Lipid profiles in hemodialysis and nonhemodialysis patients with chronic renal insufficiency

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In this study, plasma concentrations of total cholesterol (TC), triglycerides (TG), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), apolipoprotein A-I (Apo A-I) and B (Apo B), and the ratios of HDL-C to TC, HDL-C to LDL-C and Apo A-I to Apo B in 38 hemodialysis and 30 predialysis patients were compared with the concentrations and ratios in 34 healthy subjects.The highest plasma TG, HDL-C/ TC , HDL-C/ LDL-C, and Apo A-I/ Apo B ratios in both of the patient gruops. As a result, these data show that patients who undergo regular hemodialysis show tendency of atherosclerotic disease development.[Journal of Turgut Özal Medical Center 1(3):194-197,1994]

***Key Words**: Atherosclerosis, hemodialysis, lipoprotein.*

Hemodiyalize giren ve girmeyen kronik böbrek yetmezliği olan hastalarda lipit profilleri

Bu çalışmada, 38 hemodiyaliz ve 30 prediyaliz hastasında plazma total kolesterol (TC), trigliseritler (TG), yüksek dansiteli lipoprotein kolesterol (HDL-C), düşük dansiteli lipoprotein kolesterol (LDL-C), apolipoprotein A-I (Apo A-I), apolipoprotein B (Apo B) konsantrasyonları ile HDL-C'nin TC'ye, HDL-C'nin LDL-C'ye ve Apo A-I'in Apo B'ye olan oranları 34 sağlıklı kişinin plazma konsantrasyonları ve oranları ile karşılaştırıldı. Hemodiyaliz hastalarında plazma TC, HDL-C ve Apo A-I daha düşük ancak plazma TG'i daha yüksek olarak tespit edildi. Kontrollerle karşılaştırılınca HDL-C/TC, HDL-C/LDL-C ve Apo A-I/Apo B oranlarının her iki hasta grubunda da anlamlı farklılık vardı. Sonuç olarak, bu verilere göre düzenli hemodiyalize giren hastalarda aterosklerotik hastalık gelişme riski vardır. [Turgut Özal Tıp Merkezi Dergisi 1(3):194-197,1994]

***Anahtar Kelimeler**: Ateroskleroz, hemodiyaliz, lipoprotein*

Chronic renal failure is clearly associated with a disturbance in lipid metobolism and many studies have been carried out for evaluation of this pathologic condition. In uremic patients with diabetes mellitus, mortality on maintenance hemodialysis is significantly higher than in nondiabetic patients[1]. It is generally accepted that patients undergoing long-term dialysis for chronic renal failure are at increased risk for coronary artery disease[2,3]. Atherosclerotic disease are accepted to be high in patients with chronic renal failure on regular hemodialysis treament, due to rapid atherosclerotic process.

Patients on regular hemodialysis display a high prevalence of atherosclerotic disease. Mortality rate is twice or more in those patients than in normal population[4-8].

Abnormalities seen in lipid metabolism of patients with chronic renal failure on regular hemodialysis treatment accelerates course of atherosclerosis which, in turn, worsens renal failure[3-6,9,10]. In those patients, most common laboratory findings are increases in TG levels and decreases in total HDL mass and HDL-C levels[3-5,9]. HDL-C levels are inversely proportional to body cholesterol pool and HDL-C functions in

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transport of cholesterol from peripheral tissues to liver for catabolism and excretion of cholesterol[3,11,12]. There is considerable evidence, primarily from epidemiologic studies, demonstrating an association between low levels of HDL-C and increased risk of coronary artery disease[11].

Although increases in TG, TC, VLDL-C, LDL-C, Apo B, C-III and decreases in HDL-C, Apo A-I, C-II,and Apo E levels are accepted as risk factors for development of coronary artery disease, clinical studies suggest that serum levels of Apo A-I and B, particularly Apo A-I / Apo B ratio, may be more strongly related to coronary artery disease than their respective lipoprotein-cholesterol fractions[13].

In the treatment of end-stage renal disease, hemodialysis becomes more important and popular in our country due to limited renal transplantation feasibilities and increasing numbers of chronic renal failure cases from day to day. In the present study, we aimed to investigate whether long-term hemodialysis treatment has a role in pathogenesis and in acceleration of atherosclerotic vascular diseases which worsen renal failure and cause death due to cardiovascular complications at younger ages.

MATERIALS AND METHODS

Plasma TG, TC, HDL-C, LDL-C, Apo A-I and Apo B levels were measured in 34 hemodialysis patients (13 females, 21 males) with a mean age of 38 ± 10 years (range 28-54) and in 26 predialysis patients (12 females, 14 males) with a mean age of 33 ± 12 years (range 24-46) and in 24 healty controls (10 females, 14 males) with a mean age of 32 ± 6 years (range 24-49). Mean duration of hemodialysis treatment was 42 ± 18 months (range 36-54 months). The frequency of dialysis was twice of three times per week and duration of each session was 4 hours. We measured plasma concentrations of TG and LDL-C by using enzymatic colorimetric methods with commercially avaliable kits (Boehringer Mannheim, Germany) in Hithachi 717 autoanalyzer. Plasma concentration of Apo A-I and Apo B were determined by immunoturbidimetric method (Isolab Inc., USA, Code No: ID-8353).

Data were presented as mean ± standart deviation. For statistical analysis, Student's t-test was used. Signifance was defined as $p<0.05$.

