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Evaluation of serum lipid profile in patients on maintenance hemodialysis

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Abstract
This hospital-based cross-sectional comparative observational study was performed to determine the pattern of lipid profile in patients on maintenance hemodialysis. The study was performed at the Department of Biochemistry, Jawaharlal Nehru Medical College Hospital, Bhagalpur, Bihar, India from May 2020 to September 2020. Fifty patients with end-stage renal disease on maintenance hemodialysis (MHD) were studied. They comprised of 30 males and 20 females, the mean duration on hemodialysis was 7.58 ± 2.05 yrs, with frequency of 02 to 03 sessions per week and each session lasting for 04 hours. Additionally, 25 healthy volunteers (15 male, 10 female) were also studied. After obtaining informed, written consent, general information of each patient was recorded on the preformats. After 12-hours fasting, with all due universal precautions blood samples were drawn from the arterio-venous fistula before starting dialysis. The samples were analyzed in autoanalysers with their recent quality control examinations. The total cholesterol, triglyceride (TG) or low density lipoprotein (LDL) levels more than 95th percentile for age and gender or high density lipoprotein (HDL) less than 35 mg/dL is defined as Dyslipidemia. Descriptive and inferential statistical analysis was performed using SPSS version 16.0. The age among MHD and control groups was 47.88 ± 13.92 and 54.56 ± 11.16 years respectively. Serum TG and lipoprotein-a (LPa) were significantly increased (P= < 0.001 for each) while HDL-c was significantly lower (P= < 0.001) in MHD patients than in the control group. The serum cholesterol, LDL-c, VLDL-c and chylomicron levels were not significantly different in the two groups. Our study suggests that patients on MHD show abnormalities of lipid metabolism like hypertriglyceridemia, elevated lipoprotein-a & low HDL-c, which could contribute to atherosclerosis and cardiovascular disease that may increase the morbidity and mortality in these patients.

Keywords: Lipid, atherosclerosis, dyslipidemia, maintenance hemodialysis

Introduction
The incidence and prevalence of chronic kidney disease (CKD) are increasing worldwide. According to National Health and Nutritional Examination Survey (NHANES), the prevalence of CKD in the US population is 15.3% [1]. Patients with CKD are in the highest risk category for coronary heart diseases [2]. The incidence of cardiovascular disease (CVD) is high in patients on hemodialysis (HD) [3]. Approximately 50% of patients with end-stage renal disease (ESRD) die from cardiovascular events [4], which indicates that cardiovascular mortality is 30-times higher in dialysis patients. The Kidney Dialysis Outcome Quality Initiative (K/DOQI) guidelines state that patients on MHD with fasting triglycerides (TG) > 5.65 mmol/L, low density lipoprotein (LDL) > 2.59 mmol/L and non-HDL cholesterol >3 .36 mmol/ L, should be considered for treatment to reduce the cardiovascular complications in these patients [5]. Dyslipidemia has been established as known traditional risk factor for CVD in the general population as well as in CKD patients on maintenance HD. CKD is known to cause an increase in triglycerides and a decrease in high-density lipoprotein that mimic the lipid abnormalities of the metabolic syndrome, which accelerate the progression of CKD and increase the risk for cardiovascular mortality.

Table 1: Basic Demographic and Clinical characteristic of the study group.

		Patient (n=50) Mean ± SD (Range)	Control (n=25) Mean ± SD (Range)
Age (yrs)		47.88 ± 13.92 (26-74)	54.56 ± 11.16 (35-74)
Hemoglobin (gm/dL)		10.45 ± 1.47 (7.3-12.6)	13.436 ± 2.06 (10.6-16.3)
Blood Urea (mg/dL)		118.64 ± 45.10 (13-198)	13.16 ± 3.24 (8-20)
Serum Creatinine (mg/dL)		7.678 ± 3.53 (1.2-14.2)	0.432 ± 0.20 (0.2-0.8)
Serum Calcium (mg/dL)		8.334 ± 0.49 (7.6-9.8)	9.412 ± 0.47 (8.6-10.1)
Serum Phosphorus (mg/dL)		4.738 ± 1.17 (2.5-7.2)	3.212 ± 0.39 (2.5-3.7)
Hemodialysis duration (yrs)		7.58 ± 2.05 (5-13)	0
Hemodialysis Frequency	Twice weekly Thrice weekly	42 (82%) 08 (16%)	0 0
Gender	Male Female	30 (60%) 20 (40%)	15(60%) 10(40%)
Hepatitis Profile	Hepatitis B+ve Hepatitis C+ve	21 (42%) 17 (34%)	4 (16%) 3 (12%)
Locality	Rural Urban	22 (44%) 28 (56%)	11 (44%) 14 (56%)

