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ASSESSMENT OF LIPID PROFILE IN CHRONIC KIDNEY DISEASE PATIENTS: A CROSS-SECTIONAL STUDY AT A TERTIARY CARE HOSPITAL

Internal Medicine

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KEYWORDS

INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive and irreversible deterioration of renal function occurring over a period of months to years, often arising from diabetes, hypertension, infections, autoimmune conditions, and exposure to nephrotoxic agents.[2] It is defined by a glomerular filtration rate (GFR) of less than 60 ml/min/1.73 m^2 for a duration exceeding three months, accompanied by markers of kidney damage such as proteinuria, hematuria, or structuralabnormalities.[3] CKD is associated with numerous systemic complications including hematological disorders, cardiovascular disease, metabolic imbalances, gastrointestinal and neurological dysfunctions, and endocrine disturbances.[4] Dyslipidemia is a frequent metabolic manifestation in CKD, particularly in advanced stages, and contributes to disease progression as well as cardiovascular morbidity.[5] Early renal impairment shows abnormal lipoprotein metabolism, with increasing triglyceride (TG) levels and decreasing HDL concentrations, while LDL levels remain normal or modestly altered.[6] The pathophysiology involves impaired clearance of triglyceride-rich lipoproteins due to reduced activity of lipoprotein lipase and hepatic triglyceride lipase.[7] Moreover, LDL oxidation, glycation, and carbamylation result in endothelial dysfunction and glomerular injury via macrophage recruitment and cytokine-mediated inflammation, promoting glomerulosclerosis.[8] Patients with CKD also demonstrate elevated levels of small dense LDL, a known risk factor for atherosclerosis.[9] An increase in plasma homocysteine, especially in dialysis patients, adds to the cardiovascular burden.[10] Studies suggest that lipid profile disturbances are not only prevalent but also worsen with progression to end-stage renal disease (ESRD), and these changes are more profound in patients undergoing hemodialysis.[11] Given the high cardiovascular mortality observed in ESRD, especially in hemodialysis patients, it is imperative to evaluate and monitor lipid fractions routinely in CKD management.[12] This study was conducted at a tertiary care center in Mathura to assess the abnormalities in lipid profile among CKD patients and examine how these changes correlate with disease severity and treatment modality.

METHODOLOGY

This was a hospital-based, cross-sectional observational study conducted from February 2023 to February 2024 at the General Medicine Department of Krishna Mohan Medical College and Hospital, Mathura. Ethical clearance was obtained and informed consent was collected from all participants.

Study Population

A total of 100 CKD patients aged between 15 and 80 years, diagnosed based on NKF-KDOQI criteria, were included. CKD was confirmed through biochemical markers and/or imaging demonstrating kidney damage persisting for more than 3 months. Patients on lipid-lowering drugs or with conditions influencing lipid metabolism were excluded.

Data Collection and Analysis

Participants underwent detailed history-taking, clinical examination, and laboratory tests, including lipid profile (Total Cholesterol, Triglycerides, HDL, LDL, VLDL), serum creatinine, EGFR, and blood urea levels. The data were statistically analyzed to observe associations between CKD stages and lipid parameters using p-values (significance set at <0.05).

Observations

A total of 100 patients with chronic kidney disease (CKD) were enrolled in the study. Among them, 64% were males and 36% were females. The majority of the patients (28%) were within the age group of 51–60 years, followed by 17% each in the age ranges of 71–80 and 81–90 years. A considerable proportion of patients had associated comorbidities, with 54% having a history of hypertension and 46% having diabetes mellitus. Additionally, 67% of the patients were anemic, and 29% were receiving maintenance hemodialysis at the time of evaluation.

In terms of CKD staging, no patients belonged to grade 1. Grade 5 CKD accounted for the largest group (40%), followed by grade 3 (28%), grade 4 (20%), and grade 2 (12%). This trend reflects that more symptomatic patients present at later stages, consistent with the iceberg nature of CKD where earlier stages often remain undetected due to lack of symptoms.

A consistent pattern was observed between disease progression and renal function markers. There was a statistically significant inverse relationship between estimated glomerular filtration rate (eGFR) and CKD grade, with values declining progressively as CKD advanced. Conversely, blood urea and serum creatinine levels showed a significant incremental trend with worsening CKD grades, indicating declining renal clearance.

