ejpmr, 2024, 11(9), 332-342

SJIF Impact Factor 7.065

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

DISTRIBUTION OF DYSLIPIDEMIA IN PATIENTS WITH CHRONIC KIDNEY DISEASE AND ITS CORRELATION WITH PLASMA ATHEROSCLEROSIS INDEX. A CROSS-SECTIONAL STUDY

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Article Received on 17/07/2024 **Article Revised on 07/08/2024** **Article Accepted on 28/08/2024**

ABSTRACT

Objective: CKD is defined as abnormalities of kidney structure or function, present for a minimum of 3 months, with implications for health issues in both China and worldwide. CKD is classified based on Cause, Glomerular filtration rate category (G1–G5), and Albuminuria category (A1–A3). Patients with CKD treated with hemodialysis are prone to CVD such as coronary artery atherosclerosis. Dyslipidemia is one of the modifiable risk factors in CKD patients for CVD, incidence is on rise, if left untreated it can result in morbidity and mortality in patients. This cross-sectional study to evaluate the dyslipidemia in chronic kidney disease and normal control groups populations. **Methods:** From March 2023 to July 2024, 300 chronic kidney diseases with stages 3,4, and 5 were randomly collected, 185 were males and 115 were females and 100 normal control group patients were randomly collected, 81 were female and 19 were males, from the 300 CKD patients 146 are diabetic mellitus and 124 are systemic hypertension, we compare the lipid profiles between both groups who are on hemodialysis and conservative management admitted to affiliated hospital of Shandong second medical university was taken for study purpose. **Results:** The lipid status of CKD and normal control patients selected overall age of CKD patients was 59.9±13.03 and normal control patients was 53.04±20.42 years with the p value of <0. 001. The CKD and normal control patients mean EGFR was 31.85±8.62 and 108.63±21,20 with the p value of <0.001. The CKD and normal control patients mean value of total cholesterol was 191.54±72.24 and 144.6±27.13 with the p value of <0.001. the CKD and normal control patients the mean value of triglycerides was 191.54±72.24 and 68.8±25.60 with the p value of <0.001. the CKD and normal control patients the mean value of LDL-C was 110.53±67 and 80.31±21.16 with p value of <0.001. the CKD and normal control patients the mean value of HDL-C was 34.42±15.09 and 48.61±11.22 with the p value of <0.001. The CKD and normal control patients the mean value of AIP was 0.58±0.15 and 0.21±0.06 with p value of<0.001. The lipid status of non-diabetic mellitus CKD group is compared who are on hemodialysis and pre-dialysis group. There is a significant difference in the mean vaule of various lipid profiles which show significant correlation. The mean value of total cholesterol in pre dialysis and hemodialysis were 185.76±35.98 and 193.65±26.92 with a p value of 0.03. the mean value of triglycerides in pre dialysis and hemodialysis were 175.59±59 and 199.11±62.27 with p value of 0.01.the mean value of LDL-C in pre dialysis and hemodialysis were 105.37±23.1and 117.94±29.07 with p value of 0.005.the mean value of HDL-C in pre dialysis and hemodialysis were 36.40±12.72 and 26.00±8.71with p value of <0.001. and the mean value of atherogenic index of plasma in pre dialysis and hemodialysis were 0.55±0.12 and 0.66±0.25 with a p value of 0.001. Similar finding is also observed in diabetic mellitus CKD group who are on hemodialysis and pre dialysis group. There is a significant difference in the mean value of various lipid profiles which show significant correlation. **Conclusion:** The lipid profiles of CKD patients is compared with normal control groups and there is significant difference in the mean value of various lipids show positive correlation. The lipid profiles of CKD patients are compared with hemodialysis and pre dialysis patients show significant difference in the mean value where total cholesterol, triglycerides, LDL-C and AIP is increasing where HDL-C is lower in hemodialysis groups.

KEYWORDS: Dyslipidemia, Chronic kidney disease, Hemodialysis, Lipid profiles, Atherogenic index of plasma.

