Some Biochemical Changes in Serum of Hemodialysis Patients

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Abstract

The present study is concerned with the investigation of the activity of some enzymes as glutamic oxalacetic transaminase (GOT), aryl-esterase, peroxidase, and acetyl cholinesterase. The concentration of lipid profile in serum of patients with chronic renal failure (CRF) treated by hemodialysis also have been measured.

Forty-seven patients with CRF under went hemodialysis and (40) healthy controls were included in this study.

The results obtained show a significant decrease in the activity of GOT, arylesterase, peroxidase, acetyl cholinesterase and in the concentration of lipid profile in serum of CRF patients when compared with control group.

الخلاصة

شهدت الدراسة قياس فعالية الانزيمات التي تشمل كلوتاميت اوكزالو اسيتيت ترانس اميني ـ ز واريـ ـل استريز والبيروكسديز والاسيتايل كولين استريز. كذلك قياس تراكيز بعض المركبات الدهنية (الكوليـ ـستيرول الكلي والبروتين الدهني عالي الكثافة والبروتين الدهني واطئ الكثافة) في مصل المرضى المصابين بـ ـالعجز الكلوي المزمن والمعالجين بالديازة الدموية.

أجريت الدراسة على (47) عينة دم من المرضى المصابين بالعجز الكلوي والمعالجين بالديازة الدموية و (40) عينة دم من اشخاص اصحاء كمجموعة سيطرة.

تشير النتائج الى وجود انخفاض معنوي في فعالية الأنزيمات GOT واريل اسـ ـتريز والبيروكـ ـسيديز وانزيم الاسيتايل كولين استريز كذلك تراكيز الدهون في مصل دم المرضى المصابين بالعجز الكلوي مقارنة مع مجموعة السيطرة.

Introduction

Chronic renal failure (CRF) also called chronic kidney failure, chronic renal insufficiency, or uremia is a slowly progressive loss of renal function over a period of months or year and defined as an abnormally low glomerular filtration rates(GFR)[1]. CRF that leads to severe illness and requires some form of renal replacement therapy such as dialysis is called end-stage renal disease[2].

In medicine, dialysis is a type of renal replacement therapy which is used to provide an artificial replacement for lost kidney function due to renal failure. It is a life support treatment and does not treat any kidney diseases[3].

Dialysis may be used for very sick patients who have suddenly lost their kidney function (acute renal failure) or for quite stable patients who

have permanently lost their kidney function (end stage renal failure).

When healthy, the kidney remove waste products and fluids from the blood stream and excreting them in the urine. Dialysis treatments have to duplicate both of these functions as dialysis (waste removal) and ultrafiltration (fluid removal)[4].

Chronic renal failure occurs in 1.0 of every 5000 people, usually in middle-aged and older people, although children and pregnant women are also suspectible. CRF may be irreversible, and eventually leads to total kidney failure[3].

The aim of this study was to evaluate the prevalence of some biochemical changes as, GOT, arylesterase, peroxidase and acetyl cholinesterase and lipid profile in serum of chronic renal failure on hemodialysis patients.

Materials and Methods

Subjects and samples

Patients were enrolled in the present study to the artificial kidney unit in Ibn-Sina Hospital in Nineveh Governorate.

Blood serum of (47) with chronic renal failure (CRF) undergoing hemodialysis. These samples were considered as having CRF ranging in their age between (20-70) years. Blood samples from (40) control subjects were obtained for comparison.

Blood was freshly withdrawn by vene-puncture of each patient immediately. Serum then was separated by centrifugation at (3000xg) for (10) minutes, and then divided in aliquots each subject's serum was frozen at (-20 °C) before analysis.

Methods

- Glutamic oxalacetic transaminase (GOT) activity was measured by colorimetric method using manufactured kit by Biomerieux[5].
- Arylesterase activity was measured according to the method of Tomas et al., 2000[6].
- Peroxidase activity was determined according to the method of Trinder,1966[7].
- Acetyl cholinesterase activity was calculated according to the method of Mohammed and Omar,1982[8].
- Total cholesterol concentration was estimated by using the enzymatic method of (Tietz, 1999)[9] using manufactured kit by Biolabo.
- LDL-cholesterol concentration was measured by enzymatic method using manufactured kit by Syrbio[9].
- HDL-cholesterol was determined following to the method of (Tietz, 1999)[9] by using manufactured kit by Biolabo.

Results and Discussions

The results in table (1) showed that there is a significant decrease (P = 0.001) in GOT activity in serum of patients with CRF which was (24.39 ± 10.62 U/L) in comparison with (37.38 ± 4.95 U/L) in control. The decrement percent for CRF patients was about (35%) compared with control.

