A Study of Differences in Lipid Profile in Patients on Conservative Treatment and Hemodialysis

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ABSTRACT

Introduction: The magnitude of the problem has become more apparent as patients survive longer on maintenance hemodialysis. Coronary artery disease is seen in 26% of dialysis patients.Objective of the study was to note the differences in lipid profile in patients on conservative treatment and hemodialysis.

Material and Methods: A hospital based prospective study was carried out among 70 patients at Kasturba Medical College Hospitals and from Wenlock Government Hospital, Mangalore, from April 2001 to December 2003. Lipid profile of all patients was carried out.

Results: Among the 35 patients who were on conservative treatment 20 patients showed normal lipid profile, 15 patients showed abnormal lipid profile. Out of the 35 patients who were on dialysis, 26 patients showed abnormal lipid profile fraction and 9 showed normal lipid profile. This was statistically significant (P= 0.007).

Conclusion: Because the lipid abnormalities in chronic renal failure accelerate the progression of the renal failure and predispose to atherosclerosis, it is worth while detecting and treating hyperlipidemia in these patients.

Keywords: Lipid profile, Patients, Hemodialysis

INTRODUCTION

The magnitude of the problem has become more apparent as patients survive longer on maintenance hemodialysis. Coronary artery disease is seen in 26% of dialysis patients.[1]

In chronic renal failure the most prevalent lipid disorders are hypertriglyceridemia and decreased HDL concentration, LDL levels are usually normal or marginally increased. LDL isolated from uremic patients is a poor ligand for the LDL apoB receptors.[2]

The most accepted theory of atherogenesis postulates that lipoprotein taken from blood stream are taken by macrophages in the sub endothelial space leading to formation of cholesterol engulfed cells (foam cells) and they trigger a series of events leading to formation of atherosclerotic plaque.[3] The arterial narrowing that follows impairs the blood supply to several organs heart, brain, kidney etc.

Therefore this study was planned to note the differences in lipid profile in chronic renal failure patients on conservative treatment and hemodialysis.

MATERIAL AND METHODS

Study was conducted in Kasturba Medical College Hospitals and from Wenlock Government Hospital, Mangalore with the Sample size of 70 patients. Study period was from April 2001 to December 2003.

Exclusion criteria: Known cases of diabetes and nephrotic syndrome and those patients who were not willing to participate in the study.

Laboratory procedures

1. Serum Triglyceride estimation

This was determined by the fully enzymatic U-V method as per the details shown in the system.

Test Principles

Triglycerides are hydrolysed by lipase to glycerol and free fatty acids. Glycerol is phosphorylated by ATP in the presence of glycerol kinase to glycerol-3-phosphate (G-3-P) which is oxidized by the enzyme glycerol 3-phosphate oxidase (G-P-O) producing hydrogen peroxide. Hydrogen peroxide so formed reacts with 4-aminoantipytine/ 3,5 dichloro-2-hydroxy benzene sulfuric acid to give a red coloured complex which is read at 510 nm (500 – 530 nm). N o r - mal value: 65-165 mg/dl.

2. Serum Total cholesterol estimation

This test was done on a method based on *Libermann – Burchard reaction calorimetric method.*

Principle: Cholesterol estrase (CHE) hydrolyses cholesterol ester. Free cholesterol is oxidized by the cholesterol oxidase (CHO) to Cholest-4-En-3-one and hydrogen peroxide. Hydrogen peroxide formed reacts with 4-aminoantipytine and phenol in the presence of peroxidase (POD) to produce pink colour.Normal cholesterol value: 150 – 250 mg/dl

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3. HDL – Cholesterol estimation

This involves two steps, precipitation and cholesterol estimation of the HDL – fraction by a modification of the method described by Burstein et al.

Principle: Chylomicrons, VLDL, and LDL were precipitated by adding phosphotungstic acid and magnesium ions to the sample. Centrifugation of the precipitant levels only the HDL in the supernatant (centrifugation done at 4000 rpm for a minimum of 30 minutes). The supernatant was separated out and its cholesterol content was determined enzymatically.

Normal values: Males: 35 – 55 mg/dl
                 Females: 45 – 65 mg/dl

In patients with high triglyceride values

The HDLc estimation was done after dilution of serum (1:1) with isotonic saline and the resultant cholesterol value of HDL was multiplied by 2. This was done to prevent the erroneous values of HDLc due to impaired sedimentation of the precipitate in a serum with high triglyceride concentration.

