Clinical Application of Fasting and Post-Prandial Lipid Profile in Patients of Chronic Kidney Disease

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ABSTRACT

BACKGROUND

Dyslipidemia is a traditional risk factor for cerebrovascular disease and cardiovascular disease (CVD). CKD is associated with dyslipidemia. Patients with CKD will be more prone to the CVD and cerebrovascular disease as compared to normal healthy individuals. Thus, it is important to cover the postprandial lipid profile for better assessment and treatment of dyslipidemia. We wanted to study the postprandial lipid profile in patients of CKD.

METHODS

This is a case control study conducted in Acharya Vinoba Bhave Rural Hospital (AVBRH) Sawangi (Meghe), Wardha, Maharashtra, between September 2016 and September 2018. In this study, we enrolled 150 cases and 75 controls.

RESULTS

Fasting lipid profile in CKD patients was higher as compared to controls and was found to have similar post-prandial lipid profile. When we compared the fasting and post-prandial lipid profile in patients with CKD, we found that a substantial difference existed. We found a considerable difference in the fasting and post-prandial lipid profiles even in the controls.

CONCLUSIONS

Patients with CKD and diabetes mellitus had a significant increase in the total cholesterol, triglycerides, low density lipoprotein and very low-density lipoprotein in the fasting and post-prandial state. In clinical practice, the implementation of standardized methodologies and biomarker profiles would allow for the early and reliable detection of those at risk.

KEY WORDS

CKD, Cholesterol, Dyslipidaemia, Triglycerides

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BACKGROUND

Chronic Kidney Disease (CKD) is a major global health problem.[1] CKD is a non-reversible renal function decline that typically progresses over the years. CKD and end-stage renal disease (ESRD) are related to increased morbidity and mortality, reduced quality of life and increased spending on health care. End-stage renal disease continues to increase in prevalence worldwide.[2]

A decrease in estimated glomerular filtration rate (e-GFR) below 60 ml / min / 1.73 m2 and increased albuminuria are associated with increased cardiovascular disease (CVD) as well as general morbidity and mortality.[3,4,5] CKD patients will develop end-stage renal disease (ESRD) but many patients will die of CVD before dialysis is required.

Dyslipidemia is one of the traditional risk factors of the CVD and Cerebrovascular disease. CKD is associated with dyslipidemia.[6,7] A study conducted in non-diabetic CKD patients by Veeren Ganta suggests prevalence of dyslipidemia in CKD to be 65 %.[8] So, patients with CKD will be more prone to the CVD and Cerebrovascular disease as compared to normal healthy individuals. Thus, it is important to check for lipid profile in patients of CKD.

Much of our knowledge about the relationship between lipid, lipoprotein metabolism, and the development of atherosclerosis and cardiovascular disease is based on measurements in the fasting state. Although such measurements remain the foundation of clinical assessment and an important basis for decisions regarding hypolipidemic interventions, it should be acknowledged that we spend a considerable amount of time in a non-fasting, postprandial state. Based on traditional west dietary habits, most people eat 3 or more foods a day, each containing 20 - 70 g of fat.[9] A part from breakfast, each meal is most likely eaten prior to the return to the baseline of lipemic disease due to the previous consumption of plasma triacyl glycerols. Therefore, people spend most of their days in a postprandial (food) state and the degree of lipemia is continuously fluctuating throughout the day. Determination of the postprandial response is nuanced and, therefore, it is more difficult to determine cardiovascular risk associated with post-prandial lipemia, rather than under fasting conditions.[10] True, post-prandial levels of TG obtained after eating a standardized high-fat meal better predict coronary artery disease compared to rapid rates of TG. But even today, we are still following the conventional method of doing lipid profile in the fasting state. Thus, it is important to cover the postprandial lipid profile for better assessment and treatment as dyslipidemia is a risk factor associated with serious, life-threatening diseases. So, we tend to give a light of focus on evaluating the post-prandial lipid profile for better health of each and every individual.

We wanted to compare the fasting lipid profile and post-prandial lipid profile in patients of CKD.

METHODS

This is a case control study, conducted at Acharya Vinoba Bhave Rural Hospital (AVBRH) Sawangi (Meghe), Wardha, Maharashtra, from September 2016 to September 2018.

