JAMP

EXPLORING LIPID ABNORMALITIES AMONG INDIVIDUALS AFFLICTED BY CHRONIC KIDNEY DISEASE

Md Khalid Ansari[1], Sheereen Tarannum[2]

[1]Assistant Professor, Department of Biochemistry, Madhubani Medical College & Hospital, Madhubani, Bihar. India
Professor & HOD, Department of Biochemistry, Madhubani Medical College & Hospital, Madhubani, Bihar. India

Abstract
Background: Chronic Kidney Disease (CKD) is a pervasive health concern affecting millions worldwide, characterized by the progressive decline in kidney function. Emerging research has unveiled a complex interplay between CKD and lipid abnormalities, suggesting a bidirectional relationship that demands comprehensive investigation. Our study is aimed at exploring the intricate connections between lipid metabolism and CKD. **Materials and Methods:** Our study employed a cross-sectional design and it was conducted in the department of Biochemistry with collaboration of Medicine department at Madhubani Medical College & Hospital, during the period of January 2023 to July 2023, involving 50 CKD patients at various stages of the disease. Lipid profiles, including cholesterol fractions, triglycerides, and lipoprotein particles, were meticulously assessed. We investigated potential associations between lipid abnormalities and key clinical parameters, such as estimated glomerular filtration rate (eGFR), proteinuria, and CKD stage. **Result:** Preliminary findings reveal a high prevalence of lipid abnormalities in the CKD population, with significant alterations in lipid profiles as the disease progresses. Elevated levels of total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides were observed in advanced CKD stages, while high-density lipoprotein cholesterol (HDL-C) levels demonstrated a declining trend. A notable correlation was established between dyslipidemia and worsening renal function, as evidenced by lower eGFR values and higher proteinuria levels in individuals with more severe lipid abnormalities. **Conclusion:** This study underscores the intricate relationship between lipid abnormalities and CKD, emphasizing the need for tailored interventions addressing both lipid management and kidney disease progression. A deeper understanding of these interconnected pathways may pave the way for novel therapeutic strategies aimed at mitigating the cardiovascular risk burden among CKD patients, ultimately enhancing their overall quality of life.

INTRODUCTION

Chronic Kidney Disease (CKD) is a global health challenge of growing concern, characterized by the gradual loss of renal function over time. It is a multifaceted condition associated with an increased risk of cardiovascular morbidity and mortality, making it a pivotal public health.[1] Recent research has begun to illuminate the intricate relationship between lipid abnormalities and CKD, revealing a bidirectional connection that necessitates further exploration.

Dyslipidemia, characterized by alterations in lipid metabolism and lipoprotein profiles, is a common occurrence in CKD patients.[2] Lipid abnormalities such as elevated total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides, as well as reduced high-density lipoprotein cholesterol (HDL-C), are frequently observed in individuals afflicted by CKD.[3,4] These lipid perturbations are not only prevalent but also contribute to the increased risk of atherosclerosis and cardiovascular disease (CVD) in CKD patients.[5]

The interplay between CKD and lipid abnormalities is complex and multifactorial. CKD-induced inflammation, oxidative stress, and alterations in lipid metabolism all play a role in disrupting lipid homeostasis in these patients.[6-8] Moreover, the severity of lipid abnormalities often parallels the

638

progression of CKD, with more advanced stages of the disease associated with more pronounced dyslipidemia.[3]

Given the high prevalence of CKD and the substantial burden of CVD in this population, understanding the mechanisms underlying lipid abnormalities in CKD is critical for the development of targeted interventions. This study aims to explore the intricate connections between lipid metabolism and CKD, investigating the prevalence of lipid abnormalities and their association with clinical parameters, such as estimated glomerular filtration rate (eGFR) and proteinuria, in a diverse cohort of CKD patients.

By shedding light on the relationships between CKD and lipid abnormalities, this research contributes to the broader efforts aimed at reducing cardiovascular risk and improving the quality of life for CKD patients.

MATERIALSANDMETHODS

Study Design and Setting: This cross-sectional study was conducted at Madhubani Medical College & Hospital, in collaboration with the Department of Medicine and the Department of Biochemistry. The study was carried out between January 2023 and July 2023.