4. LDL-Cholesterol estimation

LDL cholesterol as calculated by using a standard WHO approved formula based on total cholesterol, triglyceride and HDL – cholesterol values.
Normal values: upto 150 mg/dl.

5. VLDL – Cholesterol

VLDL was calculated using the formulae: VLDL = Triglyceride level divided by 5.

		Normal	Abnormal	Total
Conservative	Count	20	15	35
	%	57.1	42.9	100
Dialysis	Count	9	26	35
	%	25.7	74.3	100
Total	Count	29	41	70
	%	41.4	58.6	100
$X^2 = 7.124$; p = 0.007 hs				

Table-1: List of CRF patients who are managed conservatively and on maintainence hemodialysis

In the absence of chylomicrons only three forms of lipoproteins are present in the sera – VLDL, LDL and HDL.

Since VLDL is the primary triglyceride carrying form in the fasting stage, its concentration can be approximated by dividing the amount of plasma triglyceride by 5 (based on the triglyceride to cholesterol ratio of VLDL).

Apart from the above mentioned trichemical assays, the other investigations set out in the proforma were carried out whenever necessary.

Age and sex wise distribution of serum lipids and lipoproteins were calculated with standard deviation. The correlation co-efficient was used to measure the association.

RESULTS

Total 70 cases of chronic renal failure patients were taken. Among the 35 patients who were on conservative treatment 20 patients showed normal lipid profile, 15 patients showed abnormal lipid profile. Out of the 35 patients who were on dialysis, 26 patients showed abnormal lipid profile fraction and 9 showed normal lipid profile.This was statistically significant (P= 0.007).

TC: The total cholesterol values in hemodialysis patients are increased as compared to patients on conservative treatment, 209.00 ± 45.87 and 193.91 ±47.45 respectively. However this is statistically not significant (P=0.181).

TG: There is significant rise in TG levels of hemodialysis patients as compared to patients on conservative treatment, 195.82 ± 55.70 and 141.77 ± 65.59 respectively. This is statistically highly significant (P = 0.001).

HDL: The HDL cholesterol levels are lower in hemodialysis patients as compared to patients on conservative treatment 33.85 ± 4.43 and 39.34 ± 7.67 respectively. This is statistically highly significant (P= 0.001).

LDL: The LDL cholesterol values are higher in hemodialysis patient as compared to patients on conservative management 135.97 ± 41.96 and 126.21 ± 48.46 respectively. However this is not statistically significant (P= 0.371).

VLDL: The VLDL cholesterol level in hemodialysis patients are increased as compared to patients on conservative treatment 39.16 ±11.14 and 28.35 ± 13.11 respectively. This

Lipid Profile	Group	N	Mean	Std. Deviation	t	P value
T. cholesterol	Renal fail	35	193.91	47.45	1.35	P =.181 ns
	Dialysis	35	209.00	45.87		
Triglycerides	Renal fail	35	141.77	65.59	3.71	P=.001 vhs
	Dialysis	35	195.82	55.70		
HDLc	Renal fail	35	39.34	7.67	3.66	P=.001 vhs
	Dialysis	35	33.85	4.43		
LDLc	Renal fail	35	126.21	48.46	0.90	P= .371 ns
	Dialysis	35	135.97	41.96		
VLDLc	Renal fail	35	28.35	13.11	3.71	P=.001 vhs
	Dialysis	35	39.16	11.14		
HDL/TC	Renal fail	35	0.21	6.78E-02	2.95	P=.004 hs
	Dialysis	35	0.17	5.60E-02		
Table-2: Lipid profile in chronic renal failure patients on conservative treatment and hemodialysis						

is statistically highly significant (P=0.001).

HDL/TC: The HDL/TC ratio in hemodialysis patients is decreased, as compared to patients on conservative treatment, 0.17 ± 5.60E-02 and 0.21±6.78 E-02 respectively. However this is statistically significant (P=0.004).

DISCUSSION

The results of comparative study of lipid profile in chronic renal failure patients on conservative treatment and hemodialysis showedincrease triglyceride and VLDL levels and decrease in HDL levels were seen in hemodialysis patients compared to patient on conservative treatment. But total cholesterol, LDL was not raised significantly. HDL/TC ratio was decreased in hemodialysis patients.