Results are expressed as Mean ± SD

Hemodialysis patients usually display elevated TG, reduced serum high density lipoprotein (HDL) cholesterol and

elevated concentration of lipoprotein-a (LP-a). Total and LDL cholesterol levels usually remain within normal limits.6 Cholesterol levels may be lower in MDH patients. There is an inverse relationship between mortality and the cholesterol concentration. 7 This pattern of reverse epidemiology, i.e., hypercholesterolemia associated with decreased mortality and low cholesterol concentration associated with increased CVD mortality seen in MHD patients has been related to the malnutrition-inflammation-atherosclerosis complex. 8, 9 Keeping in view the mortality associated with CVD in patients on HD, we investigated the serum lipid status in CKD patients undergoing long-term maintenance HD treatment and compared the values with healthy subjects. Additionally, LP-a levels were also investigated as an independent risk factor of CVD in these patients.

Patients and Methods

This cross sectional comparative observational study was conducted at the Department of Biochemistry, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, India. Fifty patients with CKD, who were on maintenance Hemodialysis (HD) treatment, were studied. There were 30 males and 20 females; their mean duration on HD treatment was 7.58 ± 2.05 yrs, with frequency of two to three times per week and each session of HD treatment lasting for four hours. Additionally, 25 healthy volunteers (15 male and 10 female) who had no history of hematological or renal diseases were included in the study. After they were informed about the study, written consent was obtained. General information of each patient (age, sex, bmi, duration and frequency of HD, underlying renal disease, and family history of hypertension, hyperlipidemia and myocardial infarction) were recorded. Patients were dialyzed with volumetric dialyzer machines, bicarbonate buffer-based dialysate with blood flow of 250 mL/min and dialysate flow of 500 mL/ min. All patients were dialyzed using 1.6 m^2 surface area hollow fiber polysulfone membrane dialyzers. Patients taking diuretics, lipid lowering agents as well as those with acute or chronic infection were excluded from the study.

Table 2: Distribution of BMI among the dialysis patients (n=50) and controls (n=25)

BMI (kg/m2)	Patient		Control		P value
	n=50	%)	n=25	%	
< 18.5	24	48%	3	12%	0.002*
18.5-25	21	42%	17	68%	0.05*
25-29.9	4	8%	3	12%	0.68
>30	1	2%	2	8%	0.25

**P* value is statistically significant

After 12-hours of fasting, blood samples of patients were drawn from the AV fistula before starting dialysis for lipid profile analysis which included total cholesterol, serum triglycerides (TG), high density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol, very low density lipoprotein (VLDL) cholesterol, and LP-a. Total cholesterol, TG, HDL were measured by electrophoresis method and if TG was less than 400 mg/dL, LDL and VLDL were derived from Friedwald's formula [10]. (LDL-C=TC–(HDL-C+TG/2.2). Lipoprotein electrophoresis was performed for LP-a by enzyme linked immune assay (ELISA). Serum Magnesium, Creatinine, Blood Urea, serum Calcium, and serum Phosphorus were measured using standard methods.

In the control group, blood samples were collected from the Cubital vein after 12-hours fasting. For each patient, total cholesterol, TG or LDL levels more than 95th percentile for age and gender or HDL less than 35 mg/dL was defined as Dyslipidemia.

Statistical Analysis

The data were analyzed in statistical program SPSS version 16.0. Frequencies and percentages of categorical parameters were computed on 95% confidence interval and Pearson chi square test was used for BMI parameter which was recoded and categorized into four groups. Student's t test was applied for numerical variables of investigations. *P* value ≤ 0.05 was considered as significant level.

