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RETROSPECTIVE ANALYSIS OF THE CORRELATION BETWEEN THE PREVALENCE OF DYSLIPIDEMIA AND CHRONIC RENAL DISEASE

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ABSTRACT

Background: Based on the lipid nephrotoxicity hypothesis, a great deal of research is being done worldwide to evaluate the function of hyperlipidemia in people with chronic renal disease, particularly in India.

Aim: The purpose of this retrospective clinical investigation was to evaluate the relationship between dyslipidemia and the prevalence of chronic renal disease in Indian participants.

Methods: Clinical data from patients' medical records that did not have overt renal illness were gathered and evaluated for this retrospective clinical investigation. Based on their levels of total cholesterol and low-density lipoprotein, the research participants were split into four groups. A statistical analysis was performed on the gathered data to see if chronic renal disease and blood lipid profile were correlated.

Results: The group with the greatest cholesterol had the lowest HDL-C value and the highest HDL-C value, with a value of >5.40 mmol/l ($p<0.001$). With $p<0.001$, BUN and FPG levels were highest for cholesterol ranges >5.40 mmol/l and lowest for cholesterol values ≤ 4.20 mmol/l. When comparing high cholesterol to low cholesterol levels, SUA and hypertension values were considerably higher ($p<0.001$) for high cholesterol values. The age group of >60 years old had the greatest incidence of new chronic kidney disease (CKD) at 8.08% (n=24) individuals, followed by >40-≤60 years old at 3.93% (n=21) subjects, and ≤40 years old at 1.93% (n=9) subjects. 8.07% (n=26) of the high cholesterol group's participants had new chronic kidney disease episodes, compared to 1.82% (n=6) of the low cholesterol group's individuals.

Conclusion: The elevated levels of total cholesterol, low-density lipoprotein (LDL), and triglycerides are independently associated with a higher risk of declining eGFR (estimated glomerular filtration rate) and developing chronic kidney disease.

Keywords: chronic kidney disease, eGFR, epidemiology, Lipid profiles, renal disease

INTRODUCTION

Chronic kidney disease (CKD) is becoming more commonplace worldwide, particularly in

India. Chronic kidney illness is becoming more common both internationally and in India, which places a significant strain on the healthcare system of nation. Chronic kidney disease (CKD) increases mortality and progresses to end-stage renal disease (ESRD) with a host of problems. Therefore, it is important to identify, monitor, and control the risk factors linked to chronic kidney disease (CKD), since doing so can aid in the illness prevention.[1]

Due to the frequent changes in lifestyle, eating patterns, and living standards, dyslipidemia prevalence is raising significantly both globally and in India. Mixed hyperlipidemia, hypercholesterolemia, hypertriglyceridemia, and decreased high-density lipoproteinemia are all considered forms of dyslipidemia. Data from earlier studies show that dyslipidemia raises the chance of developing cardiovascular illnesses.[2]

There was a hypothesis that linked dyslipidemia to chronic kidney disease when the Lipid Nephrotoxicity Hypothesis was proposed in 1982. This theory and postulation has been the subject of ongoing investigation and evaluation in the recent past. Research was out in the 1990s with a sizable sample size found that, following a ten-year follow-up; people with chronic renal disease also had higher levels of proteinuria if they had dyslipidemia. The incidence of chronic kidney disease is higher in high-sugar and high-fat diet groups than in vegetarian diets, where the risk of chronic kidney disease was lower, according to a different study that assessed the risk for chronic kidney diseases and dietary patterns over a 6-year follow-up period. In a similar vein, another study found a significant link between excessive intake of fat and sugar and a decline in renal function.[3]

The available information on the impact of TG (triglycerides), TC (total cholesterol), and LDL (low-density lipoprotein) on the onset of chronic kidney disease is debatable, and if it does, it's not obvious to what degree. There is not enough information in the literature to say if lowering yearly eGFR (estimated glomerular filtration rate) would cause CKD (chronic kidney disease) or whether elevated blood lipid levels are an independent risk factor for the development of chronic kidney disease. What blood lipid type has the greatest influence on the development of chronic kidney disease (CKD) is also the subject of little information in the literature.[4]

The goal of this retrospective clinical investigation was to determine if dyslipidemia and the incidence and development of chronic renal disease in Indian participants were related. Based on an annual evaluation of eGFR ≥60 mL/min/1.73 m2 and the absence of renal disease at baseline, the research was conducted. Additionally, the study examined several blood lipid types in groups.