Also the results in table (2) showed that there is no significant differences between males and females patients with CRF in GOT activity.

The results of the present study was agree with those obtained by Descombes *et al*., in patients with CRF[10].

Patient with CRF on hemodialysis acquired hepatitis (HCV) infection which important cause of chronic liver disease however, its role has been underestimated by the lower GOT activity in the dialysis population. Dialysis patients show lower GOT activity than control group

because serum GOT levels are commonly used to screen for liver disease in the dialysis population, recognition of liver damage may be hampered by the reduction in aminotransferase values in these patients[11]. Other workers explains the decreasing level of GOT may be related to inhibition of the enzymatic system rather than to true vitamine deficiency[10].

Table (1): The enzymes activity and lipid profile concentration in blood serum of hemodialysis patients

Parameters	Mean ± SD		% change	P-value
	Control (n = 40)	Patients (n = 47)		
GOT (U/L)	37.38 ± 4.95	24.39 ± 10.62	- 34.7	0.001
Peroxidase (U/L)	52.19 ± 13.99	30.31 ± 10.37	- 72.2	0.001
Arylesterase (U/ml)	151.95 ± 29.72	77.30 ± 8.75	- 49.1	< 0.001
Acetyl cholinesterase (U/L)	0.98 ± 0.10	0.73 ± 0.19	- 25.0	< 0.001
HDL (mg/dl)	46.85 ± 7.96	36.64 ± 10.71	- 21.8	< 0.001
LDL (mg/dl)	102.97 ± 23.74	82.58 ± 17.80	- 19.8	< 0.001
Cholesterol (mg/dl)	201.27 ± 32.92	141.5 ± 30.58	- 29.7	< 0.001

The results in table (1) showed a significant decrease (P = 0.001) in peroxidase activity which was (30.31 ± 10.37 U/ml) in serum of CRF patients in comparison with (52.19 ± 13.99 U/ml) in control group. The decrement percent was about (72%) in the patients in comparison with control group.

Table (2) showed that there are no significant differences between males and females of CRF patients in both peroxidase and other parameters activities.

There were several results which were conformable to our results of peroxidase activity in patients with CRF[12],[13],[14].

The decrement activity of peroxidase suggested that CRF was found to increase the oxidative stress burden in serum. Therefore, antioxidant assessment may be used to monitor baseline oxidative status in these situation[13]. Other results indicate that low levels of peroxidase in CRF patients may be due to increase utilization to scavenge lipid peroxides[14].

Compared with control group, arylesterase activity was found to be significantly decreased (P < 0.001) in serum of CRF patients as shown in table (1). The decrement percent was about (49%) compared with control group.

The results were in accordant with other studies which they show a significant decrease of arylesterase activity in patient with CRF[15,16].

There are several factors, such as lipid peroxidation products and cytokines were suggested to affect arylesterase activity and paraoxonase synthesis[17]. A possible mechanism for reduced serum arylesterase activity could be the inhibition of the enzyme activity and/or synthesis in the CRF. Juretic *et al.* suggested that uremia could induce changes in the enzyme

activity or its connection with HDL[18]. The reduction in arylesterase activity determined in this study in hemodialysis patients could reflect inhibition in paraoxonase synthesis[16].

Since arylesterase is an HDL-associated enzyme, reduced HDL levels could result in reduced serum arylesterase activity in hemodialysis patients[19]. Other suggestion shows that the arylesterase activity has been shown to be low in patients with myocardial infarction, diabetes mellitus, or familial hypercholesterolemia.

Because cardiovascular disease is the main cause of death in chronic renal failure[15]. On the other hand, these results indicates that uremia or dialysis probably induces changes in the enzyme activity, or its connection with HDL. Reduced arylesterase activity may cause decreased HDL antioxidant capacity in hemodialyzed uremic patients and would therefore be expected to contribute to the increased risk of paremature atherosclerosis found in these patients. Enzyme activity and lipid status in healthy individuals from the same area and with same living and eating habits were selected as a baseline. Dietary habits, such as lipid levels in the diet, have been reported to affect arylesterase activity[18].

Acetyl cholinesterase activity were significantly lower ($P < 0.001$) in the hemodialyzed uremic patients compared to the control which was (0.73 ± 0.19 U/ml) in comparison with (0.98 ± 0.10 U/ml) in control. The decrement percent for patients was about (25%) compared with control as shown in table (1).

