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# Role of hemodialysis in management of patients of chronic kidney disease

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## Abstract

**Introduction:** As kidney functions deteriorate, lipid profile abnormality begins. In kidney disease, more lipoprotein synthesis than its degradation results in dyslipidemia, which increases the risk of atherogenesis. The present study was aimed to study the lipid abnormality pattern in chronic kidney disease patients and to study the role of hemodialysis in management of these patients.

**Methods:** 100 diagnosed chronic kidney disease patients [50 cases undergoing hemodialysis (HD) and 50 controls i.e. managed on conservative line without dialysis] were enrolled for the study after institutional ethical committee's clearance was obtained. In this study, we measured serum lipid profile comprising of total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), very low-density lipoprotein cholesterol (VLDL-C) and atherogenic ratios (LDL-C/HDL-C, TC/HDL-C).

**Results:** In our study, we found that the mean values of TC, TG, LDL-C, VLDL-C and atherogenic ratios (LDL-C/HDL-C, TC/HDL-C) were significantly lower and HDL-C was significantly higher in cases of hemodialysis group than the corresponding values in the control group.

**Conclusion:** Hemodialysis results in improvement in lipid abnormalities in the patients with chronic kidney disease. Therefore, hemodialysis can be started early in the chronic kidney disease to retard the progression of atherosclerosis.

**Keywords:** Chronic kidney Disease, Hemodialysis, Lipid Profile.

## Introduction

As the kidneys play an important role in maintaining fluid and electrolyte homeostasis and hormonal regulation, chronic kidney disease (CKD) can affect almost every system of the body. Renal failure is the ninth leading cause of death throughout the world.(1)

**Dialysis:** Dialysis is a 'holding measure' until a renal transplant can be performed or supporting measure for those patients in whom the renal transplant would be inappropriate.(2) Dialysis may be used in acute kidney injury or progressive worsening kidney function [CKD stage 5 or end-stage renal disease (ESRD)].

**Hemodialysis (HD):** Removes waste and excess water from blood by passing it outside the body through an external filter, called a dialyzer that contains a semi permeable membrane.(3) HD is usually performed three or more times a week for 3 hours or more each time.

As kidney functions deteriorate, lipid profile abnormality begins.(4) Increased lipoprotein synthesis than its degradation in kidney disease, results in dyslipidemia. Uremic dyslipidemia is reflected more in the apolipoprotein (apo) profile than in the lipid profile. Reduced lipoprotein lipase (LPL) activity results in delayed hydrolysis and so enrichment of apo-B-containing triglyceride-rich lipoproteins (TRLs) [i.e. chylomicrons, VLDL-C]. So there is an increase in proatherogenic apo C-III enriched apo-B-containing lipoproteins (i.e. chylomicrons, VLDL-C, LDL-C) and decrease in non-atherogenic apo-A-containing lipoproteins (i.e. HDL-C).

This uremic dyslipidemia increases the risk of atherogenesis(5) which is troublesome especially in patients on long-term dialysis.(6) Patients on hemodialysis have abnormal lipoprotein metabolism and high risk of cardiovascular diseases.(7) Nearly 50% of HD patients die from cardiovascular events. The mortality due to cardiovascular disease in HD patients is estimated to be 9% annually and is 30 times higher than in the general population.(8)

The present study was aimed to study the lipid abnormality pattern in chronic kidney disease patients and to study the role of hemodialysis in management of these patients.

## Objectives

1. To study lipid abnormality pattern in chronic kidney disease patients.
2. To determine the lipid profile in patients with chronic kidney disease undergoing hemodialysis.
3. To study the role of hemodialysis in management of patients of chronic kidney disease.

## Material and Methods

The present study was undertaken in the department of Biochemistry, in the tertiary institute. Period of the study was from January 2011 to July 2012.

**Study design:** A Prospective hospital-based comparative study. This is an observational, cross-sectional study.

**Study Population:** 100 diagnosed chronic kidney disease patients (50 cases and 50 controls) attending

medicine outpatient department (OPD) and/or admitted in ward/ kidney unit in the institute and who gave consent to participate in the study were enrolled for the study after institutional ethical committee's clearance was obtained.

All the cases and controls in the study were divided into two groups, viz.

**Group A:** (n=50)50 cases i.e. Chronic Kidney Disease (CKD) patients undergoing hemodialysis (HD).

**Group B:** (n=50) 50 controls i.e. age and gender matched Chronic Kidney Disease (CKD) patients without dialysis. I.e. patients managed on conservative line.

**Inclusion criteria:** Criteria for cases of CKD undergoing HD: Patients on HD for 3 hours / 3 times weekly using high flux polysulphone hemodialysis membrane at least for the period of 2 years.

**Exclusion criteria:** Patients suffering from ischemic heart disease, nephrotic syndrome, hypertension, diabetes mellitus, hepatic diseases, hypothyroidism.

**Study duration:** 18 months.

**Sample collection:** After taking all aseptic precautions, 5 ml of blood sample was withdrawn from the anti-cubital vein of each participant using sterile needles and syringes after an overnight fast. (i.e. after 12 hours of intake of meals). Hemolysed samples were excluded from the study. A blood sample from each patient was collected in clean plain bulb which was allowed to clot. Serum was then separated by centrifugation.

Each patient underwent the clinical history, physical examination, and investigations. In this study, we measured serum lipid profile comprising of total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and very low-density lipoprotein cholesterol (VLDL-C).

