

CLINICAL STUDY

Serum leptin level has a positive correlation with BMI and creatinine clearance in CAPD patients

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Abstract: *Objective:* In a cross sectional study, 75 patients (42 males and 33 females) on continuous ambulatory peritoneal dialysis (CAPD) were enrolled from October 2007 to February 2008. Serum levels of leptin, albumin, triglyceride, dialysis adequacy (total KT/V), renal creatinine clearance (Cr Cl), mid arm circumference and demographic findings were measured in all patients.

Results: The mean age of patients was 53±14.76. The history of hemodialysis was seen in 23 patients. Mean serum leptin level in women and men were 27±23µg/l and 16±13µg/l, respectively. A significant correlation of serum leptin level with body mass index (BMI) (p<0.001) and renal Cr Cl (p<0.001) was found. There was no significant correlation of serum leptin level with KT/V, duration of renal failure, serum triglycerides (TG), serum low density lipoprotein (LDL) cholesterol and mid arm circumference (p>0.05).

Conclusions: To our knowledge, this is probably the first study to report that serum leptin level has a direct positive correlation with renal Cr Cl in CAPD patients. This may explain the increase in mortality in patients with lower serum leptin levels (Tab. 2, Fig. 2, Ref. 25). Full Text in PDF www.elis.sk.

Key words: CAPD, leptin, creatinine clearance, KT/V.

Leptin is a 16000-Dalton protein that is produced by fat cells; it is secreted into the blood stream, attaches to the leptin binding protein, and reaches the hypothalamus via cerebral spinal fluid (CSF). It decreases the neuropeptid Y, suppresses appetite, and by blocking MSH it decreases hunger which in turn decreases the weight (1). Kidneys play an important role in metabolism and excretion of leptin. Leptin is freely filtered into glomerulus but with very little excretion in urine (2). This is probably because it is reabsorbed and destructed in tubules (3). Serum leptin level is higher in chronic renal failure, hemodialysis and CAPD patients compared to general population (4, 5). Some studies reported that the level of leptin in CAPD patients and women is higher compared to hemodialysis patients and men, respectively (6, 7) but in other study, serum leptin level has been higher in hemodialysis versus CAPD patients (8). The exact cause of elevated serum leptin level in patients suffering from renal failure is not clear; however some factors including hemodialysis membrane and type of dialysis (hemodialysis versus peritoneal dialysis) (9), low serum erythropoietin level (10), chronic inflammation and hyperinsulinemia (11) may also play a role. Hyperleptinemia has probably a role in

anorexia and malnutrition of dialysis patients, but there is a controversy in this regard (12–15). To our knowledge there are only a few comprehensive studies on the relation of serum leptin level with nutritional factors. Thus we conducted the present study to find this relation.

Methods and materials

Patients who had been at least for three months on CAPD program in Al-Zahra university hospital in Isfahan were enrolled in this cross-sectional study after their written and informed consent had been taken. Information was collected from the questionnaire by PD nurse and from patient files covering the period from October 2007 to February 2008. The inclusion criterion was peritoneal dialysis for at least 3 months, and exclusion criteria included patient in compliance, inadequate blood sampling and peritonitis during the study.

The sample volume was calculated by formula:

$$n = [(z_1 + z_2)^2 (1 - r^2) / r^2] + 2,$$

where **n** was calculated to equal 63 patients. Of 101 CAPD patients, 75 patients fulfilled the inclusion criteria and entered the study. For sampling, the method of simple random sampling was used. The patients filled in a questionnaire, went through physical and laboratory examinations, and their patient files were examined. Demographic information of patients was obtained from their files. Fasting blood sample was taken at the peritoneal dialysis

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(PD) clinic for measurement of serum leptin (DRG kit, RIA, Germany), cholesterol, triglyceride, LDL, and HDL. Serum, dialysate and urine were analysed for creatinine, serum urea concentration, and albumin (bromo Cresol Green {BCG} method). Body mass index (BMI) was calculated by formula ($BMI = \text{weight } \{kg\} / \text{height}^2 \{meter\}$), and mid arm circumference was measured by fabric meter. All data collected by PD nurse and data related to calculating the total KT/V and renal Cr Cl were analyzed by PD Adequest 2 software, Baxter ,USA.