INTRODUCTION

CKD is defined as abnormalities of kidney structure or function, present for a minimum of 3 months, with implications for health. CKD is classified based on Cause, Glomerular filtration rate (GFR) category (G1–

G5), and Albuminuria category (A1–A3), abbreviated as CGA.[1]

Kidney's disease is an increasing global problem that disproportionately affects poor, vulnerable and marginalized populations, and is associated with high individual, health care and societal costs. Chronic kidney disease is considered a major threat to human health, with a prevalence of approximately 9.1%[2] Patients with CKD treated with hemodialysis are prone to cardiovascular disease and have a significant risk of mortality from CVD.[3] Approximately 700 million people are estimated to have CKD worldwide.[4] Current predictions estimate that by 2035, as many as 1.1 billion people will be over 65 years of age, an increase of 60% from 2020, with the largest number of older individuals expected to be in China and India.[5] The controversies with regard to age-adjusted definition of CKD notwithstanding, the rising prevalence of CKD translates to an increased risk of adverse outcomes in individuals in all age groups[6],[7,8]

Dyslipidemia, characterized by an abnormal amount of lipids in the blood, has been recognized as a significant risk factor for cardiovascular disease in the chronic kidney disease and general population.[9] Dyslipidemia incidence is on the rise, If left untreated, Dyslipidemia can result in cardiovascular disease leading to increased morbidity and mortality in persons worldwide. In chronic kidney disease patients undergoing hemodialysis, the link between dyslipidemia and cardiovascular risk becomes even more complex.[10] Hemodialysis itself can induce changes in lipid metabolism, leading to altered lipid profiles.[11],[12]

Cardiovascular disorders remain a predominant concern for patients undergoing maintenance hemodialysis, with these individuals exhibiting a significantly elevated risk compared to the general population.[13] In chronic kidney disease, the most prevalent lipid abnormalities which have been noted are increased triglycerides levels and decreased HDL concentration. The LDL and total cholesterol levels are usually normal or increased.[14]

A confluence of both traditional (e.g., hypertension, dyslipidemia, diabetes mellitus) and non-traditional risk factors (e.g., chronic inflammation, mineral and bone disorders, volume overload) inherent to end-stage renal disease and hemodialysis procedures contribute to this heightened vulnerability.[15]

This 'reverse phenomenon questions the validity of established lipid-targeted interventions in this specific population.[16] Additionally, the impact of hemodialysis on lipid metabolism, including the removal of certain lipid particles and alterations in lipid transport proteins, further complicates our understanding.[17],[18]

By contrast, different cardiology society guidelines worldwide have provided LDL-cholesterol targets for CKD patients according to CKD stages and cardiovascular patients' risk, which range from < 55 mg/dL for those considered very high risk (CKD stage 4–5) moving to < 70 mg/dL for those at high risk (CKD 3a-3b) and rising to a maximum of 189 mg/dL for those CKD patients between 40–75 years old and with a 10-year atherosclerotic CVD risk of ≥ 7.5%.[19],[20]

Elevated serum triglycerides represent the most frequent abnormality in the lipid profile of CKD patients. The main mechanism involved is their hindered catabolism due to the hypoactive hepatic triglyceride lipase. In addition, an increased amount of lipase inhibitors, hypoactive hepatic triglyceride lipase. namely, apo-c III, in the setting of uremia may also play a role in decreased lipoprotein lipase dependent triglyceride-rich lipoprotein catabolism and it were recently proven to be important risk factors for cardiovascular outcomes in CKD patients, highlighting a potential novel therapeutic target.[21]

HDL-mediated reverse cholesterol transport, which clears excess cholesterol from arterial walls, is impaired in CKD due to reduced Apo AI synthesis, decreased LCAT activity, and increased cholesteryl ester transfer protein (CETP) activity.[22]

The atherogenic index of plasma is a novel metabolic biomarker of atherosclerosis. The atherogenic index of plasma is composed of triglycerides and high-density lipoprotein cholesterol and is a marker for assessing the risk of atherogenicity and cardiometabolic health. An association between AIP and greater frequency of major adverse cardiovascular events in patients with type 2 diabetes mellitus and high cardiovascular disease risk has been noted.[23] The AIP is a logarithmically transformed ratio of TG to HDL-C in molar concentration (mmol/L).[24]

The optimal management of dyslipidemia in CKD - especially its advanced stages - remains under some debate, despite evidence suggesting that lipid abnormalities also influence the progression of CKD. With a recent renewed focus on the cardiovascular kidney metabolic syndrome that involves crosstalk between these shared ideas.[25]

The impact of dyslipidemia on cardiovascular outcomes seems to be substantially modified by deteriorating kidney function. Most importantly, accumulating evidence strongly suggests the association between dyslipidemia and the risk of CKD progression.[26],[27],[28]

Aim And Objective of the study

Distribution of Dyslipidemia in Patients with Chronic Kidney Disease and Its Correlation with Plasma Atherosclerosis Index. A Cross-Sectional study

A. To evaluate the difference in pattern of dyslipidemia among chronic kidney disease patients and normal control groups populations.

