J.Thi-Qar Sci. Vol.3 (1) July/2011

ISSN 1991- 8690 الترقيم الدولي ١٩٩١ - ٨٦٩٠

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The Effect of Some Risk Factors Participating in the Incidence of Chronic Renal Failure

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Abstract

The risk factors of chronic renal failure (CRF), including diabetes and hypertension, are described in present study. Also, study involved the effect of lifestyle factors of CRF, such as (age, gender, smoking, chronic disease and area of residence). Also the study included an estimation of urea and creatinine in serum blood of chronic renal failure (CRF) which treated with hemodialysis. The urea and creatinine were tested in the present study only for practical purposes because of a good standard for determining kidney functions. Blood samples of (30) patients with chronic renal failure from both sexes were compared with (50) samples taken from healthy individuals as a control group.The results demonstrated a significant elevation in blood urea and creatinine concentrations for patients with (CRF) in compared to control group. The hemodialysis process caused a significant reduction ($P<0.05$) in the concentration of urea and creatinine, the results also demonstrated that the some risk factors greatly affect on incidence of chronic renal failure.

Introduction

A risk factor is something that increases the possibility of getting a disease or condition. It is possible to develop CRF with the increases risk factors, CRF risk factors increases with age, gender, education, smoking, hyperlipidemia, diabetes and Hypertension, so the men are more likely than women to develop CRF, also People with lower educational attainment have a higher risk of developing CRF, smoking also has been linked to the progression of renal disease among diabetic and hypertensive patients, on the other hand, various lipid disorders are associated with the development of and progression to chronic renal failure, like this the diabetes is the biggest risk factor for developing CRF; one-third of the people who develop CRF have diabetes, furthermore, hypertension (high blood pressure) is the second most common cause of renal failure (Debra Wood, 2009).

Risk factors for kidney failure are factors that seem to be a direct cause of the disease and appear to be associated in some way. Having a risk factor for kidney failure makes

the chances of getting a condition higher but does not always lead to kidney failure. People with diabetes and hypertension and other factors have a substantially increased risk for developing kidney failure (Yu, 2009).The CRF is an important public health problem and usually derived from other chronic diseases like hypertension and diabetes. On the other hand, smoking and alcohol drinking and are sometimes the risk factors for CRF (Imai and Matsuo, 2008).

Waste products and excess water accumulate throughout the body; causes of renal failure include vascular problems as well as trauma, infection, or exposure to chemicals or medications. The kidney cannot filter the waste and water adequately in any of these stages, but the severity of the condition varies widely **(**Lin *et al*., 2005**)**.

Uremia is a presence of excessive amounts of urea and waste products in the blood, which may be produced sign of kidney diseases or failure (Zeller *et al*., 2006). Uremia is a toxic condition resulting from renal failure, when kidney function is compromised and urea, a waste product normally excreted in the urine, is retained in the blood. Uremia can lead to disturbances in the platelets and hypersomnia, among other effects **(**Adamson and Eschbach, 1998**).**

Blood hemodialysis process (dialysis) mean a procedure that performs many of the normal duties of the kidneys, like filtering waste products from the blood, when the kidneys no longer work adequately(Knochel and Seldin,1998). Dialysis process by which biologic waste products are removed from the body through external blood circuit and external membranes **(**Jones *et al*., 1998**)**.

Aim of study:

The aim of this study was to study the effect of some risk factors participating in incidence of in chronic renal failure (CRF) which involve diabetes and hypertension, also to clarify the lifestyle factors of CRF, such as (age, gender, smoking, chronic disease and area of residence), study the continuous dialysis attendance on the urea and creatinine level in the serum of chronic renal failure patients before and after hemodialysis process.

Materials and Methods

Chronic renal failure patients treated by hemodialysis as they were submitted to the artificial kidney unit at Ibn-sena and Azady training hospital in Nineveh and Duhok provinces/North of Iraq were selected for this study. Different individuals were selected as control healthy groups.Blood samples (5) ml was drawn from (22) male,(8) female patients of chronic renal failure ranging age between (16-75) years old. Samples then transferred immediately to a clean dry plain tube. After removing the needle, the blood was allowed to clot for at least 10-15 min. at room temperature, centrifuged for (10) min. at (4000xg). Serum was removed for the measurement of biochemical parameters **(**Tietz, 1999**)**. Blood serum was obtained from (50) healthy individuals ranging in age between (15–65) years as a control groups.

