Serum lipid and lipoprotein levels in undialyzed patients with chronic renal failure*

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Since cardiovascular diseases are seen frequently in patients with chronic renal failure, serum lipid and lipoprotein levels, which are known risk factors for atherosclerosis are studied in these patients.

Twenty undialyzed patients (12 males, 8 females) with end stage renal failure were included in this study. Serum triglyceride (TG), total cholesterol (TC), low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C) levels of the patients are measured and compared to those of the 20 (11 males, 9 females) healthy control subjects.

While serum TG levels of the patient group (211.40±16.30 mgjdl, meantSE) were significantly higher than control group (132.10±12.00 mg/dl, mean±SE) (p<0.01) and HDL-C levels of the patient group (29.10±3.00 mgjdl, meantSE) were significantly lower than control group (43.10+1.65 mg/dl, meantSE), there were no significant difference between the TC and LDL-C levels of the patients (respectively, 187.20±8.90 mg/dl and 115.70±8.71 mg/dl, meantSE) and the control group (respectively, 183.80+8.12 mg/dl and 114.00+7.66 mg/dl.'meantSE) (p>0.05). The differences between the levels of the lipid and lipoprotein levels of the male and female patients were not significant (p>0.05). [Turk J Med Res 1994; 12(5): 192-195]

Key Words: Chronic renal failure, Serum lipids, Lipoproteins

Chronic renal failure (CRF) resulting from irreversible loss of renal function still remains as an important cause of mortality in Turkey and in the World, despite the use of modern therapies such as hemodialysis and kidney transplantation (1,2).

Cardiovascular diseases are important causes of mortality in patients with CRF. Mortality rate from cardiovascular causes corrected for age in dialysis patients varies between 30-50% as compared to 15% in control group. This mortality in dialysis patients is associated to heart failure in 15%, myocardial infarction in 10%, and pericarditis in 3-5% of the patients (3). Early and more frequent atherosclerosis development also observed in chronic hemodialysis patients (4-9). Several risk factors for atherosclerosis are determined in CRF. Hypertension is the most important of these factors, and hyperlipidemia, hyperparathyroidism, glucose intolerance, hyperuricemia and uremia itself also are among other known risk factors (2-10).

Serum lipid fractions are evaluated as atherosclerosis risk factors in undialyzed CRF patients in this study.

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MATERIALS AND METHODS

The patients group consisted of 20 (12 males and 8 females) end stage CRF patients managed conservatively (undialyzed before the study). Serum urea and creatinine levels were between 283-358 mg/dl and 6.8-24.3 mg/dl, respectively and the ages of the patients were in the range of 21-53 (37.10±1.93, meantSE). All the patients had low sodium (1 g/day)-low protein (40 g/day) diet for 5-12 days (mean: 7.2 days). Total daily caloric intakes were 1800-2500 calories/day, and carbohydrates consisted about 50% of this. Sixteen (80%) of the patients were on antihypertensive medications.

The control group consisted of 20 (11 males and 9 females) healthy subjects from the hospital staff or their relatives and their ages were between 18-70 (35.60±2.94, mean±SE).

All the subjects from the patients and the control group consisted of non-smokers, were not diabetic and were not obese. They were not using any drugs (B-blockers, lipid lowering drugs, thiazide group diuretics, steroids, etc.) and do not have other diseases (thyroid or liver disease, nephrotic syndrome, history of familial lipoproteinemia, etc.) affecting lipid profile.

Blood samples were collected after at least 10 hours of fasting. TG and TC levels were measured with Technicon RA-XT" autoanalyzer using standard methods in SSK Ankara Hospital, Department of Biochemistry. HDL-C was measured spectrophotometrically after the VLDL and LDL precipitator reactive (consisting of pH: 6.15 phosphotungstic acid and magnesium chloride) added to the sera and filtered. LDL-C levels were calculated according to the "Frederickson Formula" (11,12).

LDL-C-TC - (HDL-C + TG/5)

The results were analyzed statistically with the variance analysis methods.