B. The comparison of the severity of dyslipidemia with the various stage of CKD patients.
C. To evaluate the difference in the pattern of dyslipidemia among the diabetic mellitus and non-diabetic mellitus CKD patients.
D. To evaluate the difference in the pattern of dyslipidemia among pre dialysis and dialysis CKD patients.

To calculate the atherogenic index of plasma in CKD patients and correlate it with the various stages of CKD.

MATERIALS AND METHODS

2.1: Research objects

A total number of 300 patients of chronic kidney disease (CKD from stage 3- 5) and 100 normal control group patients was taken in our study for data analysis which include both Males and Females, CKD patients who are on hemodialysis and non -hemodialysis and Diabetic mellitus patients who are on hemodialysis and conservative management. we compared the lipid profile between both who are admitted to our Shandong Second Medical University Weifang China has taken for study purpose with the consent.

For a diagnosis of chronic kidney disease (CKD) history, physical findings, signs and symptoms with supportive Hematological, Biochemical and Ultrasonographic evidence was taken as criteria for the diagnosis.

2.2: Source of Support

This study was supported by medical research ethics review of affiliated hospital of Weifang medical college (acceptance no-wyfy-2024-ky-227).

2.3: Conflict of Interest- none.

2.4: Inclusion Criteria

1. Adult Age >18 years old with history and physical findings of kidney disease for duration more than 6 months with pre-existing sign and symptoms for chronic kidney disease (CKD stage 3 to 5)
2. Hematological and Biochemical analysis of suggestive of chronic kidney disease.
3. Ultrasonographic evidence with suggestive of chronic kidney disease.

2.5: Exclusion criteria

1. Patients who are already on lipid lowering therapy agents.
2. Patients on oral and intravenous Corticosteroids, Androgen and oral Contraceptive pill and intrauterine control devices (IUCD).
3. Patient on Highly Active Antiretroviral Therapy (HAART) and live vaccinations.
4. Patient on immune suppressive agent therapy.
5. Hyper and Hypothyroidism patients on medications.
6. Chronic liver diseases and Hepatic and Uremic Encephalopathy patients.
7. Patient with history of excessive alcohol consumption.
8. Patient with acute or chronic infections.
9. Patients with Nephrotic syndrome.
10. Patients with Ischemic Heart disease.

2.6: Conduct of the study

1. At the time of admission, general information of each patient (age, sex, weight, height nutritional status, BMI, duration and nature of underlying renal disease, history of comorbid illness, socio-economic status, treatment history if any previous hospitalization, duration and frequency of hemodialysis, personal history including smoking and alcoholism, family history of non - communicable disease and kidney disease and renal trans-plantation will be recorded.
2.A thorough history taking coupled with a meticulous physical examination is done for all the patients included in the study with the patient consent and with the help of nursing staff and paramedics.
3. Five ml of venous blood will be drawn aseptically from the ante-cubital fossa of the patient after an overnight fast for lipid profile determination and early morning the samples were sent to laboratory of the affiliated hospital of Shandong second medical university has taken for study purpose**.**
4. Other Hematological and biochemical parameters like urea, creatinine, hemoglobin, total count, mean corpuscular volume, mean corpuscular hemoglobin concentration and serum electrolytes along with the lipid parameters - total cholesterol, triglycerides, LDL and HDL cholesterol will also be analyzed and recorded.
5. Ultrasonography studies has done to look for evidence of chronic kidney disease for anatomical and pathological changes.
6. Estimated glomerular filtration rate is calculated based on the Cockroft – Gault equation
CrCl= (140-age) (weight in kg)÷ (Serum Creatinine) (72) ×0.85 if female
7.According to KDIGO 2024 classification of chronic kidney disease, based on GFR grouped in five stages.[29]
G1 Normal or high ≥90ml/min/1.73m2
G2 Mildly decreased 60-89ml/min/1.73m2
G3a Mildly to moderately decreased 45-59ml/min/m2
G3b Moderately to severely decreased 30-44ml/min/m2
G4 Severely decreased 15-29ml/min/m2
G5 Kidney failure <15ml/min/m2.