Inclusion Criteria

- Cases - Persons who have been diagnosed with CKD as per kidney disease improving global outcomes (KDIGO).
- Controls - Age and gender matched healthy individuals were enrolled by calculating odds ratio and 95 % confidence interval for each variable.
- Age - More than 18 years.

Exclusion Criteria

- Alcoholics
- Ischemic Heart Disease.
- Patients already on treatment for dyslipidaemia.
- Drugs causing dyslipidaemia
- Hydrochlorothiazide (≥ 25 mg / day)
- Chlorthalidone
- Orlistat
- Omega - 3 fatty acids, etc.

Diagnosis of CKD

1. Renal damage for 3 months, as identified by structural or functional renal abnormalities, with or without e GFR decreased, manifested by either: pathological abnormalities; or
2. Kidney damage marks, including blood or urine composition abnormalities, or imaging abnormalities.
3. E-GFR > 60 ml / min / 1.73 m2, with or without kidney injury, for a period of 3 months.

Data Analysis

Descriptive statistics were used to classify the population of the sample and identify the baseline parameters studied. The data were expressed in terms of frequencies (percentages) for category variables and average default (SD) for continuous variables. The statistical research was conducted with descriptive and inferential statistics using student-t, chi-square testing, z-testing, Pearson's correlation and multiple-regression testing.

Software used in the analysis was SPSS 22.0 version and graph-pad prism 6.0 version. P-value < 0.05 was considered as statistically significant.

RESULTS

Table 1 illustrates the baseline line characteristics of cases and controls. In this study we enrolled 150 cases and 75 controls. The mean age in CKD patients (cases) was 48.04 ± 14.46 years whereas in controls it was 47.13 ± 14.80 years. There were 94 (62.67 %) males and 56 (37.33 %) females in cases whereas there were 47 (62.67 %) males and 28 (37.33 %) females in control group. Risk factors like diabetes mellitus, systemic hypertension and smoking were considered in our study and are mentioned in the above table along with baseline characteristics.

Table 2 illustrates comparison of fasting and post-prandial lipid profile in cases. Total cholesterol (TC), triglycerides (TG), high density lipoproteins (HDL), very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL) when compared in

fasting and post-prandial state by students unpaired t test was statistically significant.

Baseline Characteristics	Cases (150) Mean ± SD / n (%)	Controls (75) Mean ± SD / n (%)
Age in years	48.04 ± 14.46	47.13 ± 14.80
Gender		
Male	94 (62.67 %)	47 (62.67 %)
Female	56 (37.33 %)	28 (37.33 %)
Co-Morbid Condition		
DM	50 (33.33 %)	0 (0 %)
HTN	68 (45.33 %)	0 (0 %)
Smoking	22 (14.67 %)	3 (4 %)
Investigations		
Hb %	7.89 ± 1.92	12.78 ± 1.57
FBS	116.97 ± 39.04	94.92 ± 9.53
Urea	122.24 ± 45.94	26.41 ± 6.63
Sr. Creatinine	7.32 ± 5.22	0.73 ± 0.11
e-GFR	18.51 ± 17.22	105.22 ± 13.52
FTC	186.90 ± 22.91	160.18 ± 16.66
FTG	172.34 ± 45.54	104.44 ± 25.37
FHDL	39.88 ± 10.89	51.94 ± 8.48
FVLDL	34.52 ± 9.13	20.84 ± 5.07
FLDL	112.49 ± 22.83	87.34 ± 17.25
PPTC	209.29 ± 25.12	171.40 ± 16.99
PPTG	219.62 ± 49.55	126.08 ± 22.55
PPHDL	36.67 ± 10.91	50.13 ± 8.53
PPVLDL	43.95 ± 9.91	25.22 ± 4.51
PPLDL	128.66 ± 24.88	96.10 ± 17.53

Table 1. Base Line Characteristics of Cases and Controls

Lipid Profile	Fasting (n = 150) Mean ± SD	Post-Prandial (n = 150) Mean ± SD	Mean Difference Mean ± SD	T-Value	P-Value
TC	186.90 ± 22.91	209.29 ± 25.12	22.39 ± 2.77	8.06	0.0001,S
TG	172.34 ± 45.54	219.62 ± 49.55	47.28 ± 5.49	8.60	0.0001,S
HDL	39.88 ± 10.89	36.67 ± 10.91	3.20 ± 1.25	2.54	0.011,S
VLDL	34.52 ± 9.13	43.95 ± 9.91	9.42 ± 1.10	8.56	0.0001,S
LDL	112.49 ± 22.83	128.66 ± 24.88	16.17 ± 2.75	5.86	0.0001,S

