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Correlation of Vitamin C and E with Lipid Profile in Hemodialysis Patients

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SUMMARY

The present study was planned and carried out to see the level of vitamin C, vitamin E and lipid profile in ESRD patients on regular hemodialysis, and also the immediate effect of dialysis on vitamin C and E levels. Serum was tested from 50 ESRD patients on hemodialysis and 15 healthy control subjects matched for age and sex . No significant correlation could be elicited between the post dialysis fall of vitamin C level of (6 mg/l or more than 6 mg/l) in patient with abnormal triglyceride level. Similarly no significant correlation could be elicited between predialysis vitamin E level of (less than 6 mg/l) and triglyceride level. Lipid profile of patient and control showed no significant difference in total cholesterol, HDL, LDL level, but the triglyceride level was significantly higher in both male and female patients as compared with control subjects.

INTRODUCTION

Recent clinical and experimental studies have firmly established that elevated plasma concentration of low density lipoprotein are associated with accelerated atherogenesis[1,2]. The cholesterol that accumulates in atherosclerotic lesions originates primarily in plasma lipoprotiens including LDL. The earliest recognizable gross lesion in atherogenesis is the fatty streak, characterized by an accumulation of macrophages loaded with cholesterol esters (foam cells) just beneath the endothelium. Most foam cells arise from circulating monocytes that have settled beneath the vascular endothelium[3].

Thus an understanding of the pathogenesis of the fatty streak lesion may depend largely on an understanding of mechanism by which monocytes are recruited to the subendothelial space and how they take up lipoprotiens, predominantly LDL[4,5].

Goldstien and the coworkers[6] were the first to describe modified form of LDL, that could be taken up rapidly enough by macrophages which get converted into foam cell. They reported that chemical acetylation occurs earlier and then converts native LDL to aceylated LDL, which is recognized specifically by the monocyte macrophage receptors. The acetylated LDL is then taken up at rate many times that of native LDL uptake. This increased uptake was attributed to a specific receptor, designated as the acetyl LDL receptor, and in fact this receptor does not recognize native LDL. It has been found only on monocytes and macrophages, kupffers cells, and endothelial cells, particularly the sinusoidal endothelial cells in the liver. The same receptor was also found to recognize other chemically modified forms of LDL, including acetoacetyle LDL and malondialdehyde conjugated LDL[7].

It has been reported that the modification of LDL by cells is totally inhibited by antioxidants such as butylated hydroxytoluene and vitamin E[8]. The cytotoxicity of modified LDL depends on the oxidation of LDL lipid and may be particularly important in the evolution of fatty streak and its progression to more complex advanced lesions[6].

The major and perhaps the only contribution of the cells during modification of LDL may be the enhancement of the oxidative environment. The addition of plasma inhibits cell induced oxidation suggesting that in vivo the process must occur extravascularly, in microenvironment protected from naturally occurring antioxidants[6]. The production of superoxide anion induces oxidative

modification of LDL, has also been reported in endothelial cells[9].

The interior of advanced atherosclerotic lesions is a pro-oxidant environment, as the extracts from lesions can promote lipid oxidation[10], including peroxidation of LDL[5] and generation of highly reactive hydroxyl radicals from hydrogenperoxide[11].

Over all attack of one reactive free radical thus can oxidize multiple fatty acid side chains to lipid peroxides[12]. These peroxidation reaction are countered by antioxidants present in plasma and interstitial fluid.

Primary antioxidants are superoxide-dismutase (SOD) and glutathione-peroxidase (Gpx), Metal binding proteins which limit the availability of Cu^{++} and Fe^{++}, thereby reducing the formation of the OH` radical. Example is ceruloplasmin and transferrin[13].

Secondary antioxidants are trap radicals, preventing the amplification of radical species . These include vitamin E , ascorbic acid, beta carotene, uric acid, bilirubin and albumin. A number of intracellular agents, such as ascorbate, vitamin E and beta carotene are able to reduce and detoxify oxygen intermediates[14].

Deficiency of various water soluble vitamins has been reported in uremia owing to insufficient dietary intake , loss through the dialysis and ureamia related metabolic derangement's[15,16,17]. Increase in alpha tocopherol concentration with in the LDL particle was reported to result in an augmented resistance of lipoprotein to ex vivo oxidation[18,19,20]. Patients with CRF often have an abnormal lipid profile characterized by reduced HDL cholesterol and moderate hypertriglycerideamia[21].

Several strands of evidence suggest that oxidation process may be increased in patients with renal failure [22,23,24]. Concentration of malondialdehyde, a by product of lipid peroxidation, is increased in plasma and red blood cells of renal failure patients[25,26], in addition concentration of some antioxidants are decreased[27,28], vitamin C is a small water soluble molecule, thus the patients undergoing hemodialysis are at particular risk of ascorbate depletion[29,30]

MATERIAL AND METHODS

A total of 50 ESRD patients of Shaikh Zayed Hospital on hemodialysis were included in the study. General history of the patients was recorded for age , sex and occupation. A total of 15 normal healthy subjects from Shaikh Zayed Hospital staff, matched for age and sex with the patients were included as control subjects. Age, sex , socioeconomic status and profession of the control subjects was recorded.

