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Impact of Hemodialysis on Lipid Profile among Chronic Renal Failure Patients - A Case Control Study

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Abstract- Chronic Renal Failure (CRF) patients are at risk of cardiovascular diseases due to the elevation of various forms of lipids. Many a time CRF patients live on hemodialysis on regular basis. Present study was done to know whether hemodialysis has any impact on the lipid profile of the CRF patients. Study were divided into 3 groups, Group-I: healthy controls (30), Group-II: CRF patients who never undergone hemodialysis (30) and Group-III: CRF patients on hemodialysis for more than 6 months (30). We obtained serum samples from patients in the morning after an overnight fast and were analyzed for total cholesterol (TC), triglycerides (TGs), HDL, LDL and VLDL. Among the various parameters tested triglyceride and VLDL levels were significantly higher in group-II and III as compared to controls ($p<0.01$). HDL levels were significantly lower in group-II and III as compared to control ($p<0.05$). HDL level was found reduced in group-III as compared to Group-II ($p<0.01$). There was no significant change ($p>0.05$) observed in total cholesterol and LDL levels in between healthy controls and CRF patients with & without hemodialysis. There was no significant difference ($p>0.05$) observed between lipid profile in male and female patients in control group and in CRF patients with and without hemodialysis. It is concluded that both male and female patients of CRF with and without hemodialysis have characteristic dyslipidemias without any discrimination of sex and it is not attenuated by the hemodialysis process.

Index Terms- Chronic renal failure, hemodialysis, lipid profile, cardiovascular diseases

I. INTRODUCTION

Dyslipidemias is a very common complication of Chronic Renal Failure (CRF). Disturbances in lipoprotein metabolism are evident even at the early stages of CRF and usually follow a downhill course that parallels the deterioration in renal function. Recently published studies indicate that dyslipidemias in these patients may actively participate in the pathogenesis of Cardiovascular disease (CVD) as well as in the deterioration of renal function.[1]The characteristic lipid abnormalities seen in CRF patients are elevated triglycerides, normal/reduced total cholesterol (TC), decreased High Density Lipoprotein (HDL), normal Low Density Lipoprotein (LDL)[2]. Progressive CRF not only leads to End stage renal disease (ESRD), but it is associated with high cardiovascular morbidity & mortality. In fact, patients with CRF are much more likely to die because of dyslipidemias than to progress to ESRD.[3]With the implication of plasma lipids in the pathogenesis of atherosclerosis and ischemic heart disease, it becomes worthwhile to study the behavior of various lipid fractions in CRF patients.[4]CVD constitutes the major cause of death in patients with ESRD and it is still higher in hemodialysis patients than in post transplantation patients.[5]ESRD Patients on hemodialysis have abnormalities in lipoprotein structure and metabolism and have a high incidence of cardiovascular diseases.[6]Keeping in view the different outcomes of the researchers regarding hemodialysis modality in CRF patients, the present study was designed to see any impact of hemodialysis on lipid profile in CRF patients with and without hemodialysis.

II. METHODOLOGY

This prospective, observational study was started after prior approval from Institutional Review Board (Human Ethics Committee), Shree M. P. Shah Medical College and Guru Gobindsingh Government Hospital, Jamnagar, Gujarat (India). Informed consent was obtained from the patients before enrolment. Age and sex matched (Both male and female patients aged more than 18 years) 60 patients of CRF and 30 healthy controls were recruited for this study. In order to understand the influence of dialysis on lipid profile, the patients were divided into 2 groups: those who have CRF but undialysed and those who are on maintenance hemodialysis for more than 6 months. Thus, study was divided into Group-I (healthy controls), Group-II (CRF patients who never undergone hemodialysis) and Group-III (CRF patients on hemodialysis for more than 6 months). Exclusion criteria include Body mass index (BMI) more than 24.9 kg/m^2, known case of acute renal failure/diabetes mellitus/hypertension/ischemic heart disease, taking drugs that affect lipids and lipoproteins level.5 ml of venous blood samples were collected in plain tubes after an overnight fast. After collection, the samples were allowed to clot for half an hour following which the samples were centrifuged and serum was analysed. Serum total cholesterol (TC), triglycerides (TGs), HDL cholesterol (HDL-C), LDL cholesterol (LDL-C), Lp(a), urea and creatinine, were measured colorimetrically using commercially available kits on fully auto analyzer of Clinical Biochemistry Laboratory. VLDL cholesterol concentration was calculated using Friedewald's Formula[7].

Statistical Analysis

In data analysis, comparison of parameters (1) in between two study groups and (2) in between control group and two study groups were done by using Unpaired t-test. Microsoft excel 2007 software was used for data analysis. Comparison between male and female patients was carried out in all the three groups by using unpaired t-test in Graph Pad Prism 6 software.

III. RESULTS

The baseline characteristics of study population are shown in table I. Table II revealed the biochemical parameters among control and CRF patients with and without hemodialysis.

Table I: Baseline characteristics of study population

Characteristics	Group-I Healthy Controls	Group-II CRF pts without HD	Group-III CRF pts with HD
No. of participants	30	30	30
Age (years) Mean ± SD	44.27 ± 10.72	44.27 ± 10.72	44.27 ± 10.72
Sex (male/female)	18/12	18/12	18/12
Body mass index (kg/m^2)	22.01 ± 1.32	21.23 ± 0.86	20.89 ± 1.14
Urea (mg/dl)	27.8 ± 6.58	132.73 ± 52.55	107.26 ± 35.27
Creatinine (mg/dl)	0.84 ± 0.35	11.48 ± 3.19	6.19 ± 2.89

CRF=chronic renal failure, pts= patients, HD= hemodialysis.