Blood samples for lipid profiles estimation are ideally collected as overnight fasting blood samples. Overnight fasting mainly affect Triglycerides level and lesser to extent low density lipoproteins cholesterol level. Can Estimated form Friedwald formula.

Overnight fasting status does not affect the high-density lipoproteins cholesterol level.

Serum Total Cholesterol concentrations were categorized as[30]
Normal-<200mgldl, Borderline high- 200-239mg/dl**,** High ->240mg/dl

Serum LDL-C concentrations were categorized as[30]
Normal- <100mg/dl (with comorbidities) >100-129mg/dl (with no comorbidities)
Borderline High- 130-159mg/dl, High- 160-189mg/dl**,** Very High - >190mg/dl

Serum HDL-C Concentrations were categorized as[30]
Normal->60mg/dl**,** Borderline -40-60mg/dl**,** low- < 40mg/dl (<40 in males and < 50 in females)

Serum triglyceride concentrations were categorized as[30]
Desirable-<150, Borderline high -150–199**,** High -200–500, Very high ->500 mg/dL.

2.6: Statistic Analysis-The data was collected during the study was formulated into master chart in Microsoft office Excel. Data analysis was performed using IBM-SPSS version 27.0.2.0(IBM-SPSS Science inc., Chicago, IL).

Using this software, data are presented as mean, standard deviation, percentages, or the number of cases. Continuous data were compared by independent student t- test and One way ANOVA and the correlation tested by Pearson correlation coefficient test. Significance was defined by *P* values less than 0.05 using two tailed tests. To this study a 95% confidence interval was accepted.

OBSERVATION AND RESULTS
From March 2023 to July 2024, 300 chronic kidney diseases with stages 3,4, and 5 were randomly collected, 185 were males and 115 were females and 100 normal control group patients were randomly collected,81 were female and 19 were males, from the nephrology inpatient department of the affiliated hospital of Shandong second medical university. From the 300 chronic kidney disease patients 124 patients were systemic hypertension and 146 patients were diabetic mellitus. From 300 chronic kidney disease patients 100 patients were on hemodialysis most of them are from stages 5 chronic kidney diseases patients and 200 patients were managed conservatively most of them belongs to stages 3 and 4 chronic kidney disease.

1.1 Baseline characteristic of the study population
Table 1 shows the baseline characteristics of all the participants, the participants were male representing 51% in total and female 49 % in total in CKD groups. Where 19% female and 81% male in normal control groups.

The mean age and SD of the participants in CKD and NO CKD group control populations were 59.09±13.05 and 53.04±20 years respectively.

Likewise, the mean EGFR of the participants in both groups were 31.85±8.62 and 108.63±21.20 ml/min/1.73m2. Similarly, there was significance difference in urea, creatinine and potassium values among the patients who have CKD in comparison to NO CKD normal control group patients. The prevalence of dyslipidemia is higher in CKD patients compared to NO CKD patients.

Table no. 1: Baseline characteristic of the study populations.

Variables	CKD	No CKD Control groups
No. of subjects	300	100
Gender (M/F)	185/115	19/81
Age *(years)	59.09±13.03	53.04±20.92
Hemoglobin	10.70±1.85	12.02±1.79
RBS	132.60±74.51	95.05±16.95
Urea	132.05±75.41	26.65±9.83
Creatinine	4.15±2.96	0.63±0.14
Sodium	137.29±4.69	138.33±3.63
Potassium	4.22±0.84	3.81±0.35
EGFR	31.85±8.62	108.63±21.20
Total cholesterol	191.10±36.68	144.6±27.27
Triglycerides	191.54±72.24	68.80±25.73
HDL-C	34.42±15.11	48.61±11.27
LDL-C	110.53±37.45	80.31±21.26
AIP	0.58±0.15	0.21±0.06

The mean value and standard deviation of the various variables included in the study is shown in the above table.

2.1 Clinical and biochemical characteristic of lipid profile comparison in patients with CKD or without CKD (control group)

Tabel 2 shows the clinical and biochemical characteristic of lipid profile comparison in Patients with CKD and without CKD normal control group.

Factors considered for bivariate analysis were age, gender, hemoglobin, random blood glucose, urea creatinine, sodium, potassium, EGFR, total cholesterol, triglycerides, HDL-C, LDL-C, atherogenic index of plasma.

Among these factors age, hemoglobin, random blood glucose, urea creatinine, potassium, EGFR, total cholesterol, triglycerides, HDL-C, LDL-C, atherogenic index of plasma were found highly significant (p value<0.05) with development of dyslipidemia in chronic kidney disease.