All laboratory tests were taken after 10 hours of fasting and checked in a single laboratory. Separated plasma of patients was kept in -20c environment. After collecting all samples, the variables were measured. T-test and univariate general linear models (GLM) were used to analyze the variables statistically. All data and information are confidential, and for blood sampling an informed consent was taken from every patient.

Results

In a cross-sectional study carried out in a single center from October 2007 to February 2008, 75 CAPD patients (42 males and 33 females) finished the study.

The mean age of patients was 53±14.76 years, (in range of 20–81 years). The most common cause of end-stage renal disease was diabetes mellitus (48 %) (Tab. 1). The mean age of DM pa-

Tab. 1. Causes of ESRD in patients.

Cause	Frequency	Percent
Polycystic disease	1	1.3
DM + HTN	4	5.3
DM	32	42.7
Glomerulonephritis	1	1.3
Gout	1	1.3
hypertension	17	22.7
pregnancy	2	2.7
Renal stone	4	5.3
SLE	2	2.7
Unknown	11	14.6
Total	75	100

Tab. 2. Clinical and biochemical parameters of patients during the study.

	Number	Minimum	Maximum	Mean	Std. Deviation
Leptin (µg/lit)	75	0.09	101.00	22.00	23.00
Mid arm circumference(cm)	75	18.50	38.00	27.21	4.38
BMI (kg/m2)	75	14.20	33.30	24.26	3.89
TG (mg/dl)	75	52.00	513.00	156.15	78.77
LDL Cholesterol (mg/dl)	75	36.00	216.00	104.77	35.32
HDL Cholesterol (mg/dl)	75	28.00	59.00	44.10	6.88
Total Cholesterol (mg/dl)	75	109.00	283.00	179.12	39.72
KT/V	75	1.08	4.80	2.42	0.80
Cr Cl (ml/min)	75	.0000	29.95	3.71	4.86
WEIGHT (kg)	75	36.00	95.00	66.83	13.49
Duration of renal failure (months)	75	0.50	300.00	43.47	56.03
Duration of peritoneal dialysis (months)	75	3.00	70.00	20.16	13.79
HTN	75	0.00	1.00	0.77	0.42
Duration of hemodialysis (months)	75	0.00	72.00	4.27	12.61
Number of PD exchanges per day	75	0.36	5.00	3.76	0.88

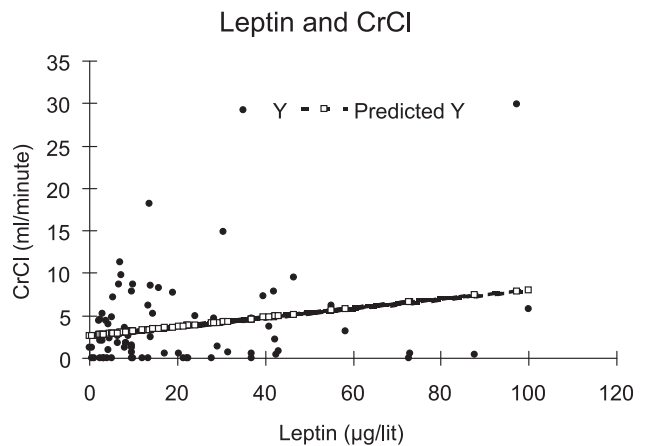


Fig. 1. Relationship between serum leptin and Cr Cl of patients (p=0.007).

tients was higher than that of patients without DM (60 years vs 46 years, respectively, p=0.028).

Twenty three (30 %) patients had the history of hemodialysis. In 58 (77 %) patients, renal Cr Cl was less than 6 ml/min and in 17 (23 %) patients it was equal or greater than 6ml/min. The mean serum leptin level in women and men were 33±4.44 µg/l and 24±3.4 µg/l, respectively (p=0.001). By using univariate general linear model, a negative relationship has been shown between age and serum leptin level (p=0.028). There was a positive relation between the serum leptin level and the duration of chronic kidney disease (p=0.01). This means that patients with a more prolonged renal failure had higher serum leptin levels. Mean BMI had a rising pattern up to 70 years and began to decline thereafter (Tab. 2).