Importantly, a pattern of dyslipidaemia emerged, where elevated total cholesterol, triglycerides, low-density lipoprotein (LDL), and very low-density lipoprotein (VLDL) levels were significantly associated with advanced CKD stages. High-density lipoprotein (HDL) levels demonstrated an inverse association, decreasing significantly as the CKD grade increased. These abnormalities were more pronounced among patients on haemodialysis as compared to those on conservative management.

Table1: Biochemical and Lipid Profile Parameters Across CKD Grades

Parameter	CKD Grade 2	CKD Grade 3	CKD Grade 4	CKD Grade 5
eGFR (ml/min/1.73 m^2)	70.25 ± 2.34	33.93 ± 2.68	22.35 ± 1.75	9.43 ± 1.9
Blood Urea (mg/dL)	50.60 ± 17.18	71.04 ± 26.4	100.70 ± 25.19	139.54 ± 26.15
Serum Creatinine (mg/dL)	1.02 ± 0.028	1.497 ± 0.243	3.19 ± 0.57	6.84 ± 1.33
Total Cholesterol (mg/dL)	166.67 ± 7.45	190.93 ± 12.2	195.40 ± 10.63	224.65 ± 10.01
Triglycerides (mg/dL)	136.33 ± 14.61	155.00 ± 13.30	170.75 ± 30.61	218.45 ± 25.28
HDL (mg/dL)	59.50 ± 3.92	46.11 ± 4.18	39.80 ± 3.28	34.95 ± 1.48
LDL (mg/dL)	83.42 ± 7.77	113.29 ± 12.78	114.85 ± 13.01	147.15 ± 10.91
VLDL (mg/dL)	20.58 ± 2.97	31.00 ± 4.19	34.90 ± 5.36	40.45 ± 2.57

DISCUSSION

CKD is a significant global health challenge, often presenting late due to the asymptomatic nature of its early stages.[3] In this study, 100 CKD patients were analyzed, with a higher prevalence observed among males (64%) and most cases concentrated in the 51–60 years age group. Hypertension (54%) and diabetes mellitus (46%) were the leading comorbid conditions, consistent with the known etiologies of CKD.[2]

Patients in advanced CKD stages showed significantly lower eGFR and elevated blood urea and serum creatinine levels, reflecting declining renal clearance.[4] These associations were statistically significant ($p < 0.001$) and consistent with previous literature on renal function deterioration in progressive CKD.[3]

Dyslipidemia was prominent, particularly hypertriglyceridemia (69%), followed by elevated LDL (66%), VLDL (65%), and total cholesterol (64%), while HDL was reduced in 60% of patients. These lipid abnormalities intensified with CKD stage, indicating a direct correlation with disease severity.[567]

The increased TG levels in CKD patients are attributed to reduced catabolism and increased hepatic production of VLDL, secondary to impaired lipase activity.[713] LDL levels also rose with disease progression, contributing to glomerular injury and atherosclerosis.[814] Elevated total cholesterol and VLDL levels reflect impaired lipid metabolism and are known risk factors for cardiovascular events in CKD.915

HDL levels decreased progressively, which is concerning due to HDL's role in reverse cholesterol transport and anti-inflammatory properties.[610] Its reduction has been identified as an independent risk factor for cardiovascular complications and CKD progression.[16]

Comparative analysis between patients on conservative management and those on hemodialysis revealed significantly higher TC, TG, LDL, and VLDL levels, and lower HDL in the dialysis group. These findings align with reports by Saini et al. and Zolezzi et al., who observed worsened dyslipidemia in dialysis patients due to oxidative stress and chronic inflammation.[1117]

CONCLUSION

This cross-sectional study highlights that:

- Dyslipidemia is prevalent among CKD patients.
- The severity of CKD is positively associated with elevated TC, TG, LDL, VLDL, and negatively associated with HDL.
- Patients on hemodialysis exhibited more profound lipid abnormalities compared to those on conservative treatment.
- These findings underscore the need for routine lipid monitoring and early management in CKD to mitigate cardiovascular risks.

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