Table 2. Comparison between Fasting and Post-Prandial Lipid Profile in Cases Student's Unpaired t Test

Stages of CKD	FTC Mean ± SD	FTG Mean ± SD	FHDL Mean ± SD	FVLDL Mean ± SD	FLDL Mean ± SD
Stage 1	176.50 ± 15.64	118.16 ± 40.76	42.50 ± 8.11	23.66 ± 7.99	110.33 ± 15.79
Stage 2	177.90 ± 16.14	134.60 ± 40.37	48.30 ± 12.32	27 ± 8.04	102.60 ± 17.38
Stage 3	187.75 ± 23.88	161.50 ± 43.48	42.50 ± 11.41	32.37 ± 8.73	112.87 ± 22.98
Stage 4	183.81 ± 19.73	163.84 ± 44.12	41.21 ± 10.41	32.84 ± 8.82	109.75 ± 19.74
Stage 5	189.55 ± 24.62	183.83 ± 42.09	38.10 ± 10.66	36.81 ± 8.48	114.63 ± 25.64
Total	186.90 ± 22.91	172.34 ± 45.54	39.88 ± 10.89	34.52 ± 9.13	112.49 ± 22.83
F-Value	1.16	6.57	2.53	6.50	0.80
P-Value	0.32,NS	0.0001,S	0.043,S	0.0001,S	0.52,NS

Table 3. Comparison of Fasting Lipid Profile with Stages of CKD

Stages of CKD	PPTC Mean ± SD	PPTG Mean ± SD	PPHDL Mean ± SD	PPVLDL Mean ± SD	PPLDL Mean ± SD
Stage 1	199.66 ± 15.76	161.83 ± 47.20	39.50 ± 7.60	32.33 ± 9.37	127.83 ± 16.97
Stage 2	200.40 ± 24.29	174.60 ± 49.18	45.70 ± 14.30	34.90 ± 9.71	119.80 ± 20.02
Stage 3	211 ± 27.12	206.62 ± 46.77	40.37 ± 11.72	41.37 ± 9.31	129.25 ± 25.89
Stage 4	203.51 ± 24.56	209.87 ± 48.88	38.48 ± 10.47	41.96 ± 9.74	123.06 ± 24.02
Stage 5	212.77 ± 25.41	232.77 ± 44.27	34.55 ± 10.23	46.60 ± 8.87	131.61 ± 25.84
Total	209.29 ± 25.12	219.62 ± 49.55	36.67 ± 10.91	43.95 ± 9.91	128.66 ± 24.88
F-value	1.44	7.23	3.34	7.34	1.06
P-value	0.22,NS	0.0001,S	0.012,S	0.0001,S	0.37,NS

Table 4. Comparison of Post-Prandial Lipid Profile with Stages of CKD

Table 3 depicts comparison of fasting lipid profile with various stages of CKD. Fasting total cholesterol (FTC) had a mean of 186.90 with standard deviation of ± 22.91. FTC distribution between various stages was not statistically significant (p-value = 0.32). Fasting triglycerides (FTG) had a mean of 172.34 with standard deviation of ± 45.54. FTG distribution between various stages was statistically significant (p-value = 0.0001). Fasting high density lipoprotein (FHDL) had a mean of 39.88 with standard deviation of ± 10.89. FHDL distribution between various stages was statistically significant (p-value = 0.043). Fasting very low-density lipoprotein (FVLDL) had a mean of 34.52 with a standard deviation of ± 9.13. FVLDL distribution between various stages was statistically significant (p-value = 0.0001). Fasting low density lipoprotein (FLDL) had a mean of 112.49 with a standard deviation of ± 22.83. FLDL distribution between various stages was not statistically significant (p-value = 0.52).