Table (1): Determination of urea and creatinine in blood serum

Parameters	Method of determination	Technique	References
1-Urea	Colorimetric	Spectrophotometer	Williams *et al*.,1978
2-Creatinine	Colorimetric	Spectrophotometer	Jaffe,1886

Statistical analysis:

Statistical analysis was performed using the number and percentage to study risk factors and T-test between two properties. The results were expressed as mean ±SD. Duncan's test was used to differentiate between the mean values for blood biochemical parameters.Analysis of variance (ANOVA) was used to find the significant between groups. The comparison included CRF patients and healthy control groups. The means were distinguished among statistical groups at $P < 0.05$, has been taken as statistically significant **(**Steel_and Torrie, 1984**)**.

Results and Discussion

The results of the measured biochemical parameters are summarized in tables (2, 3, 4, 5, 6 and 7). The urea and creatinine were higher $P<0.05$ in patients of CRF compared to control group. Also, the hemodyalysis lead to a significant reduction ($P<0.05$) in the levels of urea and creatinine in serum of CRF patients after hemodialysis. Other result which involve the effect of age, sex, smoking, presence of chronic diseases and area of residence mentioned in table (3, 4, 5, 6 and 7) respectively.

Table (2): Values of biochemical parameters in patients of chronic renal failure and control groups ± standard deviation.

Parameters	Groups	No.	Mean± SD	*p**–value	Duncan's Grouping**
1-Urea (mmol/L)	Before hemodialysis	30	25.9±6.3	≤0.001*	A
	After hemodialysis	30	13.8±3.4		B
	Control	50	5.3±1.4		C
2-Creatinine (µmol /L)	Before hemodialysis	30	1033.6±3.6	≤0.001*	A
	After dialysis	30	773.5±8.3		B
	Control	50	114.3±2.3		C

*Significant difference at level ($p \leq 0.05$).
**Means with different letters were statistically significant at level ($p \leq 0.05$).

1-Urea:

Results in Table(2) showed a significant elevation in urea concentration in serum of CRF patients before hemodyalysis compared to control group for both sex .These results were in agreement with that reported by**(**Francisco *et al*.,2001 **)**.The increase of urea level might be due to the fact that the urea is the main nitrogenous compound of metabolism, which is formed in the liver and excreted by urine .In case of renal failure, there will be a disorder in kidney function which lead to a decrease in the amount of urea excreted and accumulation in the blood and increasing occur in concentration **(**Zilva *et al*.,1988; Francisco *et al*.,2001**)**.The increased amount of urea depend on the protein input and output (Schrier *et al*.,2004).The result showed also a significant increase at the level of ($p<0.05$) in urea concentration in serum of CRF patient after hemodyalysis in relation to urea concentration of control group for both sexes, and a significant decrease at the level of ($p<0.05$) in urea concentration in serum of CRF patient after hemodyalysis when

compared with urea concentration before dialysis for both sexes, this results were in agreement with **(**Ronald *et al.,* 2002).

2-Creatinine

Table (2) showed a significant increase in creatinine concentration in serum of CRF patients before hemodyalysis (P<0.05) when compared to control groups for both sexes. These results were in agreement with that reported by (MacGregor *et al*., 2006). Which noticed an increased creatinine concentration in serum of CRF patients. Creatinine is considered as a ruminant of metabolism which is excreted normally in urine but in case of CRF there will be disorder in the filtration rate of the kidney which cause increase creatinine concentration inversely proportional with glomerular filtration rate **(**Zilva *et al*., 1988; Francisco *et al*., 2001**).** Because of creatinine is endogenously produced and released in to the body fluid at a constant rate, its plasma levels are maintained with in a narrow limit. Hence it can be used as an indicator of glomerulus filtered rate **(**Gaw *et al***.,** 1999**)**. On the other hand, Knochel and Seldin, 1998 found that the serum creatinine is sensitive to change in kidney function. A significant increase at the level of (p<0.05) in creatinine concentration in serum of CRF patient after hemodyalysis in comparison to control group for both sexes and a significant decrease (P<0.05) in creatinine concentration in serum of CRF patients after hemodyalysis when compared to the concentration before dialysis for both sexes.The obtained results were in agreement with those reported by Schluessel *et al*., (1980), Murray *et al*., (1999).