Figure 1 shows that serum leptin level had a positive correlation with renal Cr Cl (p=0.007). There was no correlation of serum leptin level with mid arm circumference, serum TG, and total and LDL cholesterol levels (p>0.05). There was a negative relationship between the serum leptin level and the duration of hemodialysis (p=0.043), but there was no relation with the duration of peritoneal dialysis, albumin and total KT/V (p>0.05). There

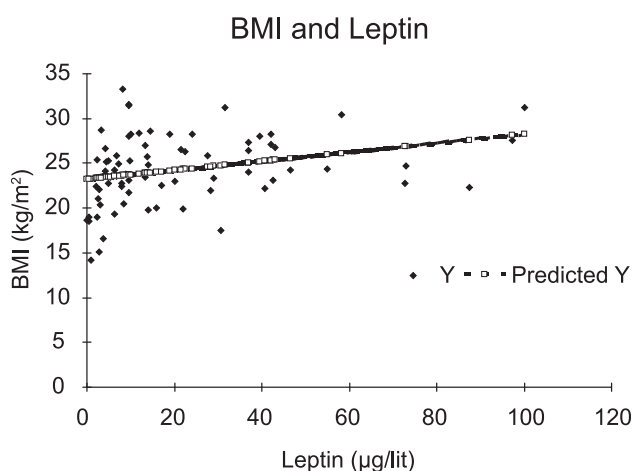


Fig. 2. Relationship between serum leptin and BMI of patients ($p < 0.001$).

was a significant correlation between the serum leptin level and BMI ($p < 0.001$) (Fig. 2).

Discussion

Some studies showed that serum leptin level is higher in female than in male population, as well as that it is higher in CAPD patients compared with those subjected to hemodialysis. Higher level of serum leptin level in CAPD patients compared to HD patients may be due to higher fat mass and serum insulin level in CAPD patients (6, 16–18).

Serum leptin level may have direct correlation with body fat mass, serum triglyceride, serum total and LDL cholesterol (13, 14, 16). Stenvinkel et al (19) reported higher serum leptin level in CAPD patients with weight loss but not in patients with weight gain. So leptin can be used as a malnutrition index in CAPD patients, although in some studies, leptin has been presented as an index of good nutritional status (14) and low serum leptin level as a possible predictor of higher mortality in patients with chronic kidney disease (20).

Our results showed that serum leptin level is higher in women compared to men and serum leptin level had a linear correlation with BMI, which is similar to the findings of Parry (16), Vignoble (21) and Kagen (22) but different from those of Kim (23).

These differences could be due to discrepancies in numbers of patients in these studies. In present study, serum leptin level was higher in patients with renal Cr CL ≥ 6 ml/min which may explain the higher mortality in CAPD patients with lower serum leptin level. Yilmaz et al (13) reported that in CAPD patients, serum leptin levels correlate with age and body mass index (BMI), however in Kastrainion (12) and Taskapan (24) studies they correlated with serum triglyceride and cholesterol. While in Stenvinkel (19) study on 36 CAPD patients, serum leptin level had an adverse correlation with BMI, there was no correlation of serum leptin level with serum albumin, transferrin and cholesterol in Aguilera (15) study in patients with BMI > 25 kg/m². In our study, there was no cor-

relation of serum leptin level with mid arm circumference, serum triglyceride, total and LDL cholesterol, and duration of peritoneal dialysis (PD). In Vignoble (21) study, serum leptin level had also no correlation with the duration of PD. The controversy of results between different studies may be due to different sample size, sex distribution, and methods of patients' evaluation. In our study, serum leptin level had no correlation with total KT/V which is consistent with the results of Parry RG (16) and Rodríguez-Carmona (25) results. Therefore we cannot use serum leptin as an index of peritoneal dialysis adequacy.

In conclusion, this is probably the first report of a positive correlation of serum leptin level with renal Cr Cl in CAPD patients. This may explain the increase in mortality in patients with lower serum leptin level.

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