RESULTS

Plasma lipid and apolipoprotein concentrations and their statistical results are shown in Table I and II. Mean plasma triglyceride concentration was significantly greater in the hemodialysis patients than in the controls ($p<0.001$). The lowest mean levels of HDL-C and Apo A-I, and the ratios of HDL-C/LDL-C and HDL-C/TC were found in the hemodialysis patients. Total cholesterol concentrations did not differ between control and hemodialysis groups, but there was significant difference between the plasma total cholesterol levels of the controls and the predialysis patients groups ($p<0.001$). As shown from Tables I and II, higher levels of TC, LDL-C and Apo B, and lower levels of HDL-C and Apo-I were found in hemodialysis group when compared to predialysis group.

Table I. Lipid and apolipoprotein concentrations (mean ± sem) in plasma of control, hemodialysis and predialysis patients.

Parameters (mg/dl)	Control subjects (n=34)	Hemodialysis patients (n=38)	Predialysis patients (n=30)
TG	102 ± 24.8	136 ± 0.6	129 ± 35
TC	166 ± 23.2	162 ± 28.5	181 ± 46
HDL-C	51 ± 4.9	38 ± 5.8	42 ± 5
LDL-C	90 ± 13.6	113 ± 22.6	123 ± 16
Apo A-I	124 ± 17.3	95 ± 14.7	102 ± 14.2
Apo B	78 ± 12.9	98 ± 14.2	112 ± 7.2
Ratios			
HDL-C/TC	0.31 ± 0.04	0.23 ± 0.06	0.23 ± 0.02
HDL-C/LDL-C	0.57 ± 0.13	0.34 ± 0.14	0.34 ± 0.05
Apo A-I/Apo B	1.59 ± 0.4	0.97 ± 0.24	0.91 ± 0.04

Table II. Statistical evaluation of the results

	C-HD		C-NHD		HD-NHD	
Parameters (mg/dl)	t	p	t	p	t	p
TG	4.2	< 0.01	3.9	< 0.01	0.57	> 0.05
TC	0.8	> 0.05	1.87	< 0.05	2.03	< 0.05
HDL-C	10.06	< 0.001	3.2	< 0.01	2.78	< 0.05
LDL-C	5.16	< 0.001	5.2	< 0.001	3.47	< 0.01
Apo A-I	10.34	< 0.001	4.9	< 0.001	1.95	< 0.05
Apo-B	6.24	< 0.001	5.8	< 0.001	4.8	< 0.005
HDL-C/TC	2.55	< 0.05	2.54	< 0.05	0.04	> 0.05
HDL-C/DL	5.1	< 0.001	5.1	< 0.001	0.03	> 0.05
Apo A-I/Apo B	4.2	< 0.01	3.9	< 0.01	2.2	< 0.05

C: control, HD: hemodialysis, NHD: predialysis

DISCUSSION

Patients with chronic renal failure undergoing regular hemodialysis display a high prevalence of athersclerotic disease. However it is still uncertain whether uremic patients are more prone to develop such disease[14,15]. When compared with the controls,

the patients showed markedly increased plasma concentrations of triglyceride and LDL-C. These increases may be due to the increases of VLDL, IDL, LDL that are rich in triglyceride. Fatty acid precursors (acetate) which are provided via dialysates results in de novo triglyceride synthesis by induction of hepatic synthesis of VLDL. In addition chronic renal failure patients show decreased catabolism and excretion of lipoproteins[5,6]. Diminishes in the in activities of hepatic trigliceride lipase and lipoprotein lipase (LPL) give rise to reduced catabolism of triglyceride-rich proteins[6,8,9]. The reason for decreased LPL activity which is parallel to PDL-C levels and inversely proportional to TG levels has not been identified yet. However, it was claimed that the low level of Apo C-II (LPL activator) and LPL inhibitors detected in the plasma of uremic patients may play a role in decreasing LPL activity[6,16,17].

In the present study, HDL-C levels were found significantly lower in both of the patient groups than in the controls. This may be due decreased lipolysis of VLDL and chylomicrons (CM). Another mechanism for reduction of HDL-C levels in uremic patients is the inhibition of lecithin: cholesterol acyltransferase (LCAT) activity due to uremic toxins. It is also thought that increased VLDL levels are not sufficient for stimulation of LCAT[5]. LCAT that esterifies cholesterol and has a role in reverse transport that is activated by Apo A-I which is found to be low in uremic patients. Apo A-I and II constitute nearly 90 % of HDL proteins that have antiatherogenic effect. It is thought that decreased Apo A-I activity that results in decreased levels of HDL is a better discriminator of atherosclerotic heart disease risk than any other parameter[11-13].

On the other hand Apo B, the major constituent of LDL and neccessary for CM and VLDL formation and for secretion to plasma, was higher in the patients when compared with that of the controls.

In summary, we found very significantly low Apo A-I / Apo B ratio in the ptient group. When there is a decrease in this ratio reverse cholesterol transport becomes restricted and consequently cholesterol accumulates in the peripheral tissues. Some authors consider the Apo A-I / Apo B ratio an even more effective indicator than the individual apolipoproteins (5, 9, 13, 18). Our study also confirmed this finding. HDL-C / TC and HDL-C / LDL-C ratios which are also criterias for determining coronary artery disease risk were signigicantly lower in the patients than the controls.

As a conclusion, since Apo A-I / Apo B ratio, that is strongly related to development of coronary artery disease was found higher in hemodialysis group, it may be speculated that hemodialysis group patients have more tendency to develop atherosclerotic disease than nonhemodialysis group patients.

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