Table 4 depicts comparison of post-prandial lipid profile according to stages of CKD. Post-prandial total cholesterol (PPTC) had a mean of 209.29 with standard deviation of ± 25.12. PPTC distribution between various stages was not statistically significant (p-value = 0.22). Post-prandial triglycerides (PPTG) had a mean of 219.62 with standard deviation of ± 49.55. PPTG distribution between various stages was statistically significant (p-value = 0.0001). Post-prandial high density lipoprotein (PPHDL) had a mean of 36.67 with standard deviation of ± 10.91. PPHDL distribution between various stages was statistically significant (p-value = 0.012). Post-prandial very low density lipoprotein (PPVLDL) had a mean of 43.95 with a standard deviation of ± 9.91. PPVLDL distribution between various stages was statistically significant (p-value = 0.0001). Post-prandial low density lipoprotein (PPLDL) had a mean of 128.66 with a standard deviation of ± 24.88. PPLDL distribution between various stages was not statistically significant (p-value = 0.37). [Table 4]

Lipid Profile	Fasting (n = 50) Mean ± SD	Post Prandial (n = 50) Mean ± SD	Mean Difference Mean ± SD	T-Value	P-Value
TC	197.80 ± 25.08	220.56 ± 25.29	22.76 ± 5.03	4.51	0.0001,S
TG	187.22 ± 46.96	232.42 ± 48.85	45.20 ± 9.58	4.71	0.0001,S
HDL	38.86 ± 10.91	35.74 ± 10.81	3.12 ± 2.17	1.43	0.15,NS
VLDL	37.48 ± 9.47	46.50 ± 9.77	9.02 ± 1.92	4.68	0.0001,S
LDL	121.46 ± 26.14	138.32 ± 26.56	16.86 ± 5.27	3.19	0.002,S

Table 5. Comparison between Fasting and Post-Prandial Lipid Profile in Cases with Diabetes Mellitus

Student's unpaired t test

In our research, we compared the quick and post-prandial lipid profile with CKD with mellitus and found statistical significance for total cholesterol (TC), triglycerides (TG), very low lipoprotein density (VLDL) and low lipoprotein density (LDL). Lipoprotein of high density (HDL) was not statistically important. [Table 5]

Study	No. of Cases	Fasting Total Cholesterol (Mean ± SD)	Post-Prandial Total Cholesterol (Mean ± SD)	P-Values
Lokhande Suryabhan et al[11]	50	208.10 ± 53.18	238.90 ± 56.77	< 0.001
Vinod Wali et al[12]	75	217.45 ± 49.63	249.78 ± 54.13	≤ 0.01
Present Study	150	186.90 ± 22.91	209.29 ± 25.12	0.0001

Table 6. Comparison of Fasting and Post-Prandial Total Cholesterol in Various Studies

DISCUSSION

A total of 225 participants participated in this study. Of these, 150 individuals were already diagnosed with CKD based on

the classification of kidney disease that enhanced global outcomes (KDIGO) and 75 years and sex had healthy individuals matched as controls.

We have discussed the findings in our study under the following headings:

1. Comparison of fasting and post-prandial individual parameter of lipid profile with stages of CKD.
2. Comparison of fasting lipid profile between cases and controls.
3. Comparison of post-prandial lipid profile between cases and controls.
4. Comparison of fasting and post-prandial lipid profile in cases with diabetes mellitus.

Comparison of Fasting and Post-Prandial Lipid Profile in Cases

In our study we observed that total cholesterol (TC), triglycerides (TG), high density lipoproteins (HDL), very low density lipoprotein (VLDL) and low density lipoprotein (LDL) when compared in fasting and post-prandial state in cases by students unpaired t test was statistically significant. Vinod Wali et al (2016)[12] and Lokhande Suryabhan et al (2013)[11] performed similar study but in patients with diabetes mellitus found similar findings as that of in our study.

Comparison of Lipid Profile and Stages of CKD

In our study we have compared lipid profile in fasting and post-prandial state with various stages of CKD. We have also compared fasting lipid profile with post-prandial lipid profile in total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL), very low density lipoprotein (VLDL) and low density lipoprotein (LDL).