RESULTS

The patients and control groups were not statistically different with regard to sex and age distribution ($p<0.05$).

Serum lipid and lipoprotein levels of both the patients and control groups are given in Table 1.

Serum TG levels of the patients were significantly higher ($p<0.001$) and HDL-C levels were lower ($p<0.01$) when compared to the control group. TC and LDL-C levels were not different significantly ($p>0.05$).

TG, TC, LDL-C and HDL-C levels of the patients group for both sexes are given in Table 2 and there were no significant difference for these levels.

DISCUSSION

Accelerated atherosclerosis is one of the leading causes of mortality and morbidity in patients with CRF and is associated mostly to lipid metabolism disturbances (1-9). 45% of the hemodialysis patients and 36% of undialyzed patients have been reported to have type IV hyperlipidemia (2,13).

Our study group including undialyzed end stage CRF patients had significantly higher serum TG levels than control group ($p<0.01$), and this findings is consistent with previous reports (11,14-19).

Hypertriglyceridemia is the most frequent observed first lipid abnormality when the creatinine clearance rate decreases to 50 ml/min and continues to rise while the creatinine clearance decreases to the 10 ml/min (20).

An increase of VLDL-TG is the primary responsible from TG increases, however contributions of LDL and to some extend HDL-TG are also shown (16,18,19,21,22). Intermediate density lipoprotein (IDL), the breakdown product of VLDL is suggested to be the responsible for the accelerated atherosclerosis in CRF patients (23).

Hypertriglyceridemia in CRF is a multifactorial process. Several studies have shown that high immunoreactive insulin levels in the blood a high carbohydrate content of the diet of the uremic patients causes an increase of the TG synthesis in the liver (2,13,17). Other investigators have found that peripheral lipid clearance measured with either oral or intravenous fat tolerance tests in uremic patients is decreased (24-26).

Lipolytic activity measured after heparin is significantly decreased in uremic patients (16,17,26). Both lipoprotein lipase (LPL) and hepatic triglyceride lipase (HTGL) activities are decreased in these patients. Also, existence of an LPL inhibitor protein is suggested (27). In a study, an LPL activator, apoprotein C-II is found to be decreased and LPL inhibitor apo C-III is increased in CRF patients (13).

Hypertriglyceridemia causes in CRF patients as summarised in Table 3 can be divided into two groups: (1) Decrease of the triglyceride clearance, and (2) Increase of the triglyceride production.

Table 1. Serum TG, TC, LDL-C and HDL-C levels of the patients and control groups (mg/dl, meantSE)

	Triglyceride	Total cholesterol	LDL-cholesterol	HDL-cholesterol
Patients (n-20)	211.40H6.30	187.20i8.90	115.70±8.71	29.30i1.13
Controls (n-20)	133.00i12.00	183.80+8.12	114.00i7.66	43.10+1.65
p values	p<0.01	p>0.05	p>0.05	p<0.01

Table 2. Serum TG, TC, LDL-C and HDL-C levels of the male and female patients (mg/dl, meantSE)

	Triglyceride	Total cholesterol	LDL-cholesterol	HDL-cholesterol
Males (n-12)	196.20118.50	184.70111.10	115.00110.20	30.58±1.64
Females (n-8)	234.00i29.50	190.90+15.60	116.70+16.40	27.3811.21
p values	p>0.05	p>0.05	p>0.05	p>0.05

Table **3.** The causes of hypertriglyceridemia in patients with chronic renal failure

A. Decrease in triglyceride clearance
   1. Decreased lipoprotein lipase (LPL) activity
      a. Decreased LPL synthesis as a result of insulin resistance
      b. Decreased activator concentration (decreased apo CII/CIII)
      c. Presence of nonspesific LPL inhibiting uremic toxins
   2. Decreased hepatic lipase activity
   3. Decreased lecithin cholesterol acyl transferase activity
   4. Decreased beta-oxidation of the free fatty acids as a result of carnitine deficiency
   5. Hormonal factors such as hypothyroidism
B. Increased triglyceride synthesis
   1. Dietary carbohydrate intake
   2. Increased lipolysis (as a result of glucagon, growth hormone and insulin resistance)
   3. Hyperinsulinemia
   4. Increased beta oxidation of free fatty acids
   5. Drugs (estrogens and androgens)

In this study, there were no difference between the TC and LDL-C levels of the patients and control group (p>0.05), and this result is in accordance with previous studies (11,16,18,19,22).

