

Effect of one turn hemodialysis on malondialdehyde, superoxide dismutase and glutathione peroxidase

ŞEKEROĞLU M.R.¹, ASLAN R.², TARAĞCIOĞLU M.¹, MERAL İ.³, AYDIN S.⁴

Departments of Biochemistry¹, Physiology², and Urology³, School of Medicine, Van

Department of Physiology⁴, Veterinary Faculty, Yuzuncu Yil University, Van

Objective The purpose of this study was to investigate the changes in serum malondialdehyde (MDA), uric acid, bilirubin, erythrocyte MDA, glutathione peroxidase (GSH-Px) and superoxide dismutase levels after a turn of hemodialysis treatment.

Methods In this study, 14 male and 4 female volunteers with chronic renal failure and under a continuous hemodialysis treatment were studied to investigate the effect of hemodialysis in serum and erythrocyte lipid peroxidation and antioxidant levels. Malondialdehyde (MDA), uric acid, bilirubin, erythrocyte MDA, glutathione peroxidase (GSH-Px) and superoxide

dismutase (SOD) levels were measured before and after the hemodialysis.

Results Although erythrocyte MDA and serum uric acid levels significantly decreased ($P < 0.01$, $p < 0.05$ respectively), serum MDA level and erythrocyte SOD and GSH-Px activities did not significantly change after the hemodialysis ($P > 0.05$).

Conclusion It is concluded that hemodialysis decreases the increased lipid peroxidation level in patients with chronic renal failure without having any significant effect on antioxidant levels.

Key words Hemodialysis, lipid peroxidation, antioxidants, chronic renal failure.

Introduction

Although hemodialysis is used to compensate deficient renal function, it also causes some complications in blood parameters (1). It has been suggested that these complications are due to an inadequate defense system and increased free radicals in hemodialyzed patients (2).

Free radicals, produced by environmental and endogen factors, cause an increase in malondialdehyde (MDA) and conjugate diens (CD) that are the products of lipid peroxidation. Healthy organisms are normally protected from these oxidants by an antioxidant defense system (3). This defense system includes enzymes such as, superoxide dismutase, glutathione peroxidase and catalase, nonenzymes such as, uric acid, glucose, bilirubin, transferrin and seruloplasmin (4).

It is known that free radicals increase in renal failure, diabetes mellitus and atherosclerosis. It is also known that blood antioxidant level decreases in renal failure causing an increase in lipid peroxidation (2, 4). However, it is still questioned whether these changes in oxidant/antioxidant rate in hemodialyzed patients are due to the hemodialysis or the deprived metabolic function of patients with renal insufficiency.

The purpose of this study was to investigate the changes in serum malondialdehyde (MDA), uric acid, bilirubin, erythrocyte MDA, glutathione peroxidase (GSH-Px) and superoxide dismutase

levels after a turn of hemodialysis treatment in patients with chronic renal failure.

Material and Method

Fourteen males and 4 females, 13-51 years old underwent a hemodialysis treatment for one year (3 times a week) were studied. Dialyse bags (Cuprophane dialyser) were same trade and pores of these bags had same diameters. Renasol BA-140 was used as solution. Malondialdehyde (MDA), uric acid, bilirubin, erythrocyte MDA, glutathione peroxidase (GSH-Px) and superoxide dismutase (SOD) levels were measured before and after hemodialysis.

The MDA level was determined with a calorimetric method described by Valenzuela (5). Briefly, phosphate buffer (pH 7.4), butylated hydroxytoluene (BHT) and 30% trichloroacetic acid (TBA) were added into an erythrocyte and serum packs. After incubating two hours at -20°C , mixture was centrifuged (2000 g) for 15 min at 4°C . Supernatant was collected and 0.1 mol EDTA and 1% thiobarbituric acid (TBA) were added. Tubes with teflon-lined screw caps were incubated at 100°C in water bath for 15 minutes and cooled to room temperature. Mixture was examined on spectrophotometer (Novaspec II Pharmacia-Biotech) with excitation-emission wavelengths of 532 and 600 nm. Res ults were expressed as $\text{nM}/10^{10}$ erythrocyte.

Accepted for publication: 30 May, 1996

Table 1. Concentrations of the MDA and antioxidants in patients with renal failure before and after the hemodialysis.

Parameters	Before Dialysis	After Dialysis
Erythrocyte MDA (nm / 10 ¹⁰ erythrocyte)	3.50 ± 0.62	2.78 ± 0.52*
Erythrocyte SOD activity (U / gr Hb)	1029.80 ± 62.90	981.50 ± 66.70
Erythrocyte GSH-Px activity (U / gr Hb)	64.75 ± 9.88	69.50 ± 7.63
Serum MDA (nm/ml)	4.02 ± 0.58	3.83 ± 0.60
Serum uric acid (mg / dl)	6.79 ± 1.29	4.70 ± 0.04**
Serum bilirubin (mg / dl)	0.34 ± 0.17	0.32 ± 0.18

* p < 0.01, ** p < 0.05

Erythrocyte GSH-Px and SOD activities were determined in an otooanalyzer (Technicon RA-XT 9219104) using commercial kits (Ransod Lot No 8136 C and Ransod-Ransel Lot No 7843 C). Serum uric acid and glucose levels were also measured in the otooanalyzer using commercial kits (Biotrol). To check the distribution normality goodness of fit test (Shapiro-Wilk's) was done (P > 0.05). Then paired t test was used for statistically analysis.