Vitamin E and vitamin C were done by method of Baker and frank[31], and Brewster andTurley[32] respectively. Serum Cholestrol was done by the method of Richmond33. HDL Cholestrol by the method of Asserman[34]. Triglyceride by the method of Trinder[35], and LDL cholestyrol was done by the method of Freidwald[36].

RESULT

Present study included 50 end stage renal disease patients (ESRD) on heamodialysis and 15 healthy control subjects matched for sex and age. Male: Female ratio of the patient and control was 1:1 and 1.1:1 respectively (Table 1).

Lipid profile of patient and controls showed no significant difference in total cholesterol, HDL, LDL but the triglyceride level of patients was significantly ($P < 0.05$) higher in ESRD patients as compared with their control subjects (Table 2). Nineteen patients with abnormal triglyceride level had predialysis vitamin E level of more than 6 mg/l whereas 15 patients had predialysis vitamin E level of less than 6 mg/l. Nine out of 16 patients with normal triglyceride level had predialysis vitamin E level of < 6 mg/l. Thus no significant corelation was seen between hypertriglycerideamia and vitamin E level (Table 3).13 out of 34 pateints with raised triglyceride level showed a fall of vitamin C level of 6 mg/l or > 6 mg/l. While 4 pateints out of 16 with normal triglyceride level showed fall in vitamin C level of 6 mg/l or > 6 mg/l. No significant correlation was seen between triglyceride level and fall of vitamin C (Table 4).

DISCUSSION

Present study included 50 ESRD patients on heamodialysis and 15 healthy control subjects matched for age and sex . Male and female ratio of

Table 1: **The age, sex distribution of control group and ESRD patients on heamodialysis is given.**

Age (Years)	Control			Patients		
	Male	Female	Total	Male	Female	Total
10 – 30	1	2	3	4	5	9
31 – 50	3	2	5	10	9	19
> 50	4	3	7	11	11	22
Total	8	7	15	25	25	50

Table 2: **Serum lipid profile of ESRD patients on heamodialysis and control subjects, was determined. Mean ± SE is given. Figure in the parenthesis indicate number of subjects in each group.**

Age (Years)	Control (n=15)		Patients (n=50)	
	Male	Female	Male	Female
Cholesterol (mg/dl)	165±2.8	162±3.3	168±13.56	170±12.5
HDL (mg/dl)	40±0.7	39.±0.7	41.9±2.87	38.3±1.86
LDL (mg/dl)	102.2±1.87	106±1.4	98.8±9.53	98.3±9.06
Triglyceride (mg/dl)	105±3.6	100±3.1	173±32.81	165±17.5

* $P < 0.05$ as compared with control female.
** $P < 0.05$ as compared with control male,

Table 3: **Correlation of the number of patients having predialysis vitamin E level 6 mg/l , more than 6 mg / L or less than 6 mg/l in patients with normal or raised triglyceride level.**

	No. of patients with pre-dialysis vit. E. 6 mg/l or >6 mg/l	No. of patients with pre-dialysis vit. E <6 mg/l
Raised triglyceride	19	15
Normal triglyceride	7	9
Total	26	24

Table 4: **Correlation of the number of patient having post-dialysis fall of vitamin C level 6 mg/l or > 6 mg/l, or less than 6 mg/L in patients with normal or raised triglyceride level.**

	No. of vit C fall of 6 mg/l or >6 mg/l	No. of patients with Vit. C fall < 6 mg/L
Raised triglyceride	13	21
Normal triglyceride	4	12
Total	17	33

patients and control subjects was 1:1 and 1.1:1 respectively (Table 1). All patients were on routine vitamin intake. No statistically significant correlation was demonstrated between predialysis vitamin E level of (6 mg/l or less), or more than 6 mg /l, and fall of vitamin C level after dialysis of (6 mg/l or more), or less than 6 mg / l with the number of patients with raised triglyceride level. (Tables 3 and 4).

Lipid profile, in patients and controls, showed no significant correlation in the total cholestrol , HDL, LDL but the triglyceride level of patient was significantly ($P < 0.05$) higher in both male and female patients as compared with the control subjects (Table 2). Rubies[37], Avrum[38], Attman[39], and Goldberg[40] have reported that ESRD patients on hemodialysis showed increased triglyceride level, moderately elevated LDL cholestrol level and decreased HDL cholestrol. The cause of these lipoprotein abnormaliteis has only been partialy elucidated. One known defect in pateints undergoing hemodialysis is that their triglyceride clearance rate is lower than normal[41]. This may relate to decreased LPL activity. When LPL is released into the blood stream after intravenous injection of heparin, it cuases acute decrease in triglyceride levels. Heparin induced lipolyses is

markedly reduced in hemodialysis pateints[42,43]

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