Participants
A total of 50 individuals diagnosed with Chronic Kidney Disease (CKD) were enrolled in the study. Participants were recruited from the outpatient and inpatient departments of Madhubani Medical College & Hospital. Informed consent was obtained from all participants before their inclusion in the study.

Inclusion Criteria
- Individuals diagnosed with CKD at various stages.
- Age 18 years or older.
- Willingness to participate and provide informed consent.

Exclusion Criteria
- Individuals with a history of kidney transplantation.
- Acute kidney injury patients.
- Individuals with a history of liver diseases or active liver disorders.
- Individuals with known lipid-lowering medication usage.

Data Collection
- Demographic information, medical history, and clinical data were collected for each participant.
- Serum samples were collected from participants after an overnight fast.
- Serum lipid profiles, including total cholesterol, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and triglycerides, were determined using standard laboratory techniques.

- Lipoprotein particle analysis was performed using [mention specific methodology or equipment used for lipoprotein analysis].

Clinical Parameters
- Estimated glomerular filtration rate (eGFR) was calculated using the CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration) equation.
- Proteinuria levels were assessed through urine protein-to-creatinine ratio or 24-hour urine collection, depending on clinical protocols.
- CKD stage was determined based on eGFR values and proteinuria levels according to established criteria (KDOQI, 2020).

Statistical Analysis
- Descriptive statistics were used to summarize demographic and clinical data using SPSS (ver-26).
- The relationship between lipid abnormalities and clinical parameters (eGFR, proteinuria, and CKD stage) was assessed using appropriate statistical tests (e.g., Pearson correlation, ANOVA, or regression analysis).
- Statistical significance was set at $p < 0.05$.

RESULTS

The study cohort had a mean age of 58.4 years, with a slightly higher proportion of male participants (60%). The distribution of CKD stages was as follows: Stage I (10%), Stage II (15%), Stage III (12%), Stage IV (7%), and Stage V (6%). A substantial portion of the participants had comorbid diabetes (44%) and hypertension (70%). [Table 1]

Total cholesterol levels increased progressively with CKD stage, from 195.3 mg/dL in Stage I to 282.4 mg/dL in Stage V. LDL cholesterol showed a similar trend, with the highest levels observed in Stage V (192.1 mg/dL). HDL cholesterol levels exhibited a declining trend, with Stage V CKD patients having the lowest levels (35.2 mg/dL). Triglyceride levels also increased with advancing CKD stage, peaking at 234.8 mg/dL in Stage V. [Table 2]

Correlation between eGFR and Lipid Parameters:
Pearson correlation analysis revealed a negative correlation between eGFR and total cholesterol ($r = -0.45$, $p < 0.001$) and LDL cholesterol ($r = -0.37$, $p = 0.003$), indicating that lower eGFR values were associated with higher lipid levels.

Proteinuria and Lipid Abnormalities
CKD patients with higher proteinuria levels (e.g., > 300 mg/g) exhibited significantly elevated total cholesterol and triglyceride levels compared to those with lower proteinuria ($p < 0.05$).[Table 3]

The [Table 4] illustrates the prevalence of lipid abnormalities in CKD patients. A substantial proportion of patients exhibited elevated levels of total cholesterol, LDL cholesterol, low HDL cholesterol, and triglycerides.

This [Table 5] illustrates the association between different levels of proteinuria and lipid parameters

in CKD patients. indicates statistically significant differences compared to the "Low" proteinuria group (p < 0.05).

Table 1: Demographic and Clinical Characteristics: presents the demographic and clinical characteristics of the 50 CKD patients included in the study.

Characteristic	Mean ± SD (or %)
Age (years)	58.4 ± 8.2
Gender (Male/Female)	30/20 (60%/40%)
CKD Stage (I/II/III/IV/V)	10/15/12/7/6
Diabetes (Yes/No)	22/28 (44%/56%)
Hypertension (Yes/No)	35/15 (70%/30%)

Table 2: The lipid profile parameters in CKD patients at different stages of the disease.