Results

Results are shown in table 2. Although erythrocyte MDA and serum uric acid levels significantly decreased (P=0.005 and P=0.020 respectively), serum MDA, Erythrocyte SOD, serum bilirubine and erythrocyte GSH-Px levels did not significantly change (P>0.05) after the hemodialysis.

Table 2. Some characteristics of the subjects and dialysis program.

Criteria	Characteristics of subjects
Number and sex	14 males, 4 females
Age (year)	42 (13-51)
Hemodialysis time	210 minutes

Discussion

This study was undertaken to investigate the effect of hemodialysis in serum and erythrocyte lipid peroxidation and antioxidant levels in patients with chronic renal failure. Although many studies show that hemodialysis increases the oxidative stress (2,6,7), Loughrey et al. (8) suggested that it does not have any significant effect on lipid peroxidation or oxidative stress. In our experiment, we found that the erythrocyte MDA and the serum uric acid levels significantly decreased. Reasons of the decreased antioxidant defense system and the increased oxidative stress after the hemodialysis are not well understood. Richard et al. (1) suggested that the decrease in antioxidant level is due to the filtration of defense components during

hemodialysis. However, Schettler et al. (9) suggested that the decrease in antioxidant level is due to the inhibition of antioxidant enzymes by increased oxygen metabolites that decreases the activity of antioxidant defense system.

Our experiment is the first one that compares the lipid peroxidation and antioxidant levels before and after the hemodialysis in patients with chronic renal failure. Many studies have compared the lipid peroxidation and antioxidant levels of hemodialyzed patients those levels of healthy people. Haldar et al. (6) suggested that the lipid peroxidation was higher and antioxidant level was lower in patients with chronic renal failure when compared to healthy people. They also suggested that hemodialysis did not significantly change these levels. Paşaoğlu et al. (10) suggested that GSH and related antioxidant enzyme levels were low in patients with chronic renal failure. They also suggested that hemodialysis compensated low GSH and related antioxidant enzyme levels.

This study supports the idea that decrease in antioxidant levels is due to the pathology of the disease rather than the hemodialysis. However, more studies are needed to demonstrate the reason of decreased antioxidant levels after hemodialysis in chronic renal failure.

References

- Richard MJ, Arnaud J, Jankovitz C, Hachschke T, Melahi H, Laporte F, Foret M, Fauvir A, Cordonnier D: Trace elements and lipid peroxidation abnormalities in patients with chronic renal failure. *Nephron*, 57 (1) 10-5, 1991.
- Clerkson PM: Antioxidants and Physical Performance. *Critical Reviews in Food Science and Nutrition*, 35, 1&2, 131-41, 1995.
- Pal Yu B: Cellular Defenses Against Damage from Reactive Species. *Physiological Reviews*, 74, 1, 139-162, 1994.
- Paul JL, Sall ND, Sont T, Poinget JL, Lindenbaum A, Mor N, Moatti N, Raichow D: Lipid peroxidation abnormalities in hemodialyzed patients. *Nephron*, 64: 106-109, 1993.

5. Valerusela A: The biological significance of malondialdehyde determination in the assessment of tissue oxidative stress. *Life Scien.* 48: 301-9, 1990.
6. Haldar G., Yegenaga I., Yakın AS.: Evaluation of oxidant stress in chronic hemodialysis patients: use of different parameters. *Clin Chim Acta.* 23: 109-114, 1995.
7. Paul JL., Man NK., Moatti N., Reichwang D: Membrane phospholipid peroxidation in renal insufficiency and chronic hemodialysis. *Nephrology.* 12 (1) 4-7, 1991.
8. Loughrey CM., Young JS., Lighthody JH., McMaster D., McNamara PT., Trimble ER: Oxidative stress in hemodialysis *QJM* 87 (11) 679-683, 1994.
9. Schettler V., Wastland E., Verweibe R., Scheler F., Ollertch M: Plasma lipids are not oxidized during hemodialysis. *Nephron.* 67 (1) : 42-47, 1994.
10. Paşaoğlu H., Muhtaroğlu S., Güneş M., Ulaş C.: Kronik böbrek yetmezliği olan hastalarda hemodiyaliz öncesi ve sonrası eritrosit ve plazma GSH ve ilgili enzim düzeyleri. *Antalya XIII Ulusal Biyokimya Kongresi Özet Kitabı* 1996.

Correspondence to:

Yrd.Doç.Dr. M.Ramazan Şekeröglü
Yüzüncü Yıl Üniversitesi Tıp Fakültesi
Biyokimya Anabilim Dalı, Van
Tel : (432) 216 47 06 / 1027
Faks : (432) 216 75 19