MATERIALS AND METHODS

The current retrospective clinical investigation was carried out to evaluate the relationship between dyslipidemia and the occurrence and development of chronic renal disease in Indian participants. The yearly evaluation of eGFR ≥60 mL/min/1.73 m2 and the absence of renal disease at baseline served as the foundation for the investigation. The study also examined various blood lipid types in groups. The research was carried out at Department of General

Medicine, Rama Medical College Hapur, Uttar Pradesh, from January 2023 to December 2023. The individuals who visited the Institute's outpatient department made up the study population.

With baseline data available, a total of 2453 participants were screened for the current investigation. The final sample size consisted of 1296 subjects with complete medical records and follow-up. Study subjects were excluded due to incomplete data, life-threatening illness, renal surgery, malignancy, severe infections, liver damage, baseline eGFR of <60ml/min/173m2, cerebrovascular diseases, and cardiovascular diseases.

After the final inclusion of the study subjects, detailed history was recorded for all the subjects followed by a clinical examination. At baseline, medical history, gender, age, and biochemical tests were recorded for each individual. Moreover, weight and height were recorded to determine BMI in kg/m^2. Following a 15-minute rest period, blood pressure was measured in all individuals while they were seated. Two measurements were recorded, and the average was calculated.

All of the individuals had their fasting blood samples obtained after an overnight fast of 12 hours in order to complete the biochemical tests. A biochemical automated enzyme analyzer was utilized to evaluate several biochemical parameters, such as serum uric acid (SUA), total cholesterol (TC), triglycerides (TG), HDL (high-density lipoprotein), LDL (low-density lipoprotein), FBG (fasting blood glucose), and blood urea nitrogen (BUN).

Every parameter was evaluated both at the baseline and throughout the follow-up. The kidney function was evaluated using the eGFR formula, which is as follows: eGFR (ml / min / 1.73m2) = 186 × S. Cr - 1.154×age - 0.203 (in females, X0.742). This formula is adapted from the Chinese version of the MDRD (Modification of Diet in Renal Disease). According to the kidney disease, Improving Global Outcomes clinical practice recommendations from 2012, an incident of chronic kidney disease (CKD) were defined as having an eGFR of less than 60 ml/min/1.73 m2. Only the initial occurrence of chronic renal disease was taken into consideration for research purposes in participants who experienced several events throughout the follow-up.

RESULTS

The current retrospective clinical investigation was carried out to evaluate the relationship between dyslipidemia and the occurrence and development of chronic renal disease in Indian participants. There were 1296 people in the research, both male and female. Table 1 lists the baseline characteristics of the research participants with and without CKD. The research individuals with and without CKD had mean ages of 68.42±24.46 and 47.64±21.28 years, respectively. The subjects with CKD had a substantially higher mean age ($p<0.001$). With $p=0.969$, the gender difference was statistically not significant. The research participants BMIs were 24.34±2.76 kg/m2 for those without CKD and 23.16±3.03 kg/m2 for those with.

In comparison to subjects without CKD, TG, TC, LDL, HDL-C, FBG, BUN, and serum uric acid were significantly higher in CKD subjects (1.73±1.27, 5.14±1.04, 2.96±0.84, 1.33±0.26,

5.44±1.03, 5.66±1.19 mmol/l, and 6.22±1.43 mg/dl, respectively). p<0.001 indicated that each of these factors was statistically significant. When comparing people without CKD, eGFR at baseline and ending was 87.03±15.14 and 72.36±10.97 ml/min/1.73 m2 (p<0.001). In contrast, eGFR at baseline and finishing was considerably lower in those with CKD, with values at baseline and ending being 68.73±7.64 and 48.73±8.74 ml/min/1.73m2. Moreover, participants with CKD had considerably higher levels of diabetes and hypertension (p<0.001) (Table 1).