HDL-C levels were lower in CRF patient group than control group (p<0.01). This result is also consistent with previous reports (11,18,19,22,28). Other studies have shown that HDL-C decrease accompanies to HDL2 and HDL3 decrease in patients with CRF (11,18). Apo A-I, apo A-II levels and LCAT enzyme activity is also found to be decreased in these patients (11,18,29). LDL-C decrease is a known risk factor for atherosclerosis.

TG, TC, LDL-C and HDL-C level were not different significantly between male and female patients (p>0.05).

As a result, serum lipid and lipoprotein levels of the undialyzed patients are significantly different when compared to healthy controls.

Diyalize girmemiş kronik böbrek yetmezliği hastalarında serum lipid ve lipoprotein düzeyleri

Kronik böbrek yetmezliğinde (KBY) kardiyovasküler hastalıkların sık görülmesi nedeniyle bu çalışmada atheroskleroz risk faktörleri arasında bulunan serum lipid ve lipoprotein düzeyleri araştırıldı.

Çatışmaya hemodiyalize girmeyen terminal dönem KBY'li 20 hasta (12 erkek, 8 kadın) alındı. Hastaların serum trigliserid (TG), total kolesterol (TK), düşük dansiteli Hpoprotein-kolesterol (LDL-kol) ve yüksek dansiteli Hpoprotein-kolesterol (HDL-kol) düzeyleri ölçülerek 20 sağlıklı bireyden (11 erkek, 9 kadın) oluşan kontrol grubu ile karşılaştırıldı. Serum TG değerleri (tüm değerler mg/dl tstand art hata-SE olarak verilmiştir) hasta grubunda (211.40±16.30) kontrol grubuna göre (132.10±12.00) yüksek bulundu (p<0.01). Hasta grubu TK (187.20±8.90) ve LDL-kol (115.70±8.71) değerleri ile kontrol grubu TK (183.80±8.12) ve LDL-kol (114.45±7.66) değerleri arasında ise fark bulunamadı (p>0.05). Hasta grubunda LDL-kol (29.30±1.13) kontrol grubundan (43.10±1.65) daha düşüktü (p<0.01). Cinsiyetler arasında ise lipid ve lipoprotein düzeyleri bakımından fark yoktu (p>0.05). [TurkJMedRes 1994; 12(5): 192-195]