Table no. 2: Clinical and biochemical characteristic of lipid profile comparison in patients with CKD or without CKD (control group).

Variables	CKD (n=300)	No CKD Control groups (n=100)	P value
No. of subjects	300	100	<0.001
Gender (M/F)	185/115	19/81	<0.001
Age *(years)	59.09±13.03	53.04±20.92	<0.001
Hemoglobin	10.70±1.85	12.02±1.79	<0.001
RBS	132.60±74.51	95.05±16.95	<0.001
Urea	132.05±75.41	26.65±9.83	<0.001
Creatinine	4.15±2.96	0.63±0.14	<0.001
Sodium	137.29±4.69	138.33±3.63	<0.001
Potassium	4.22±0.84	3.81±0.35	<0.001
EGFR	31.85±8.62	108.63±21.20	<0.001
Lipid profiles			
Total cholesterol	191.10±36.68	144.6±27.27	<0.001
Triglycerides	191.54±72.24	68.80±25.73	<0.001
HDL-C	34.42±15.11	48.61±11.27	<0.001
LDL-C	110.53±37.45	80.31±21.26	<0.001
AIP	0.58±0.15	0.21±0.06	<0.001

High density lipoprotein cholesterol, low density lipoprotein cholesterol Atherogenic index of plasma. ** *significant at p value <0.05***

Independent t test was used for continuous data

3.1 Correlation of EGFR Vs Atherogenic index of plasma in various stages of CKD

The Pearson correlation test was done to analyze the relationship between EGFR and Atherogenic index of plasma, which showed a significant negative correlation [with decreasing GFR values, there is an increase in the AIP values].

Table no. 3: Correlation of EGFR Vs Atherogenic index of plasma in various stages of CKD.

Correlation Coefficient	*P value*
-0.10911	<0.02**

** *significant at p value <0.05*

The atherogenic index of plasma, which is the logarithmic ratio of triglyceride (TG) to high-density lipoprotein cholesterol (HDL-C), had a linear relationship with clinical outcomes in the chronic kidney disease and coronary artery diseases patients.[24]

4.1 Group Statistic –Hemodialysis

The lipid status of the hemodialysis and the pre-dialysis CKD patients is compared. There is a significant difference in the mean value of various lipids. The mean ±SD of total cholesterol in hemodialysis and pre-dialysis were 199.01±32.03 and 187.30±38.26. The mean value of Triglycerides means± SD in hemodialysis and pre-dialysis were 205.12±92.24 and 183.56±58. The mean± SD of LDL-C in hemodialysis and pre dialysis were 112.38±42.80 and 107.69±25.95. The mean ±SD of HDL-C in hemodialysis and pre-dialysis were 29.23±11.48 and 36.28±12.61 with p value of <0. 001. The related statistics is represented in the table below.

Table No. 4: Group Statistics Hemodialysis.

Lipid Profiles Variables	On Hemodialysis (No-non dialysis N=200) (Yes-on hemodialysis N=100)	N	MEAN±SD	p value
Total Cholesterol	NO YES	200 100	187.30±38.26 199.01±32.03	0.008**
Triglyceride	NO YES	200 100	183.56±58 205.12±92.24	0.01**
LDL-C	NO YES	200 100	107.69±25.95 112.38±42.80	0.24**
HDL-C	NO YES	200 100	36.28±12.61 29.23±11.48	<0.001
AIP	NO YES	200 100	0.56±0.13 0.61±0.19	0.005**

High density lipoprotein cholesterol, low density lipoprotein cholesterol Atherogenic index of plasma. ** *significant at p value <0.05** Independent t test was used for continuous data.*

5.1 Group Statistic -Diabetic Mellitus

The lipid status of the diabetic mellitus and non- diabetic mellitus chronic kidney disease patient is compared. It is observed that there is significant difference in the mean values and SD of the total cholesterol in diabetic mellitus and non-diabetic mellitus were 195.19±33.28 and 186.59±38.94 with p value of 0.04**. the mean value and SD of triglycerides in diabetic mellitus and non-diabetic mellitus were 199.07±77.80 and 183.47±58.96 with p value of 0.05** the mean value and SD of HDL-C in diabetic and non-diabetic mellitus were 32.39±11.22 and 34.90±11.89 with p value of 0.05**. The mean and SD of LDL-C in diabetic mellitus and non-diabetic mellitus were 113.27±42.01 and 107.09±31.17 and the mean value of atherogenic index of plasma in diabetic mellitus and non-diabetic mellitus were 0.59±0.18 and o.56±0.12 respectively.