Out of 70 CRF patients 35 patients were on continuous hemodialysis and 35 were on conservative management. The patients who were on hemodialysis were suffering from chronic renal failure from long time compared to patients on conservative management. Probably that might have contributed to increase number of lipid abnormalities in those patients.

The dialysate glucose, acetate buffer, heparinization in hemodialysis contributed to aggravation of hyperlipidemia.[4] Glucose and acetate primarily contribute to aggravation of the hyperlipidemia.

Heparinization can deplete lipoprotein lipase (LPL) stores, hepatic triglyceride lipase (HTGL) and also inhibit LCAT.[5] In this study triglycerides were markedly elevated in hemodialysis patients as compared to patients on conservative treatment and this was statistically significant (P=0.001).

Monzani et al., in their study showed hemodialyis patients had general worsening of the lipoprotein profile with elevated APO-E levels and indirect evidence of remnant accumulation. PTH did not have any significant influence on lipoprotein pattern. Increased insulin levels during HD might partly account for high triglyceride of these patients.

The results point to elevated Apo CIII, reduced Apo CII / Apo CIII and Apo E/ APO CII ratios as typical features of uremic hyperlipidemia and show that a defective triglyceride removal is the major pathogenic mechanism of uremic high triglyceride.

Hemodialysis treatment generally seems to worsen the lipid and Apo lipoprotein pattern observed in predialytic stage of CRF.[7] M. Senti et al in their study on patients with CRF on HD had high triglyceride levels.[6] Increased serum triglyceride levels have been well documented in patients on chronic maintainance hemodialysis.[7,8]

HDL levels were significantly low in dialysis patients as compared to patients on conservative treatment and this was statistically significant (P=0.001). M. Senti, et al., their study of CRF patients on HD showed low HDL levels.[6]

Morena Marion, et al., in their study on hemodialysis patients states that hemodialysis patients are exposed to several atherogenic factors resulting from qualitative and functional lipid abnormalities, including triglyceride rich particles, increased susceptibility to LDL oxidation and finally impairment of HDL protective effects.

The results suggest that qualitative abnormalities such as an impairment of HDL associated enzymes are associated with a decrease of HDL levels during hemodialysis.

Hence in addition to the known impairment of reverse cholesterol transport, the reduction of HDL protective capacity against oxidative stress could be involved in the development of HD induced atherosclerosis.[9]

The VLDL levels in chronic renal failure on hemodialysis were increased significantly compared to patients who were as conservative treatment. This increase was statistically significant (P=0.001).

J. Pedro–Botet in his study showed increased levels of VLDL fractions in hemodialysis patients. The possible rise of hypertriglyceridemia and changes in VLDL composition as risk factor for coronary heart disease remains a matter of dispute.[10]

The total cholesterol is marginally raised in hemodialysis patients as compared to patients on conservative management and it is not statistically significant (P=0.181). The LDL cholesterol was not raised significantly in dialysis patient as compared to patient on conservative management (P=0.371). It is statistically not significant.

The HDL/TC ratio is low in hemodialysis patients as compared to patients on conservative treatment (P=0.004) it is statistically significant.

Shah et al., showed low values of LDL cholesterol and total cholesterol in dialysis patients.[4] DC Wheeler stated increased LDL cholesterol and hypercholestremia seen in hemodialysis patients.[11] According to King W. Ma, hypercholesterolemia rarely occurs in uremic and dialysed patients.[12]

CONCLUSION

On comparison of chronic renal failure patients on hemodialysis and patients on conservative treatment there is significant rise in triglycerides and VLDL cholesterol levels, however HDL cholesterol level were found to be significantly lower in hemodialysis patients as compared to patients on conservative treatment.

The significant rise in triglyceride and VLDL concentrations is the cause for increase cardiovascular abnormalities in CRF patients.Significant reduction in HDL and HDL / TC ratio are the important predictive indices for the risk of developing coronary artery disease in all groups of patients with chronic renal failure. This may be major contributory factor for enhanced atherogenesis in these patients.

Finally because the lipid abnormalities in chronic renal failure accelerate the progression of the renal failure and predispose to atherosclerosis, it is worth while detecting and treating hyperlipidemia in these patients.

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