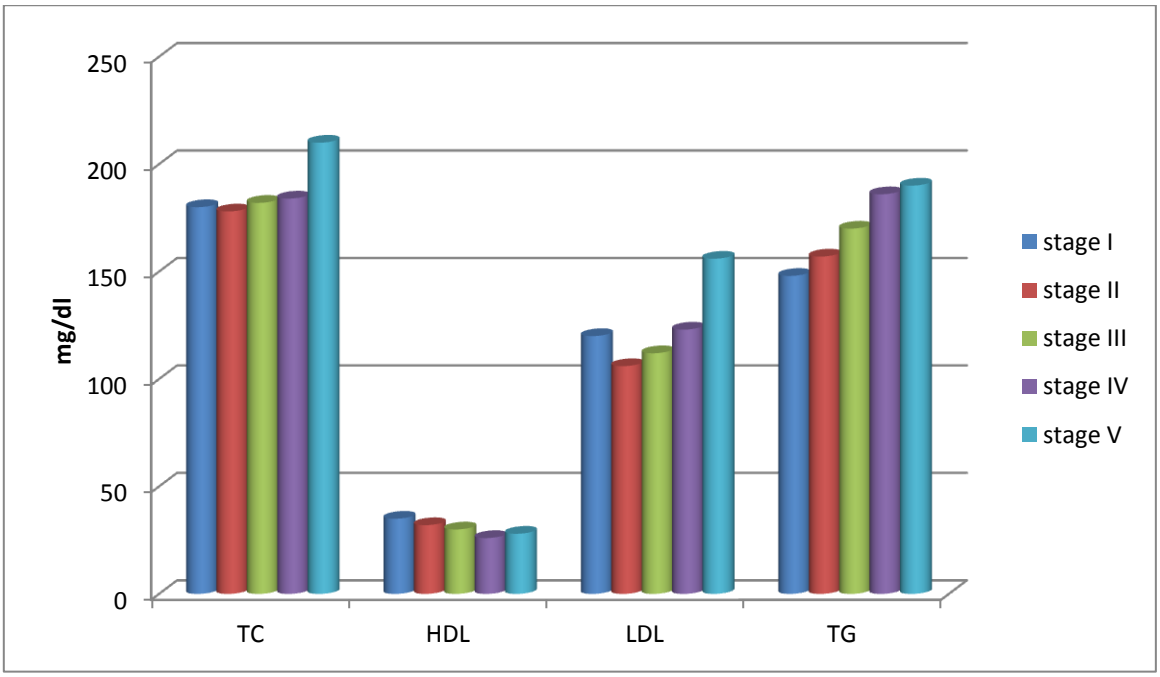

Fig 3.Lipid profile in different stages of CKD

Discussion

There was increase of serum total cholesterol in patients as CKD stage progressed but this was not statistically significant (p =0.8). P.O. Attman et al in their study showed no significant change in levels of total cholesterol.

There was increase in the level of serum LDL in patients as CKD progressed but this was not found to be statistically significant (p > 0.1). In our study, triglyceride value in CKD patients were found to be high anda rising trend was seen as the stage of CKD progressed. But this rising trend was not statistically significant (p value >0.12).

According to Attman P.O, Alaupovic P, hypertriglyceridemia is the most common plasma lipid abnormality in patients of chronic renal failure.

P.O. Attman et al found that there was decrease in plasma HDL cholesterol concentration in patients with CRF. It was reported that decreased HDL was associated with decrease in the fractional catabolic rate and the total synthetic rate of Apo A /HDL. The slow fractional catabolic rate of Apo A in patients with chronic renal failure could be a primary event resulting from a decrease in synthesis or secretion of Apo A1.

Patients with CKD have decreased HDL level in comparison with individuals with normal kidney function. This state predisposes them at higher risk for atherosclerosis development. Patients with impaired kidney function often have decreased levels of apolipoproteins A-I and A-II, which are the main components of HDL. Furthermore, in CKD patients, the activity of lecithin–cholesterol acyltransferase, the key enzyme for the esterification of free cholesterol in HDL, is impaired. On the other hand, the activity of cholesterol ester transfer protein, which helps in the transfer of cholesterol esters from HDL to triglyceride-rich lipoproteins, is increased. All these processes are in together, responsible for the decreased serum level of HDL. These factors may thus contribute to accelerated atherogenesis in this specific population[12-14]. In this study, serum HDL fraction was significantly low in CKD patients as compared to the control group(p <0.01). Among the CKD group, there was gradual decline in HDL level as the renal impairment progressed, but this was not found to be statistically significant (p > 0.1).

Shah B et. al., studied the impact of lipid abnormalities in patients with chronic renal failure and in renal transplants. In their study they

observed increase in triglyceride levels in chronic renal failure patients compared to controls. But no change in total cholesterol, HDL and LDL level were seen by them.

Koch et.al., showed association between the history of coronary artery stenosis and dyslipidemia in patients with CKD. They observed that Lp(a) levels were increased along with decreased HDL, but no change in total cholesterol, LDL and triglyceride levels were observed by them.

In their review article Mikolasevic et al have concluded that dyslipidemia is often present in patients with renal impairment and there is both qualitative and quantitative difference in the degree of dyslipidemia in non dialysis-dependent patients, patients with nephrotic range proteinuria, ESRD patients, and renal transplant recipients.

Conclusion

Dyslipidemia is a common finding in patients with renal impairment with high total cholesterol, triglyceride and low HDL level. It can further detoriorate the kidney function and significantly increase the risk of CVD development. Thus, early diagnosis of dyslipidemia and management of these patients are important to potentially improve their clinical outcome.

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