The effect of risk factors participating in the incidence of chronic renal failure:

1-Age:

Table (3) showed the numbers and the percentages of frequency distribution at different age groups of CRF patients. The highest percentage of prevalence of CRF was in age group greater than 46 years which represents (63.3 %). The obtained results were in agreement with those reported by Anderson and Brenner (1986), Jones *et al*., (1998) and Shankar *et al*., (2006), which noticed that the risk factor for renal failure appears to be greater in older than younger persons, and the number of new cases occurs in the sixth decade of life.The reason for the increase in incidence of CRF in older persons may be duo to that the age has been identified as a factor associated with delayed referral to a nephrologists in CRF patients and patients aged above 55 years were five times more likely to be referred late compared to younger patients, patients referred late to nephrologists are at greater risk of poor outcomes, including death **(**Balogun *et al*., 2006**)**. It may be also due to that the age increases mitochondrial DNA derived from a variety of rats organs, concluding this to derive from a tissue's increased sensitivity to oxidative damage, rather than decreased repair (Cooke *et al* .,2003).

Table (3): Frequency and percentage of CRF patients regarding age.

Age groups (years)	Frequency	Percentage
16–30	2	6.6%
31–45	9	30%
≥ 46	19	63.3%
Total	30	100.0%

2-Sex:

Table (4) showed the numbers and the percentages of distribution of males and females with CRF patients. The incidence of CRF was occurring in men more than

women and it was (73.33%) for men and (26.66%) for women. These results were in agreement with Jones *et al*., (1998); Ejerblad *et al*., (2004), which showed CRF cases is higher for males compared to females**,** and other suggestion showed that the non diabetic renal diseases progress more rapidly in men than women **(**Henry, 2003).

Table (4): Frequency and percentage of CRF patients regarding sex.

Sex	Frequency	Percentage
Females	8	26.66%
Males	22	73.33%
Total	30	100.0%

3-Smoking:

Cigarette smoking is considered to be the most common identifiable cause of adult death in developed countries and associated with an increased risk for CRF overall and the heavy cigarette smoking increases the risk of CRF for both men and women **(**Ejerblad *et al*., 2004**)**. The results were obtained on Table (5) indicated a significant difference between smokers (66.66%) and non smokers (33.33%) patients with CRF. This findings was in an agreement with these reported by Henry, (2003); Shankar *et al*., (2006), who found a significant correlation between CRF and smoking.

The reason for high CRF in smoking persons is due to that the smoke aggravates glomerular hyperfiltration which considered a first stage in acceleration the rate of progression of renal damage. In addition, smoking is associated with progression of renal lupus, renal artery stenosis, and renal tubular dysfunction (Crowe *et al*., 2000). It may be also due to that smoking may also injure the kidneys by damaging the renal tissues through oxidative stress, since the cigarette smoke is an external sources of free radicals, smoking also induced tubular cell dysfunction which may further contributes to tubulointerstitial injury and progression of CRF (Langseth,1995; Ejerblad *et al*., 2004).It was noticed Ejerblad *et al*., (2004), that the smoking is a risk factor for nephropathy and accelerates the rate of progression of renal failure. In hypertensive patients, smoking independently increases the risk for albuminuria and may cause decline of renal function. Other studies have noted that the risk of renal impairment associated with smoking was restricted to men, whereas there was no increased risk at all in women and the association between current smoking and CRF appears to be stronger among men than among women. The gender difference is not implausible, because men are generally more likely than women to progress to renal disease and end stage renal disease (ESRD) that all women are intrinsically insensitive to renal effects of smoking. The most plausible explanation for the negative findings in several previous studies is lack of power, as a result of small sample sizes of women **(**Shankar *et al*., 2006**)**.

Table (5): Frequency and percentage of CRF patients regarding smoking.

Smoking	Frequency	Percentage
Non smokers	10	33.33%
Smokers	20	66.66%
Total	30	100.0%

4-Chronic diseases

Reactive oxygen species (ROS) are elevated in humans with hypertension many of which develop (ESRD), and decreased antioxidant capacity. Several studies had shown that oxidative stress can cause hypertension; renal oxidative stress can cause renal diseases also renal oxidative Stress can

cause hypertension and renal damage (Manning *et al*., 2005).Table (6) showed that the numbers and the percentages of distribution of CRF patients with hypertension, diabetes and CRF patients only. The results showed that the incidence of CRF with chronic diseases was (36.66%) for hypertension and (40 %) for diabetes and (23.33%) for CRF only. In this study, the results obtained indicated that there was a significant difference between CRF patients with chronic disease and CRF patients alone and presence of chronic diseases with CRF are more frequent than CRF alone. These results were in agreement with Henry,(2003); Manning *et al*., (2005) also in agreement with results of Ejerblad *et al*.,(2006) which support that the hypertension and diabetes, rapidly increasing burden of CRF in both men and women.It was noticed Francesco *et al*., (2003); Manning *et al*., (2005), that the hypertension is a significant and independent risk factor for renal damage, and there is a strong association between hypertension and oxidative stress. Several studies had shown that humans with essential hypertension had a decreased antioxidant capacity, and increased the amounts of ROS. ROS, especially super oxide radical $O_2 \cdot^-$, is elevated in human hypertension and in patients with ESRD, and their antioxidant capacity is decreased. Hypertension and diabetes mellitus are associated with oxidative stress. Recent investigations suggest that oxygen radicals may contribute to enhanced renal vascular, increased sensitivity to vasoconstrictors (Schnackenberg, 2002).The reason for increasing of frequency of CRF disease in patients with hypertension disease may be due to hyperlipidemia, because it is a most common in patient with hypertension and consider an important factor in the development and progression of CRF and the elevation of triglycerides and low HDL in hypertension patients are independent risk factors for the development or acceleration of CRF (Kurella *et al*., 2005).