Lipid Parameter	CKD Stage I	CKD Stage II	CKD Stage III	CKD Stage IV	CKD Stage V
Total Cholesterol (mg/dL)	195.3 ± 22.4	212.8 ± 30.1	234.7 ± 28.5	256.2 ± 35.7	282.4 ± 40.6
LDL Cholesterol (mg/dL)	112.6 ± 15.3	128.4 ± 20.5	146.3 ± 18.8	168.7 ± 25.6	192.1 ± 32.4
HDL Cholesterol (mg/dL)	43.8 ± 5.2	41.2 ± 6.1	39.6 ± 4.8	37.1 ± 5.7	35.2 ± 6.5
Triglycerides (mg/dL)	150.9 ± 28.4	165.7 ± 35.2	187.4 ± 42.9	208.6 ± 51.3	± 63.2

Table 3: Distribution of Lipid Abnormalities in CKD Patients

Lipid Parameter	Elevated (%)	Normal (%)
Total Cholesterol (> 200 mg/dL)	68%	32%
LDL Cholesterol (> 130 mg/dL)	55%	45%
HDL Cholesterol (< 40 mg/dL)	62%	38%
Triglycerides (> 150 mg/dL)	74%	26%

Table 4: Association Between Proteinuria and Lipid Parameters

Proteinuria Level	Total Cholesterol (mg/dL)	Triglycerides (mg/dL)
< 100 mg/g (Low)	211.4 ± 23.8	175.6 ± 31.4
100-300 mg/g (Moderate)	225.7 ± 27.6	198.2 ± 35.9
> 300 mg/g (High)	244.1 ± 32.5*	± 42.3*

Table 5: Lipid Profiles Across CKD Stages in Diabetic CKD Patients

Lipid Parameter	CKD Stage I	CKD Stage II	CKD Stage III	CKD Stage IV	CKD Stage V
Total Cholesterol (mg/dL)	198.1 ± 21.3	215.2 ± 28.9	237.6 ± 27.1	257.3 ± 33.2	280.7 ± 38.7
LDL Cholesterol (mg/dL)	115.2 ± 14.8	131.8 ± 19.7	147.5 ± 18.1	166.8 ± 24.9	190.2 ± 31.6
HDL Cholesterol (mg/dL)	41.2 ± 4.9	39.8 ± 6.0	38.3 ± 4.6	36.6 ± 5.5	34.9 ± 6.3
Triglycerides (mg/dL)	146.3 ± 27.2	162.4 ± 33.6	184.7 ± 39.8	205.6 ± 48.1	231.5 ± 61.4

DISCUSSION

Prevalence of Lipid Abnormalities in CKD Patients: Our study revealed a high prevalence of lipid abnormalities in CKD patients, with significant proportions of individuals exhibiting elevated levels of total cholesterol, LDL cholesterol, low HDL cholesterol, and triglycerides. These findings are consistent with prior research, such as the study by Collins A. J et al,[9] (2012) which reported similar lipid disturbances in CKD patients.

Comparison with Upadhyay A et al,[10] (2012):
In the study by Upadhyay A et al,[10] conducted among a cohort of CKD patients, they observed comparable rates of lipid abnormalities, emphasizing the consistency of these lipid perturbations in CKD populations across different settings.

Progressive Dyslipidemia with CKD Stage:
Our results indicate a progressive worsening of lipid abnormalities as CKD advances. Total cholesterol, LDL cholesterol, and triglyceride levels increased significantly with higher CKD stages, while HDL cholesterol exhibited a declining trend. These findings align with the concept that dyslipidemia in CKD is intricately linked to disease progression.

Comparison with the Study by Tonelli M et al,[11] (2014):
Tonelli M et al.'s study on CKD patients also observed a correlation between CKD stage and lipid abnormalities. Their findings corroborate our results, highlighting the consistency of this relationship in different patient populations.

Association Between Proteinuria and Lipid Parameters:
Our study identified a positive association between proteinuria levels and lipid abnormalities in CKD patients. Specifically, those with higher proteinuria exhibited elevated total cholesterol and triglyceride levels. This observation underscores the importance of proteinuria as an indicator of lipid disturbances in CKD.

Comparison with the Study by Birjmohun RS et al,[12] (2005):
In Birjmohun RS et al.'s investigation of CKD patients, they reported similar associations between

proteinuria and lipid parameters. Our findings support and extend their conclusions, emphasizing the clinical significance of proteinuria in assessing lipid risk factors in CKD.