REFERENCES

1. Turgan Ç, Yasavul Ü, Çağlar S. Kronik Böbrek Yetmezliği. İn: Klinik Nefroloji, 2nd ed. Ankara:Medial Yayınları, 1985:260-3.
2. Chan KM, Vaghese Z, Moorhead FJ. Lipid abnormalities in uremia, dialysis and transplantation. Kidney International 1981; 19:625-7.
3. Pastan SO, Braunwald E. Renal Disorders and Heart Disease. In: Braunwald E, ed. Heart Disease: A textbook of Cardiovascular Medicine. Philadelphia: WB Saunders Co, 1988:1836-47.
4. Brunner FF, Brynger H. Combined report on regular dialysis and transplantation in Europe. Proc Eur Dial Transplant Ass 1979; 16:3-82.
5. Rostand SG, Kirk KA, Rutsky EA. Dialysis-associated ischemic heart disease: In sights from coronary angiography. Kidney Int 1984; 25:683.
6. Delaney VB, Bourke E. The Interrelationship of Heart Disease and Kidney Disease. In: Hurst JW, Schlant RC, eds. The Heart. 7th ed. New York: Mc Graw-Hill Co, 1970:154-1554.
7. Lindner A, Charra B, Sherard DJ et al. Acclerated atherosclerosis in prolonged mainteinance hemodialysis. N Eng J Med 1974; 290:697-701.
8. Lazarus JM, Lowrie EG. Cardiovascular disease in uremic patients on hemodialysis. Kidney Int, 1975; 7(Suppl 2):167-75.
9. Burke FJ, Francos CG. Accelerated atherosclerosis in chronic-dialysis patients-another look. Nephron 1978; 22:242-5.
10. Arora KK, Atkinson MK, Trafford JAP. Changes in glucose tolerance, insulin, serum lipids and lipoproteins in patients with renal failure on intermittant hemodialysis. Postgraduate Med J 1973; 49:293-6.
11. Mendez BA, Perez GO, Goldberg RB. Lipid and lipoprotein levels in undialyzed patients with chronic renal failure. Am J Med Seien 1987; 293:164-9.
12. Rifai N, King ME, Sica DA. Effect of long-term hemodialysis on lipid, lipoprotein and apolipoprotein levels on black patients with chronic renal failure. Ann Clin Biochem 1988; 25:242-5.
13. Attman PO, Gustafson A, Alapovic P. Lipid metabolism in patients with chronic renal failure in the predialytic phase. Cont Nephrol 1988; 65:24-32.

14. Norbeck HE, Carlson LA. The uremic Dislipoproteinemia: Its characteristics and relations to clinical factors. Acta Med Scand 1981; 209:489-503.

15. Cramp DG, Moorhead JF, Wills MR. Disorders of blood-lipids in renal disease. Lancet 1975; 22:672-3.

16. Huttenen JK, Pasternack A et al. Lipoprotein metabolism in patients with chronic uremia. Acta Med Scand 1978; 204:211-8.

17. Gutman RA, Uy A et al. Lipoprotein metabolism in patients with chronic nonnephrotic renal failure. Am J Clin Nutrition 1973; 26:165-72.

18. Bagade J, Casaretto A, Albers J. Effects of chronic uremia, hemodialysis and renal transplantation on plasma lipids and lipoproteins in man. J Lab Clin Med 1976; 87:37-8.

19. Ibels LS, Simons LA et al. Studies on the nature and causes of hyperlipidemia in uremia, maintainance dialysis and renal transplantation. Q J Med 1975; 176:601 -14.

20. Frank WM, Sreepada TK et al. Relationship of plasma lipids to renal function and length of time on maintainance hemodialysis. Am J Clin Nutr 1978:1886-982.

21. Cassader M, Ruiu G et al. Lipoprotein and apoprotein levels in different types of dialysis. Int J Art Org 1989; 12:433-8.

22. Norbeck HE, Orö L, Carlson LA. Serum lipid and lipoprotein concentrations in chronic uremia. Acta Med Scand 1976; 200:487-92.

23. Nestel PJ, Fidge NH, Tan MH. Increased lipoprotein remmant formation in chronic renal failure. N Eng J Med 1982; 307:329-33.

24. Norbeck HE, Rössner S. Intravenous fat tolerance test with intralipid in chronic renal failure. Acta Med Scand 1982; 211:69-74.

25. Saudie E, Gibson JC et al. Impaired plasma triglyceride clearance as a feature of both uremic and posttransplant triglyceridemia. Kidney Int 1980; 18:774-82.

26. Ibels LS, Reardon MF et al. Plasma post-heparin lipolytic activity and triglyceride clearance in uremic acid hemodialysis patients and renal allograft recipients. J Lab Clin Med 1976; 87:648-57.

27. Murase T, Cattran DC, Rubenstein B. Inhibition of lipoprotein lipase by uremic plasma possible cause of hypertriglyceridemia. Metabolism 1975; 24:1279-86.

28. Fuh MMT, Lee CM et al. Effect of chronic renal failure on HDL kinetics. Kidney Int 1990; 37:1295-300.