Table no. 5: Group Statistics Diabetic Mellitus.

Lipid Profiles Variables	Diabetic Mellitus (No-non-diabetics) (Yes- yes- diabetics)	N	MEAN±SD	p value
Total Cholesterol	NO YES	154 146	186.59±38.94 195.19±33.28	0.04**
Triglyceride	NO YES	154 146	183.47±58.96 199.07±77.80	0.05**
LDL-C	NO YES	154 146	107.09±31.17 113.27±42.01	0.14**
HDL-C	NO YES	154 146	34.90±11.89 32.39±11.22	0.05**
AIP	NO YES	154 146	0.56±0.12 0.59±0.18	0.13**

High density lipoprotein cholesterol, low density lipoprotein cholesterol Atherogenic index of plasma. ** *significant at p value <0.05** Independent t test was used for continuous data.*

6.1 The Comparison of the Severity of Dyslipidemia with Various Stages of CKD

The lipid status in the stage 3,4 and 5 of chronic kidney disease is compared. There is a significant difference in the mean value of various lipids which showed a positive correlation. The mean value of the total cholesterol in stage 3,4 and 5 of CKD were 182.45±27.64, 187.89±52.69 and 196.79±37.17. The mean value of triglycerides in stage 3, 4 and 5 stages of CKD were 172.42±43.00, 186.67±73.00 and 202.43±8.63. The mean value of HDL-C in stage3,4 and 5 of CKD were 36.44±11.98,34.78±14.00 and 31.13±18.74. The mean value of LDL-c stages 3, 4 and 5 of CKD were 102.47±21.30, 117.39±51.90 and 108.57±35.01 respectively.

Table 6: The Comparison of the Severity of Dyslipidemia with various Stages of CKD.

Lipid Profiles Variables	CKD Stages	N	MEAN±SD	p value
Total Cholesterol	3 4 5	100 100 100	182.45±27.64 187.89± 52.69 196.79± 37.17	0.01**

Triglyceride	3 4 5	100 100 100	172.42±43.00 186.67±73.00 202.43±8.63	0.005**
HDL-C	3 4 5	100 100 100	36.44±11.89 34.78±14.00 31.13±18.74	0.01**
LDL-C	3 4 5	100 100 100	102.47±21.30 117.39±51.90 108.57±35.01	0.01**
AIP	3 4 5	100 100 100	0.56±0.12 0.56±0.14 0.60±0.14	0.05**

High density lipoprotein cholesterol, low density lipoprotein cholesterol Atherogenic index of plasma. ** *significant at p value <0.05** ANOVA Test was used for continuous data.*

7.1 Subgroup Statistic Non -Diabetics Mellitus

Among the non-diabetic mellitus group, a significant difference exists between the dialysis and pre dialysis group. The mean value and SD of total cholesterol in pre dialysis and hemodialysis were 185.76±35.98 and 193.65±26.92. the mean value and SD of triglycerides in pre dialysis and hemodialysis were 175.59±59 and 199.11±62.27. the mean value and SD of LDL-C in pre dialysis and hemodialysis were 105.37±23.1and 117.94±29.07. the mean value and SD of HDL-C in pre dialysis and hemodialysis were 36.40±12.72 and 26.00±8.71 and the mean value of atherogenic index of plasma in pre dialysis and hemodialysis were 0.55±0.12 and 0.66±0.25.

Table 7: Subgroups Statistics Non -Diabetics Mellitus.

Lipid Profiles Variables	**On Hemodialysis (No-non dialysis N=119) (Yes-on hemodialysis N=35)**	**N**	**MEAN±SD**	**p value**
Total Cholesterol	NO YES	119 35	185.76±35.98 193.65±26.92	0.03**
Triglyceride	NO YES	119 35	175.59±46.35 199.11±62.27	0.01**
LDL-C	NO YES	119 35	105.37±23.1 117.94±29.07	0.005**
HDL-C	NO YES	119 35	36.40±12.72 26.00±8.71	<0.001**
AIP	NO YES	119 35	0.55±0.12 0.66±0.25	0.001**

Table no. 8: Subgroup Statistics-Diabetic Mellitus.