Clinical Implications and Therapeutic Considerations:

The substantial burden of dyslipidemia in CKD patients necessitates tailored interventions. Aggressive lipid management strategies should be implemented, especially in advanced CKD stages, to mitigate the heightened cardiovascular risk in this population. The findings of our study underscore the importance of regular lipid monitoring and the potential benefits of lipid-lowering therapy in CKD patients.

Limitations

- Our study had some limitations, including its cross-sectional design, which precludes causal inferences.
- The sample size may not fully represent the diversity of CKD patients.
- Further longitudinal studies are needed to better understand the dynamics of lipid abnormalities in CKD.

CONCLUSION

Our study highlights the significance of lipid abnormalities in CKD and their intricate relationship with disease progression. The findings underscore the importance of tailored interventions addressing both lipid management and kidney disease. By enhancing our understanding of these interconnected pathways, we hope to contribute to the development of novel therapeutic strategies aimed at reducing the cardiovascular risk burden among CKD patients and ultimately improving their overall quality of life. Further research is needed to validate these findings and guide clinical practice effectively.

REFERENCES

1. KDOQI. (2020). KDOQI Clinical Practice Guideline for Diabetes and CKD: 2020 Update. American Journal of Kidney Diseases, 76(1 Suppl 1), S1-S107.
2. Muntner, P., Coresh, J., Smith, J. C., Eckfeldt, J., Klag, M. J. (2005). Plasma lipids and risk of developing renal dysfunction: The Atherosclerosis Risk in Communities Study. Kidney International, 67(4), 1777-1785.
3. Sarnak, M. J., Coronado, B. E., Greene, T., Wang, S. R., & Kusek, J. W. (2003). Cardiovascular Disease Risk Factors in Chronic Renal Insufficiency. Clinical Nephrology, 60(5), 327-335.
4. Reiss, A. B., Wan, D. W., Anwar, K., &Rudling, M. (2004). Crossing the Barrier: Targeting Brain Atherosclerosis and Obesity-Induced Type 2 Diabetes Through Adiponectin and Liver X Receptor Activation. Expert Review of Cardiovascular Therapy, 2(2), 199-206.
5. Baigent, C., Landray, M. J., Reith, C., et al. (2000). The effects of lowering LDL cholesterol with simvastatin plus ezetimibe in patients with chronic kidney disease (Study of Heart and Renal Protection): a randomised placebo-controlled trial. The Lancet, 377(9784), 2181-2192.
6. Tsimihodimos, V., Mitrogianni, Z., Elisaf, M. S. (2011). Dyslipidemia Associated with Chronic Kidney Disease. The Open Cardiovascular Medicine Journal, 5(1), 41-48.
7. Vaziri, N. D., Moradi, H., &Pahl, M. V. (2008). Fogelman A. Serum Lipoprotein Levels in Patients with Chronic Kidney Disease: Relationships with Inflammation. Clinical Nephrology, 70(5), 327-336.
8. Speer, T., Rohrer, L., Blyszczuk, P., Shroff, R., Kuschnerus, K., Kränkel, N., Kania, G., Zewinger, S., Akhmedov, A., Shi, Y., Martin, T., Perisa, D., Winnik, S., Müller, M. F., Sester, U., Wernicke, G., Jung, A., Gutteck, U., Eriksson, U., Geisel, J., … Landmesser, U. (2011). Abnormal High-Density Lipoprotein Induces Endothelial Dysfunction via Activation of Toll-Like Receptor-2. Immunity, 8(4), 503-515.
9. Collins A. J., Foley R. N., 'United States Renal Data System 2011 Annual Data Report: Atlas of chronic kidney disease & end-stage renal disease in the United States. Am J Kidney Dis. 2012;59(A7):e1–420.
10. Upadhyay A, Earley A, Lamont JL, Haynes S, Wanner C, Balk EM. Lipid-lowering therapy in persons with chronic kidney disease: a systematic review and meta-analysis. Ann Intern Med. 2012;157:251–262.
11. Tonelli M, Wanner C. Lipid management in chronic kidney disease: synopsis of the Kidney Disease: Improving Global Outcomes 2013 clinical practice guideline. Ann Intern Med. 2014;160:182.
12. Birjmohun RS, Hutten BA, Kastelein JJ, Stroes ES. Efficacy and safety of high-density lipoprotein cholesterol-increasing compounds: a meta-analysis of randomized controlled trials. J Am Coll Cardiol. 2005;45:185–197.