Fasting total cholesterol (FTC) when compared with various stages of CKD was not statistically significant (p-value = 0.32). Similarly, post-prandial total cholesterol (PPTC) when compared with various stages of CKD was not statistically significant (p-value = 0.22). Fasting triglycerides (FTG) when compared with various stages of CKD was statistically significant (p-value = 0.0001). Similarly, post-prandial triglycerides (PPTG) when compared with various stages of CKD was statistically significant (p-value = 0.0001). Fasting high density lipoprotein (FHDL) when compared with various stages of CKD was statistically significant (p-value = 0.043). Similarly, post-prandial high-density lipoprotein (PPHDL) when compared with various stages of CKD was statistically significant (p-value = 0.012). Fasting very low-density lipoprotein (FVLDL) when compared with various stages of CKD was statistically significant (p-value = 0.0001). Similarly, post-prandial very low-density lipoprotein (PPVLDL) when compared with various stages of CKD was statistically significant (p-value = 0.0001). Fasting low density lipoprotein (FLDL) when compared with various stages of CKD was not statistically significant (p-value = 0.52). Similarly, post-prandial low density lipoprotein (PPLDL) when compared with various stages of CKD was not statistically significant (p-value = 0.37).

So in our study we observed that fasting and post-prandial triglycerides (TG), high density lipoprotein (HDL), very low density lipoprotein (VLDL) have statistical significance when compared with various stages of CKD whereas total cholesterol (TC) and low density lipoprotein (LDL) doesn't have statistical significance when compared with various stages of CKD.

Comparison of Fasting and Post-Prandial Individual Parameters of Lipid Profile with Stages of CKD

We have compared total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL), very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL) individually in fasting and post-prandial state with various stages of CKD. Fasting and post-prandial total cholesterol (TC) when compared with various stages of CKD was found to be statistically significant in all stages of CKD except stage III of CKD. Fasting and post-prandial triglycerides (TG) when compared with various stages of CKD was found to be only statistically significant in stage IV and V of CKD. Fasting and post-prandial high-density lipoprotein (HDL) when compared with various stages of CKD was found to be statistically significant only in stage V of CKD. Fasting and post-prandial very low-density lipoprotein (VLDL) when compared with various stages of CKD was found to be statistically significant in stage IV and V of CKD. Fasting and post-prandial low-density lipoprotein (LDL) when compared with various stages of CKD was found to be significant in stage IV and stage V.

Comparison of Fasting Lipid Profile between Cases and Controls

In our study we compared the fasting lipid profile in cases and controls. It was found statistically significant in FTC, FTG, FHDL, FVLDL and FLDL. (p-value = 0.0001)

Comparison of Post-Prandial Lipid Profile between Cases and Controls

In our study we compared the post- prandial lipid profile in cases and controls. It was found statistically significant in PPTC, PPTG, PPHDL, PPVLDL and PPLDL. (p-value = 0.0001)

Comparison of Fasting and Post-Prandial Lipid Profile in Cases with Diabetes Mellitus

In our study we compared the fasting and post-prandial lipid profile in cases with diabetes mellitus. We found that TC, TG, VLDL and LDL were statistically significant.

CONCLUSIONS

Dyslipidemia of CKD is characterized by raised triglycerides, very low-density lipoprotein and decreased high density lipoprotein. Fasting lipid profile in CKD patients was higher as compared to controls and was found to be similar with regard to post-prandial lipid profile. When we compared the fasting and post-prandial lipid profile in CKD patients, we found that there is a significant difference. Even in controls, we found a significant difference in the fasting and post-prandial lipid profile. Patients with CKD and diabetes mellitus had a significant increase in total cholesterol, triglycerides, low density lipoprotein and very low density lipoprotein in fasting and post-prandial state. In clinical practice, the

implementation of standardized methodologies and biomarker profiles would allow for the early and reliable detection of those at risk.

Limitations

In present study most of the patients were in advanced stages of CKD because of the unawareness in the rural population. Therefore, further study is required to evaluate the post-prandial lipid profile in early stages of CKD.

- There are no standard guidelines to check for postprandial lipid profile.
- There was no restriction on the meal after which the post-prandial lipid profile was done.
- There is no standard reference range for post-prandial lipid profile and further studies are required for standardization of postprandial lipid profile levels.

Recommendation

In patients of CKD, inclusion of post-prandial lipid profile should be considered along with fasting lipid profile for better assessment and management of dyslipidemia.

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