Result

Seventy five subjects, 50 in the maintenance hemodialysis (MHD) group and 25 in the control group were studied. There were 30 males (60%) and 20 females (40%) in the MHD group, and 15 males (60%) and 09 females (40%) in the control group (Table 1).

Table 3: Etiology of End Stage Renal disease in patients on maintenance hemodialysis treatment (n=50)

Etiology	N	%
Primary Glomerular disease	2	4
Hypertension	11	22
Diabetes Mellitus	15	30
Analgesic Nephropathy	3	6
ADPKD(Autosomal dominant polycystic kidney disease)	4	8
Chronic Pyelonephritis	2	4
Obstructive Nephropathy	3	6
Renal artery stenosis	1	2
Diabetes	6	12
Idiopathic	3	6

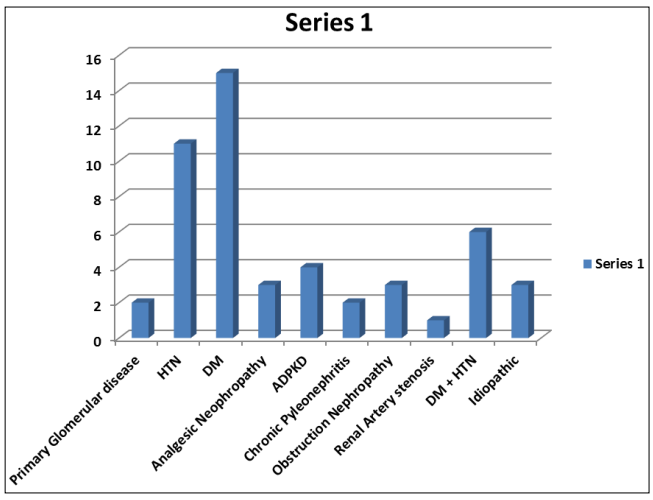

Fig 1: Graphical presentation of etiology of end-stage renal disease in patients on maintenance hemodialysis treatment (n=50)

Age among MHD and control groups were 47.88 ± 13.92 and 54.56 ± 11.16 years respectively. The mean duration on HD among the MHD patients was 7.58 + 2.05 years, with frequency of twice weekly in 42 (88%) and thrice weekly in eight patients (16%).

The MHD patients had lower BMI compared with the control group; mean (SD) 19.83 ± 4.05 *vs.* 22.21 ± 3.8

(Table 2). The mean haemoglobin among MHD patients and control groups was 10.45 + 1.47 and 13.43 + 2.06 gm/ dL. Among MHD patients, the mean urea was 118.64 + 45.1 mg/dL and creatinine was 7.67 + 3.53 mg/dL (Table 1). The serum triglyceride and LP-a levels were significantly higher in MHD patients than in the control group (P= < 0.001 for each), while HDL-c was significantly lower in MHD patients compared to control group (P= <0.001). The serum cholesterol, LDL-c, VLDL-c and chylomicron levels were not significantly different in the two groups. The most common abnormality observed among MHD patients was low HDL cholesterol followed by increased serum triglycerides and LP-a level (Table 3).

The etiology of CKD among MHD patients was diabetes mellitus in 15 (30%), hypertension in 11 (22%), both hypertension and diabetes mellitus in six (12%), ADPKD (Autosomal dominant polycystic kidney disease) in four (8%), analgesic nephropathy, obstructive nephropathy and idiopathic in three patients each (6%), primary glomerular disease and chronic pyelonephritis in two patients each (4%) and renal artery stenosis in one patient (2%) (Figure 1).