Lipid Profiles Variables	**On Hemodialysis (No-non dialysis N=78) (Yes-on hemodialysis N=68)**	**N**	**MEAN±SD**	**p value**
Total Cholesterol	NO YES	78 68	188.78±41.57 202.10±33.93	0.03**
Triglyceride	NO YES	78 68	181.25±56.11 218.85±93.93	0.003**
LDL-C	NO YES	78 68	109.38±28.24 114.22±33.1	0.03**
HDL-C	NO YES	78 68	36.79±11.02 29.27±9.35	<0.001**
AIP	NO YES	78 68	0.56±0.13 0.61±0.13	0.005**

High density lipoprotein cholesterol, low density lipoprotein cholesterol Atherogenic index of plasma. ** *significant at p value <0.05** Independent t test was used for continuous data.*

Among the diabetic mellitus group, a significant difference exists between the dialysis and pre dialysis group. The mean value and SD of total cholesterol in pre dialysis and hemodialysis were 188.78±41.57 and 202.10±33.93. the mean value and SD of triglycerides in pre dialysis and hemodialysis were 181.25±56.11 and

218.85±93.93. the mean value and SD of LDL-C in pre dialysis and hemodialysis were 109.38±28.24 and 114.22±33.1. the mean value and SD of HDL-C in pre dialysis and hemodialysis were 36.79±11.02 and 29.27±9.35 and the mean value of atherogenic index of plasma in pre dialysis and hemodialysis were 0.55±0.12 and 0.66±0.25. similar finding is also observed in diabetic mellitus group who are on hemodialysis and pre dialysis group. where the various lipids profiles were higher in hemodialysis group and HDL-C is lower in hemodialysis.

DISCUSSION

The study was conducted in affiliated hospital Shandong second medical university to evaluate the distribution of dyslipidemia in patients with chronic kidney disease and its correlation with plasma atherosclerosis index. 300 patients with chronic kidney disease and 100 normal control group patients are collected from inpatient department of nephrology. We have compared the variables parameter and lipid profiles with CKD patients and control group patients.

Among the patients selected overall age of CKD patients was 59.9±13.03 and normal control group patients was 53.04±20.42 years with the p value of <0. 001. The CKD patients and normal control group mean EGFR was 31.85±8.62 and 108.63±21,20 with the p value of <0.001. The CKD patients and normal control group mean value of total cholesterol was 191.54±72.24 and 144.6±27.13 with the p value of <0.001.the CKD patients and normal control group patients the mean value of triglycerides was 191.54±72.24 and 68.8±25.60 with the p value of <0.001. the CKD patients and normal control group patients the mean value of LDL-C was 110.53±67 and 80.31±21.16 with p value of <0.001. the CKD patients and normal control group patients the mean value of HDL-C was 34.42±15.09 and 48.61±11.22 with the p value of <0.001. the CKD patients and normal control group patients the mean value of atherogenic index of plasma was 0.58±0.15 and 0.21±0.06 with p value of<0.001.

The lipid profiles of the CKD patients on hemodialysis and pre dialysis is compared. There is significant difference in the mean value of total cholesterol in hemodialysis and pre dialysis was 199.01±32.03 and 187.30± 38.26 with p value of 0.008. The mean value of triglycerides in hemodialysis and pre dialysis was 205.12±92.24 and 183.56±58 with p value of 0.01. The mean value of HDL-C in hemodialysis and pre dialysis was 29.23±11.48 and 36.28±12 with p value of <0.001. The mean value of AIP in hemodialysis and pre dialysis was 0.61±0.19 and 0.56±0.13 with p value of 0.005. The mean value of LDL-C hemodialysis and pre dialysis was 112.38±42.80 and 107.69±25.95 with p value of 0.24** respectively. A similar study was conducted in Syria and India found the similar result achieved our study. Where total cholesterol, triglycerides and LDL-C, AIP is increasing where HDL-C is decreasing.[31] Elevated LDL, Hypertriglyceridemia and total cholesterol levels in the hemodialysis group signify a heightened risk for atherosclerotic cardiovascular diseases, given that LDL cholesterol is a primary carrier of cholesterol in the blood and plays a central role in its deposition on arterial walls.[32] The reduced HDL levels further compound this risk, as HDL is known for its protective role in transporting cholesterol away from the arteries.[33]

The lipid status in the stage 3,4 and 5 of chronic kidney disease is compared. There is a significant difference in the mean value of various lipids which showed a positive correlation. The mean value of the total cholesterol in stage 3,4 and 5 of CKD were 182.45±27.64, 187.89±52.69 and 196.79±37.17 with p value of 0.01. The mean value of triglycerides in stage 3, 4 and 5 stages of CKD were 172.42±43.00, 186.67±73.00 and 202.43±8.63 with p value of 0.005. The mean value of HDL-C in stage 3,4 and 5 of CKD were 36.44±11.98,34.78±14.00 and 31.13±18.74 with p value of 0.01. the mean value of LDL-c stages 3, 4 and 5 of CKD were 102.47±21.30, 117.39±51.90 and 108.57±35.01 with p value of 0.01 respectively.