When the characteristics of the research participants were analysed according to age groups, it was found that there were considerably more men than females for all age categories: ≤40, >40-≤60, and >60 (p<0.001). With mean ages of 72±6.83, 51±8.24, and 34±4.66 years, respectively, the age group >60 years was substantially older than the age groups >40–≤60 years and ≤40 years (p<0.001). The age groups with the greatest BMI were likewise those over 60, >40–≤60, and ≤40, with mean values of 23.83±2.96, 23.57±2.87, and 22.46±3.07 kg/m2 (p<0.001). With a p-value of 0.001 for cholesterol and <0.001 for HDL-C, the values were likewise considerably higher at >60 years, >40-≤60 years, and ≤40 years, respectively.

With p-values of 0.002, <0.001, and <0.001, respectively, HDL-C, BUN, and FPG were likewise considerably higher for those over 60, followed by those between 40 and 60 years old, and those under 40. With p=0.07, S. creatinine did not significantly differ across the three age groups. Between the three age groups, there was a statistically significant difference (p<0.001) in serum uric acid, diabetes, and hypertension. The age groups of >60 years, >40-≤60 years, and ≤40 years had eGFR values that were considerably lower, with mean values of 86.84±11.75, 87.77±14.02, and 93.85±14.92, respectively, and p<0.001. According to Table 2, the incidence of new chronic kidney disease (CKD) was highest in persons over 60 (8.08%; n = 24), followed by >40–60 (3.93%; n = 21) and ≤40 (1.93%; n = 9).

The study individuals were categorized into four groups based on their total cholesterol levels: ≤4.20 mmol/l, >4.20 -≤4.80 mmol/l, >4.80-≤5.40 mmol/l, and >5.40 mmol/l. In all four age categories, the proportion of men was considerably greater (p<0.001). When the cholesterol level was more than 5.40 kg/m2, the BMI increased; when the cholesterol level fell, the BMI decreased (p<0.001). Triglyceride levels were higher when cholesterol was more than 5.40 mmol/l and reduced when cholesterol was lower (p<0.001). With a value of >5.40mmol/l (p<0.001), the highest cholesterol group had the lowest and highest HDL-C levels. With p<0.001, BUN and FPG levels were highest for cholesterol ranges >5.40 mmol/l and lowest for cholesterol values ≤ 4.20 mmol/l.

While serum creatinine and diabetes percentage showed non-significant differences with higher values in the high cholesterol group and respective p-values of 0.373 and 0.08, SUA and hypertension values were significantly highest for high cholesterol values compared to low cholesterol values with p<0.001. A substantial decrease in eGFR was seen with elevated cholesterol levels (p<0.001). The high cholesterol group had an incidence of 8.07% (n=26) new chronic kidney disease events, whereas the low cholesterol group had an incidence of 1.82% (n=6) patients (Table 3).

DISCUSSION

The current retrospective clinical investigation was carried out to evaluate the relationship between dyslipidemia and the occurrence and development of chronic renal disease in Indian participants. There were 1296 people in the research, both male and female.

The study participants with and without CKD had mean ages of 68.42±24.46 and 47.64±21, respectively. The subjects with CKD had significantly higher serum uric acid, TG, TC, LDL, HDL-C, FBG, BUN, and serum uric acid with respective values of 1.73±1.27, 5.14±1.04, 2.96±0.84, 1.33±0.26, 5.44±1.03, 5.66±1.19 mmol/l, and 6.22±1.43 mg/dl, while the subjects without CKD had values of 1.44±1.13, 4.85±0.93, 2.84±0.75, 1.32±0.33, 5.22±0.84, 4.94±1.16 mmol/l, and 5.57±1.35 mg/dl. With $p<0.001$, each of these values was statistically significant. participants with CKD had eGFR values at baseline and ending points of 68.73±7.64 and 48.73±8.74 ml/min/1.73m2, substantially lower than participants without CKD, whose values were 87.03±15.14 and 72.36±10.97 ml/min/1.73m2 ($p<0.001$).

Moreover, those with CKD had considerably higher levels of diabetes and hypertension ($p<0.001$). These demographics were similar to those of the investigations conducted in 2018 by Li LC et al[5] and in 2016 by Yokoi H et al,[6] where the authors evaluated patients who had similar demographics with the current study.