Table 4: Lipid profile among study groups

	Patient (n=50)	Control (n=25)	P Value
Cholesterol (mg/dL)	131.38 ± 36.4	120.32 ± 7.15	0.138
High Density Lipoprotein-Cholestrol (mg/dL)	24.62 ± 6.43	50.48 ± 9.47	<0.001*
Low Density Lipoprotein-Cholesterol (mg/dL)	95.34 ± 25.5	88.20 ± 16.26	0.20
Very Low Density Lipoprotein-Cholestrol(mg/dL)	25.77 ± 6.27	25.69 ± 6.24	0.95
S-Triglycerides (mg/dL)	270.74 ± 231.65	71.68 ± 20.71	<0.001*
Lipoprotein a (mg/dL)	45.52 ± 15.24	19.99 ± 5.46	<0.001*
Chylomicron (mg/dL)	2.19 ± 0.88	1.92 ± 1.38	0.31

Results are expressed as Mean ± SD* P value highly significant

Discussion

In study, the pattern of dyslipidemia in ESRD patients on MHD showed hypertriglyceridemia, elevated LP-a & reduced HDL-c. Also, patients on MHD treatment had significantly low BMI as compared to control group, a finding that has been observed in several other studies [11, 12]. About 48% of the patients on MHD, in our study, had BMI < 18.5 kg/m^2, this indicates increased prevalence of malnutrition in patients according to WHO guidelines for adults [13].

In our study, 42% were of normal weight, 8% were overweight and 2% were obese in the MHD group. In contrast, Tourn *et al*. reported that 59% had normal weight, 24% were overweight and 17% were obese in their MHD patients [14]. This indicates that our patients are more malnourished as compared to their western counterparts.

In our study, the serum triglyceride levels were found to be significantly higher in MHD patients as compared to control group. Similar hypertriglyceridemia was also observed in several other studies including the CHOICE study [15, 18].

The second most common lipid abnormality in our study was low HDL-c level as compared to healthy volunteers. HDL-C was similarly found to be low in MHD patients by Pennell P *et al.* [17] and in the CHOICE study [18]. Piperi C *et al*. [19] also reported significantly low HDL-c level in their study. Total cholesterol, LDL-c, VLDL-c and chylomicrons were not significantly different between the patient and control groups.

We also observed elevated levels of LP-a in MHD patients as compared to the control group. Lipoprotein-(a) is an independent risk factor for cardiovascular disease [20, 21]. Liu J *et al.* [22] have suggested that increased levels of LP-a is highly atherogenic. Kaysen GA [23] also reported elevated LP-a levels in patients with kidney disease, which was associated with cardiovascular events among their dialysis patients.

Routine counseling and encouraging physical activity in MHD patients has potential to improve physical functioning, optimizing the quality of life [24] and possibly improving the plasma lipids and lipoprotein pattern. Our study indicates that if we apply regular exercise program in our dialysis patients, we can achieve improvement in lipid and lipoprotein levels.

Conclusion

Our results indicate that patients undergoing MHD show important abnormalities of lipid metabolism such as hypertriglyceridemia, elevated LP-a and low HDL-c, which could contribute to atherosclerosis and cardiovascular disease and may increase the morbidity and mortality in this group. As a first step of controlling hyperlipidemia, body weight normalization, dietary modification, regular exercise and education about diet should be applied. It may also be useful to supplement the diet with polyunsaturated fatty acids from fish oil in order to reduce triglycerides. Fibrates are not recommended in patients with renal failure, because of their renal excretion. Statins can be used safely in patients with CKD with careful monitoring. They reduce plasma LDL cholesterol by approximately 25-40%.

References

1. Whaley-Connell AT, Sowers JR, Stevens LA, *et al*. CKD in the United States: Kidney Early Evaluation Program (KEEP) and National Health and Nutrition Examination Survey (NHANES) 1999-2004. Am J Kidney Dis. 2008; 51(suppl 2):S13-20.
2. National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: Evaluation, classification, and stratification. Am J Kidney Dis. 2002; 39:S1-266.
3. Gowdak LH, Arantes RL, de Paula FJ, Krieger EM, De Lima JJ. Under use of American College of Cardiology/American Heart Association Guidelines in hemodialysis patients. Ren Fail. 2007; 29(5):559-65.
4. Foley RN, Parfrey PS, Sarnak MJ. Clinical epidemiology of cardiovascular disease in chronic renal disease. Am J Kidney Dis. 1998; 32:S112-9.
5. National Kidney Foundation. K/DOQI clinical practice guidelines for managing dyslipidemias in chronic kidney disease. Am J Kidney Dis 2003;41(suppl 3):S1-92
6. Deighan CJ, Caslake MJ, McConnell M, Boulton-