Table II: The Biochemical parameters among Control and CRF patients with and without hemodialysis (In Mean± Standard deviation)

Parameters (mg/dl)	Group –I Healthy Controls (n=30)	Group- II CRF pts without HD (n=30)	Group –III CRF pts with HD (n=30)
TC	171.97 ± 16.45	176.52 ± 43.42	172.3 ± 40.74
TGs	138.66 ± 20.58	204.47 ± 23.66**	243.67 ± 36.07**
HDL	45.6 ± 10.90	41.30 ± 13.16**	27.79 ± 15.05**
LDL	106.26 ± 13.52	102.63 ± 21.05	102.82 ± 21.53
VLDL	27.67 ± 4.2	41.46 ± 5.3**	48.73 ± 7.2**

* p< 0.05 **p < 0.01. Figures in parentheses indicate the number of patients. CRF= chronic renal failure, pts= patients, HD= hemodialysis.

Among 3 groups, 90% patients of CRF with hemodialysis have elevated triglyceride level and 80% patients without hemodialysis have elevated triglyceride level as compared to controls (p<0.01). There is no significant difference observed between total cholesterol levels in all the three groups (p>0.05). HDL cholesterol levels reduced in CRF patients with and without hemodialysis as compared to controls (<0.05). Reduction in HDL cholesterol is observed in 60% of the CRF patients with hemodialysis as compared to 10% in CRF patients without hemodialysis (p<0.01). There is no significant difference observed between LDL cholesterol levels in all the three groups (p>0.05). VLDL cholesterol levels found to be higher in CRF patients with and without hemodialysis as compared to the controls (p<0.01).

Out of 30, there were 18 male patients and 12 female patients in each group. There was no significant difference observed between lipid profile levels in male and female patients in CRF patients with and without hemodialysis and in control group (p>0.05).

IV. DISCUSSION

CRF is a worldwide health problem and is the leading cause of morbidity and mortality in the developed world. Patients with CRF are at high risk forCVD and cerebrovascular disease (CBVD), and they are more likely to die of CVD than to develop ESRD. CRF is associated with premature atherosclerosis and increased incidence of cardiovascular morbidity and mortality. Several factors contribute to atherogenesis and cardiovascular disease in patients with CRF, the notably among all is dyslipidemias.[8]Chronic renal failure, per se, primarily affects the metabolism of high-density lipoprotein (HDL) and triglyceride (TG)-rich lipoproteins.[9]The characteristic dyslipidemias observed in CRF patients without hemodialysis in this study are shown in table III which were also reported by Amin *et al* (2006)[2], Vaziri *et al* (2006)[10] and Saland *et al* (2007)[11] .

Table III: Dyslipidemias observed in present study

	TGs	TC	HDL	LDL	VLDL
CRF patients without hemodialysis	↑	↔	↓	↔	↑
CRF patients with hemodialysis	↑↑	↔	↓↓	↔	↑↑
(↑= increased, ↑↑= highly increased, ↓= decreased, ↓↓= highly decreased, ↔= neither increased nor decreased)					

Cardiovascular disorders are one of the most serious problems in chronic hemodialysis patients. The mortality due to cardiovascular disease in hemodialysis patients is estimated to be 9% annually and is 30 times higher than that observed in the general population.[12] Dyslipidemias observed in CRF patients with hemodialysis in this study are shown in table III which were also supported by Janicki *et al* (2007)[13], Mekki *et al* (2009)[14] and Reddy *et al* (2009)[15].

In hemodialysis patients, postheparin plasma lipoprotein lipase activity and hepatic lipase activity have been reported to be reduced, while the apo CII/apo CIII ratio is decreased. A possible disturbance in both enzymes, accompanied by an increase in apo CIII in VLDL, results in a prolonged half-life of the VLDL particles, which may explain the observed hypertriglyceridemia in these patients[16-18].However, the effects of long term hemodialysis on lipolytic activities are not be clarified.Literature data about the effect of hemodialysis duration on dyslipidemias generated by CRF are few and controversy. The present study demonstrates that in CRF patients treated by intermittent dialysis, long-term hemodialysis fails to correct dyslipidemias generated by CRF. Our finding is differed from those of some authors who found that lipid and lipoprotein

compositions did not appear to be influenced by dialysis in CRF patients[16-18].

We also compared the lipid profile levels between male and female patients. Both male and female patients were equally affected by dyslipidemias of CRF. Amin *et al* (2006)[2]also reported the same.

V. CONCLUSION

CRF patients with and without hemodialysis are at greater risk of development of dyslipidemias, characterized by hypertriglyceridemia, elevated VLDL and decreased HDL levels without any discrimination of sex .Hemodialysis can effectively reduce the accumulation of nitrogenous waste products but fails to clear dyslipidemias generated during the course of CRF. But still the patients on hemodialysis are still exposed to several of the metabolic consequences of renal failure.On the basis of the findings of the present study, it is further suggested that prescribing lipid lowering treatment in CRF patients with dyslipidemias for preventing future episode of cardiovascular events could help and will also preserve renal function. A strict monitoring of lipid profile and lipoproteins can reduce the morbidity and mortality rate and will also improve the quality of life of CRF patients.

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