When the characteristics of the research participants were examined based on age groupings, it was found that there were considerably more men than females for all age categories: ≤40 years, >40-≤60 years, and >60 years ($p<0.001$). With mean ages of 72±6.83, 51±8.24, and 34±4.66 years, respectively, the age group >60 years was substantially older than the age groups >40–≤60 years and ≤40 years ($p<0.001$).

The age groups with the greatest BMI were likewise those over 60, >40–≤60, and ≤40, with mean values of 23.83±2.96, 23.57±2.87, and 22.46±3.07 kg/m2 ($p<0.001$). With a p-value of 0.001 for cholesterol and <0.001 for HDL-C, the values were likewise considerably higher at >60 years, >40-≤60 years, and ≤40 years, respectively. With p-values of 0.002, <0.001, and <0.001, respectively, HDL-C, BUN, and FPG were likewise considerably higher for those over 60, followed by those between 40 and 60 years old, and those under 40. With $p=0.07$, S. creatinine did not significantly differ across the three age groups. Between the three age groups, there was a statistically significant difference ($p<0.001$) in serum uric acid, diabetes, and hypertension.

The age groups of >60 years, >40-≤60 years, and ≤40 years had eGFR values that were considerably lower, with mean values of 86.84±11.75, 87.77±14.02, and 93.85±14.92, respectively, and $p<0.001$. The age group of >60 years old had the greatest incidence of new chronic kidney disease (CKD) at 8.08% (n=24) individuals, followed by >40-≤60 years old at 3.93% (n=21) subjects, and ≤40 years old at 1.93% (n=9) subjects. These outcomes supported the findings of Adeosun SO et al[7] (2018) and Gai Z et al[8] (2019), who demonstrated that worse parameters for chronic kidney disease were linked to an older age group.

The research participants were classified into four groups according to their total cholesterol levels: ≤4.20 mmol/l, >4.20 -≤4.80 mmol/l, >4.80-≤5.40 mmol/l, and >5.40 mmol/l. This allowed for a comparison of their features. In all four age categories, the proportion of men was considerably greater ($p<0.001$). When the cholesterol level was more than 5.40 kg/m2, the BMI increased; when the cholesterol level fell, the BMI decreased ($p<0.001$). Triglyceride levels were higher when cholesterol was more than 5.40 mmol/l and reduced when cholesterol was lower ($p<0.001$). With a value of >5.40mmol/l ($p<0.001$), the highest cholesterol group had the lowest and highest HDL-C levels. With $p<0.001$, BUN and FPG levels were highest for cholesterol ranges >5.40 mmol/l and lowest for cholesterol values ≤ 4.20 mmol/l.

While serum creatinine and diabetes percentage showed non-significant differences with higher values in the high cholesterol group and respective p-values of 0.373 and 0.08, SUA and hypertension values were significantly highest for high cholesterol values compared to low cholesterol values with $p<0.001$. A substantial decrease in eGFR was seen with elevated cholesterol levels ($p<0.001$). The high cholesterol group had an incidence of 8.07% (n=26) new chronic kidney disease events, while the low cholesterol group had an incidence of 1.82% (n=6). These findings corroborated those of research by Chang YC et al[9] (2019) and Asghari G et al[10] (2018), which found a correlation between worsening chronic kidney disease parameters and elevated cholesterol levels.

CONCLUSION

Within the bounds of its limitations, the current study suggests that elevated levels of total cholesterol, low-density lipoprotein (LDL), and triglycerides are independently associated with a higher risk of declining estimated glomerular filtration rate (eGFR) and developing chronic kidney disease. A few drawbacks of the current study included biases related to geographic areas, a limited sample size, and a short monitoring time. Therefore, further long-term research with bigger sample sizes and longer observation periods will aid in coming to a conclusive result.