Jones JM, Packard CJ. Atherogenic lipoprotein. Phenotype in end-stage renal failure: origin and extent of small dense low density lipoprotein formation. Am J Kidney Dis. 2000; 35:852-62
7. Iseki K, Yamazato M, Tozawa M, Takishita S. Hypocholesterolemia is a significant predictor of death in a cohort of chronic hemodialysis patients. Kidney Int. 2002; 61:1887-93.
8. Liu Y, Coresh J, Eustace JA, *et al*. Association between cholesterol level and mortality in dialysis patients: Role of inflammation and malnutrition. JAMA. 2004; 291:451-9.
9. Kalantar-Zadeh K, Block G, Humphreys MH, Kopple JD. Reverse epidemiology of cardiovascular risk factors in maintenance dialysis patients. Kidney. 2003; 63(3):793-808.
10. Friedwald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma without use of preparative ultracentrifuge. Clin Chem. 1972; 18:499-502.
11. Bednarek-Skublewska A, Baranowicz-Gaszczyk I, Jóźwiak L, Dzik M, Majdan M, Ksiazek A, *et al*. Comparison of some nutritional parameters in hemodialysis patients over and below 65 years of age. Pol Arch Med Wewn. 2005; 113(5):417-23.
12. Basaleem HO, Alwan SM, Ahmed AA, Al-Sakkaf KA. Assessment of the nutritional status of endstage renal disease patients on maintenance hemodialysis. Saudi J Kidney Dis Transpl. 2004; 15(4):455-6.
13. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. Geneva, World Health Organization, (WHO Technical Report Series, No.854), 1995.
14. Torun D, Micozkadioglu H, Torun N, *et al*. Increased body mass index is not a reliable marker of good nutrition in hemodialysis patients. Ren Fail. 2007; 29(4):487-93.
15. Shah B, Nair S, Sirsat RA, Ashavaid TF, Nair KG. Dyslipedemia in patients with chronic renal failure and in renal transplant patients. J Postgrad Med. 1994; 40(2):57-60.
16. de Gomez Dumm NT, Giammona AM, Touceda LA, Raimondi C. Lipid abnormalities in chronic renal failure patients undergoing hemodialysis. Medicina (Buenos Aires). 2001; 61:142- 6.
17. Pennell P, Leclercq B, Delahunty MI, Walters BA. The utility of non-HDL in managing dyslipidemia of stage 5 chronic kidney diseases. Clin Nephrol. 2006; 66(5):336-47.
18. Longenecker JC, Coresh J, Powe NR, *et al*. Traditional cardiovascular disease risk factors in dialysis patients compared with the general population: The CHOICE Study. J Am Soc Nephrol. 2002; 13(7):1918-27.
19. Piperi C, Kalofoutis C, Tzivras M, Troupis T, Skenderis A, Kalofoutis A, *et al*. Effects of hemodialysis on serum lipids and phospholipids of end-stage renal failure patients. Mol Cell Biochem. 2004; 265(1-2):57-61.
20. Kronenberg F, Kathrein H, Ko¨nig P, *et al*. Apolipoprotein (a) phenotypes predicts the risk for carotid atherosclerosis in patients with endstage renal disease. Arterioscler Thromb. 1994; 14:1405-11.
21. Cressman MD, Heyka RJ, Paganini EP, *et al*. Lipoprotein (a) is an independent risk factor for cardiovascular disease in hemodialysis patients. Circulation. 1992; 86:475-82.
22. Liu J, Rosner MH. Lipid abnormalities associated with end-stage renal disease. Semin Dial 2006; 19(1):32-40.
23. Kaysen GA. Hyperlipidemia in chronic kidney disease. Int J Artif Organs. 2007; 30(11):987-92.
24. Painter P. Physical functioning in end-stage renal disease patients: Update 2005. Hemodial Int. 2005; 9(3):218-35.
25. Shipra Parag Shrivastava, Rajesh Kumar Sahu, Rakhi Shrivastava. Establishment of reference intervals for fasting and non-fasting serum lipid profile from healthy population in Bhopal, Madhya Pradesh, India. International Journal of Biology Research, Volume 5, Issue 3, 2020, Pages 01-04