The causes of decreased serum cholinesterase activity are hepatic parenchymal disease (reduced synthesis), ingestion, or absorption through the skin, of such anticholinesterase as organophosphates, and the inherited abnormal cholinesterase variants, with a low biological activity[20].

In this study lipid profile was determined in CRF patients, all to significant abnormality. High-density lipoprotein (HDL) cholesterol in dialysis patients had a significant lower (36.64 ± 10.71 mg/dl vs. 46.85 ± 7.96 mg/dl, $P < 0.001$). Reduced concentration of a similar level for HDL was also found in hemodialyzed uremic patients from other countries[21,22].

The data suggest that in patients with chronic renal failure, low levels of plasma HDL of abnormal composition may restrict the incorporation of cell cholesterol into the antiatherogenic HDL fraction potentially leading to inefficient transport of cholesterol from peripheral tissues and the development of atherosclerosis. These abnormalities appear to be reversed by renal transplantation[21].

Several arguments have suggested a protective role of HDL against LDL oxidative modifications. Morena *et al*. have reported a protective effect of HDL depending on incubation time and HDL concentration[23]. However, the lack of HDL effect in preventing conjugated diene formation observed in hemodialysis patients (HD) suggests that HDL are both quantitatively modified and functionally impaired in HD patients. Several enzymes such as lecithin cholesterol acyltransferase, protease, phospholipase and arylesterase are associated in the HDL lipoprotein complex[24]. Other investigations demonstrated that HDL associated arylesterase, a component of HDL, might contribute to its protective action against LDL oxidation which suggests a possible involvement of arylesterase in the antiatherogenic properties of HDL[15]. Accordingly, the absence of protective activity of HDL against

LDL oxidation might be related to the impairment of HDL-associated enzymes and especially arylesterase[16].

Decreased clearances of low-density lipoprotein in patients with chronic renal failure was observed in this study as shown in table (1) which indicated a significant decreased ($P < 0.001$) in LDL concentration (82.58 ± 17.80 mg/dl) in comparison with (102.97 ± 23.74 mg/dl) in control group. The decrement percent was about (20%) compared with control.

These results were conformable with several results of LDL concentration in patients with CRF[22,25].

Cardiovascular disease is the most common cause of morbidity and mortality in patients with CRF, particularly in hemodialysis patients, which they show lipid and lipoprotein abnormalities characterized by reduced HDL-cholesterol. In addition to the role of HDL in reverse cholesterol transport, HDL has the ability to protect LDL against oxidation. LDL oxidation is currently considered to be an early key event in the development of atherosclerosis leading to LDL uptake by the macrophage scavenger receptor, and therefore, to foam-cell formation. In addition to its pivotal role in foam-cell formation, oxidized-LDL possesses additional atherogenic properties which include cytotoxicity and the stimulation of thromobotic and inflammatory events. The underlying mechanism by which HDL inhibits LDL oxidation is partly enzymatic[16]. Other suggestion indicated that the alteration in the metabolism of the most atherogenic particle in plasma may contribute to the accelerated atherosclerosis in uremic patients[25].

Total cholesterol was assays in serum of patients with CRF and the results indicated that there was a significant decreased ($P < 0.001$) in patients compared with control group which was (141.5 ± 30.58 mg/dl vs. 201.27 ± 32.92 mg/dl). The decrement percent was about (30%), as shown in table (1).

These results were similar to that found by Sutherland et al., and Korcagora et al.,[21,22]. The decrease of cholesterol concentration could be due to increased hepatic syndrum defective triglyceride removal[26].

Other suggestion concluded that reduced total cholesterol contributed to atherosclerosis pathogenesis in dialysis patients[22].

Table (2): The enzymes activity and lipid profile concentration in blood serum of males and females hemodialysis patients

Parameters	Mean ± SD		P-value
	Male (n = 26)	Female (n = 21)	
GOT (U/L)	23.35 ± 13.83	25.69 ± 16.29	0.70 (NS)
Peroxidase (U/L)	31.33 ± 15.55	32.5 ± 11.47	0.25 (NS)
Arylesterase (U/ml)	78.46 ± 8.13	75.86 ± 9.47	0.32 (NS)
Acetyl cholinesterase (U/L)	0.75 ± 0.19	0.72 ± 0.21	0.64 (NS)
HDL (mg/dl)	37.21 ± 10.77	35.94 ± 10.86	0.69 (NS)
LDL (mg/dl)	83.26 ± 17.39	81.75 ± 18.68	0.78 (NS)
Cholesterol (mg/dl)	135.01 ± 24.14	149.54 ± 36.06	0.11 (NS)

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