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Characteristics	CKD (n=57)	Without CKD (n=1239)	p-value
Gender			
Males	34	759	0.969
Females	22	480	
Age (years)	68.42±24.46	47.64±21.28	<0.001
BMI (kg/m2)	24.34±2.76	23.16±3.03	<0.001
Triglycerides	1.73±1.27	1.44±1.13	0.001
Total Cholesterol	5.14±1.04	4.85±0.93	<0.001
LDL	2.96±0.84	2.84±0.75	<0.001
HDL-C	1.33±0.26	1.32±0.33	0.04
FBG	5.44±1.03	5.22±0.84	<0.001
BUN	5.66±1.19	4.94±1.16	<0.001
S. Uric acid	6.22±1.43	5.57±1.35	<0.001
Hypertension (%)	26 (45.61)	187 (15.09)	<0.001
Diabetes (%)	7 (12.28)	44 (3.55)	<0.001
eGFR (ml/min/1.73m2)			
Baseline	68.73±7.64	87.03±15.14	<0.001
Ending	48.73±8.74	72.36±10.97	<0.001

Table 1: Demographic characteristics of the study subjects at baseline

Age range (years)	≤40 (n=465)	>40-≤60 (n=534)	>60 (n=297)	p-value
Gender				
Males	302	320	178	<0.001
Females	163	214	119	
Age (years)	34±4.66	51±8.24	72±6.83	<0.001
BMI (kg/m2)	22.46±3.07	23.57±2.87	23.83±2.96	<0.001

Triglycerides	1.16±0.93	1.55±1.31	1.63±1.04	<0.001
Total Cholesterol	4.47±0.83	4.91±0.87	5.14±0.91	0.001
LDL	2.56±0.73	2.86±0.72	3.03±0.76	<0.001
HDL-C	1.32±0.27	1.26±0.33	1.33±0.34	0.002
BUN	4.74±1.04	4.97±1.14	5.36±1.17	<0.001
FPG	4.92±0.38	5.22±0.81	5.72±1.06	<0.001
S. Creatinine	82.55±13.82	82.51±13.93	83.62±13.22	0.07
SUA	5.46±1.34	5.56±1.36	5.72±1.34	<0.001
Hypertension (%)	9 (0.43)	72 (13.48)	136 (45.79)	<0.001
Diabetes (%)	1 (0.21)	15 (2.80)	37 (12.45)	<0.001
eGFR (ml/min/1.73m2)	93.85±14.92	87.77±14.02	86.84±11.75	<0.001
New CKD incidence	9 (1.93)	21 (3.93)	24 (8.08)	<0.001

Table 2: Comparison of characteristics of the study subjects based on the age groups

Age range (years)	**≤4.20 (n=329)**	**>4.20 - ≤4.80 (n=322)**	**>4.80-≤5.40 (n=323)**	**>5.40 (n=322)**	**p-value**
Gender					
Males	207	203	200	183	<0.001
Females	122	119	123	139	
Age (years)	38±4.48	46±6.24	50±2.96	55±3.64	<0.001
BMI (kg/m2)	22.52±2.97	22.14±2.92	23.46±2.93	23.82±3.13	<0.001
Triglycerides	1.06±0.78	1.26±0.87	1.47±0.98	1.85±1.29	<0.001
HDL-C	1.35±0.36	1.30±0.32	1.27±0.31	1.230.23	<0.001
LDL-C	2.05±0.36	2.57±0.32	2.96±0.39	3.65±0.69	<0.001
BUN	4.77±1.09	4.96±1.15	5.05±1.17	5.13±1.15	<0.001
FPG	5.06±0.67	5.18±0.83	5.24±0.82	5.43±0.97	<0.001
S. Creatinine	82.24±13.46	82.73±13.93	83.01±13.63	83.11±13.86	0.373
SUA	5.42±1.26	5.54±1.34	5.63±1.34	5.81±1.37	<0.001
Hypertension (%)	33 (10.03)	48 (14.90)	58 (17.95)	74 (22.98)	<0.001
Diabetes (%)	10 (3.03)	13 (4.03)	9 (2.78)	16 (4.96)	0.08
eGFR (ml/min/1.73m2)	90.83±15.65	87.62±16.07	84.82±14.33	81.54±13.42	<0.001
New CKD incidence	6 (1.82)	13 (4.03)	10 (3.09)	26 (8.07)	<0.001

Table 3: Comparison of characteristics of the study subjects based on the total cholesterol