We compare the dyslipidemia between diabetic mellitus and non-diabetic mellitus CKD patients. It is observed that there is significant difference in the mean values and SD of both were 195.19±33.28 and 186.59±38.94 with p value of 0.04. the mean value and SD of triglycerides in both groups were 199.07±77.80 and 183.47±58.96 with p value of 0.05. the mean value and SD of HDL-C in both groups were 32.39±11.22 and 34.90±11.89 with p value of 0.05. The mean and SD of LDL-C in both groups were 113.27±42.01 and 107.09±31.17 and the mean value of atherogenic index of plasma in both groups were 0.59±0.18 and o.56±0.12 respectively. Similar study was done in Nepal Increased total cholesterol, triglycerides, LDL-C and reduced HDL-C level was seen.[34]

Comparison was done between the non-diabetic mellitus CKD group who are on dialysis and pre dialysis group, significant difference is seen. The mean value of total cholesterol in pre dialysis and hemodialysis were 185.76±35.98 and 193.65±26.92 with a p value of 0.03. the mean value of triglycerides in pre dialysis and hemodialysis were 175.59±59 and 199.11±62.27 with p value of 0.01.the mean value of LDL-C in pre dialysis and hemodialysis were 105.37±23.1and 117.94±29.07 with p value of 0.005.the mean value of HDL-C in pre dialysis and hemodialysis were 36.40±12.72 and 26.00±8.71with p value of <0.001. and the mean value of atherogenic index of plasma in pre dialysis and hemodialysis were 0.55±0.12 and 0.66±0.25 with a p value of 0.001.

Similar finding is also observed in diabetic mellitus CKD group who are on hemodialysis and pre dialysis group. There is a significant difference in the mean value of various lipid profiles which show significant

correlation.Similar study was done in India which show similar results.[35]

CVD is the leading etiology of hospitalization and mortality and morbidity in CKD patient and remain a predominant concern for patients undergoing maintenance hemodialysis, with these individuals exhibiting a significantly elevated risk compared to the general population.[13] A confluence of both traditional and non-traditional risk factors inherent to end-stage renal disease and hemodialysis procedures contribute to this heightened vulnerability in CKD patients.[15,36]

According to KDIGO guidelines, lipid-lowering treatments should not be initiated in dialysis patients, but those already on such treatments should continue.[17] Due to the intricate nature of dyslipidemia in hemodialysis patients, merely reducing lipid levels doesn't yield the expected benefits commonly observed in the general population. This limited efficacy of statins is attributed to the prevalence non atherosclerotic cardiovascular conditions in Hemodialysis patients.[37]

The Pearson correlation test was done to analyze the relationship between EGFR and AIP, which showed a significant negative correlation [with decreasing GFR values, there is an increased in the AIP values].

CONCLUSION

1. The lipid status of CKD patients is compared with normal control groups and there is significant difference in the mean value of various lipids show positive correlation.
2. The lipid status of CKD patients is compared with hemodialysis and pre dialysis patients show significant difference in the mean value where total cholesterol, triglycerides, LDL-C and Atherogenic index of plasma is increasing where HDL-C is lower in hemodialysis groups.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to Prof Dr. Xiangming Wang (MBBS, MD, PHD NEPHROLOGY) I am greatly indebted by to my beloved teacher Prof. DR WANG JING LING (MBBS, MD, PHD NEPHROLOGY)

I would like to thank all the Nursing staff, Paramedical staff, Assistance, attendance and other related staff of Department of Nephrology for their help and cooperation for this study.

I would like to thank my Seniors, My colleagues and my juniors and my friends for consistent support encouragement and cooperation and valuable criticism.

I am extremely thankful to all my family members for their love and continuous supports. Above all I thank God Almighty for his blessing and supports.

Last but not the least, my profound gratitude to all the patients, to whom I owe everything because this venture would not have been possible without them.

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