**Equipment:** Transasia Erba Chem plus Semi-automatic analyzer.

Parameters were estimated with methods: (Table 1)

**Table 1: Lipid profile parameters with methods of Estimation**

| Parameter | Method |
|---|---|
| Total Cholesterol | Enzymatic method - Cholesterol esterase, cholesterol oxidase and peroxidase[9] |
| HDL-C | Phosphotungstate/ Mg2+ precipitation method – End point[10] |
| Triglycerides | Enzymatic method- Glycerol phosphate oxidase and peroxidase; End point[11] |
| VLDL-C and LDL-C | Indirect method- Friedewald Equation[12]<br>Serum VLDL-C= Serum TG/ 5<br>Serum LDL-C =<br>Serum total cholesterol – (Serum VLDL-C + Serum HDL-C) |

**Atherogenic ratios:**

i. LDL-C/ HDL-C[13]
ii. TC/HDL-C[13]

**Statistical Analysis:**

- Statistical data was recorded on Microsoft Excel Program.
- Data was analysed using prism GraphPad software.
- The values were quoted in the form of mean ± standard deviation wherever required.
- Data between two groups was compared using unpaired student's t-test.
- The p-value ($p < 0.05$) is considered as significant and the p-value ($p < 0.001$) is considered as highly significant.

## Results

Most of the subjects of cases and controls were between 41-60 years. (Table 2)

The mean values of TC, TG, LDL-C, VLDL-C and atherogenic ratios (LDL-C/HDL-C, TC/HDL-C) were significantly lower and HDL-C was significantly higher in cases of hemodialysis group than the corresponding values in the control group. (Table 3)

**Table 2: Age wise distribution of cases**

| | Hemodialysis Cases (n=50) | Controls (n=50) |
|---|---|---|
| Mean Age | 45.92 ± 10.14 | 44.92 ± 10.94 |

**Table 3: Serum lipid profile in cases of chronic kidney disease undergoing hemodialysis and controls**

| SERUM LIPIDS (mg/dl) | Hemodialysis Cases (n=50) (Mean ± SD) | Controls(n=50) (Mean ± SD) | p value |
|---|---|---|---|
| Total Cholesterol | 143.98 ± 25.84 | 165.74 ± 34.12 | 0.0005*** |
| Triglycerides | 114.22 ± 37.43 | 167.77 ± 55.68 | 0.0000*** |
| HDL Cholesterol | 39.24 ± 12.48 | 32.80 ± 5.32 | 0.0011** |
| LDL Cholesterol | 95.80 ± 32.72 | 125.75 ± 41.41 | 0.0001*** |
| VLDL Cholesterol | 22.84 ± 7.17 | 36.74 ± 10.92 | 0.0000*** |
| LDL-C/HDL-C | 2.67 ± 1.20 | 3.93 ± 1.50 | 0.0000*** |
| TC/HDL-C | 4.07 ± 1.60 | 5.24 ±1.63 | 0.0005*** |

n=number of subjects; * = ($p<0.05$), **= ($p<0.01$), ***= ($p<0.001$)

## Discussion

Dialysis does not correct uremic dyslipidemia completely, but may alter its pattern. Factors which may be responsible for such results in our study are:

In our study, patients undergoing HD showed a fall in serum total cholesterol (TC), as compared to patients managed on conservative line. High flux polysulphone membrane used during HD can remove cholesterol in patients undergoing HD.[14] Also in our study, patients undergoing HD also showed lowering of triglyceride (TG) levels. It was probably caused by increase in plasma lipoprotein lipase (LPL) activity. LPL is bound to endothelium and released by heparin.[15]

Another significant finding in our study, patients undergoing HD demonstrated an elevation in HDL-C levels. Characteristics of dialysis and dose of heparin could be responsible factors for effect on HDL-C level in HD patients.[14] Overall changes in lipoprotein pattern in hemodialysis patients can be attributed to the removal of lipoproteins by repeated dialysis.

Our study results coincided well with the following studies reports:

S. Sathiyanarayanan et al 2013[16] showed that TC, TG, LDL-C, were significantly lower and HDL-C was significantly higher in cases of HD group in the 5th visit than the corresponding values in same patients when they were without dialysis.

Peter J Blankestijn et al (1995)[17] showed that HD with high-flux, polysulphone membrane was associated with a decrease in serum TG, TC, VLDL-C and increase in HDL-C as compared with low-flux, cellulose-based membranes. Delima JJ et al (1995)[18] showed that serum TC and LDL-C levels were significantly lower in the dialysis patients than in normal controls.

Shah B et al (1994)[19] showed that serum TG, TC, HDL-C and VLDL-C levels are significantly decreased in HD group in comparison to the non-dialysis group. But the change in serum LDL-C level between both the groups was not significant.

TG-lowering effect of HD was found by Abdullah Al-Hwiesh et al (2012).[20] Teraoka et al (1982),[21] Wessel-Aas et al (1982).[22] Lipolytic activity increased and TG levels decreased during HD with heparin, but not when the heparin was omitted.[21]

The limitations of this study are that other parameters that can affect lipid profile during HD such as the type of membrane (low flux & high flux), purity of dialysate, type of heparin (unfractionated heparin and low molecular weight heparin) etc., were not studied. Furthermore, the study sample was small. So there is a further need for studies with larger sample size to study the role of hemodialysis in management of patients of chronic kidney disease.

## Conclusion

Hemodialysis results in improvement in lipid abnormalities in the patients with chronic kidney disease. So, the management of Chronic Renal Failure patients by hemodialysis has a beneficial effect on lowering the cardiovascular risk factors. Therefore, hemodialysis can be started early in the chronic kidney disease to retard the progression of atherosclerosis.

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