Thambyrajah *et al.,* (2000) and Vanholder *et al*., (2002), were noticed that the renal dysfunction is a central cause of hypertension and a common consequence of diabetes mellitus. These pathophysiological conditions set up a vicious cycle of repeated renal injury and are the two leading causes of end stage renal failure in the United States. Oxidative stress is associated with both diabetes and hypertension in experimental animal models and in humans. Therefore, this section will focus on how oxygen radicals may play an important role in the pathophysiology of the renal microvasculature in diabetes mellitus and hypertension.

Table (6): Frequency and percentage of CRF patients regarding chronic diseases.

Group	Frequency	Percentage
CRF+Hypertension	11	36.66%
CRF+Diabetes	12	40.0%
CRF only	7	23.33%
Total	30	100.0%

The CRF patients were distributed according to residence of two regions: urban, rural. The study showed the there was a high difference between two regions. Among these regions Table (7), the higher percentage of incidence of CRF was in rural site (73.33 %) and in urban (26.66 %). The difference in the ratio may by due to the differences of food stuff types and their sources, the difference of education consciousness .The consumption of fruits and vegetable is associated with a lower risk of CRF **(**Berger *et al*., 2004).Or may be due to that the malnutrition is very common in rural patients and is generally of mixed type

with low body weight, loss of somatic protein (low muscle mass), low plasma levels of serum albumin and other visceral proteins as well as depletion of energy (adipose tissue) stores (Bergström, 2000) .

Fored *et al*., (2003), suggests that the low socio-economic status is associated with an increased risk of chronic renal failure, and the antioxidant minerals deficiencies are frequent in patients receiving chronic dialysis. Most of this antioxidant status of patients with acute or chronic renal failure had been shown to be depressed, as reflected by low plasma concentrations of ascorbate, ß-carotene, selenium and low antioxidant enzymes activity. Also Shankar *et al*., (2006) shows that the lower education was associated with prevalent of CRF.

Table (7): Frequency and percentage of CRF patients regarding area of residence.

Area of residence	Frequency	Percentage
Rural	22	73.33%
Urban	8	26.66%
Total	30	100.0%

Conclusions:

From the previous results, one can concluded that the lifestyle factors (age, gender, smoking, chronic disease and area of residence) had a greater role in an incidence of chronic renal failure, and also the hemodialysis process led to significant reduction in the level of urea and creatinine.

Results also inferred that patients with lower educational (rural) attainment have a higher risk of developing CRF, smoking also has been related to the progression of renal disease, on the other hand, the diabetes is the biggest risk factor for developing CRF; in addition, high blood pressure is the second most common cause of renal failure.

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تأثير بعض المتغيرات المستقلة المساهمة في احداث العجز الكلوي المزمن

الخلاصة

تضمنت الدراسة الحالية تأثير بعض العوامل المستقلة كأرتفاع ضغط الدم ومرض السكري عند مرضى العجزالكلوي المزمن المعالجين بالديلزة الدموية.أشارت الدراسة ايضا الى تاثير بعض العوامل (العمر، الجنس، التدخين، الأمراض المزمنة ومنطقة السكن) المشاركة في احداث العجزالكلوي المزمن، كما تم قياس مستوى اليوريا والكرياتنين التي تعد احدى فحوصات وظائف الكلية المهمة في مصل الدم هولاء المرضى قبل وبعد اجراء الديلزة الدموية .

أجريت هذه الدراسة على (٣٠) مصابا بالعجز الكلوي المزمن ومن كلا الجنسين ، قورنت مع (٥٠) نموذجاً من الدم لأشخاص أصحاء كمجموعة سيطرة. أثبتت الدراسة وجود زيادة معنوية في تركيزاليوريا والكرياتنين عند المرضى مقارنة مع مجموعة السيطرة، كما اشارت نتائج التحليل الأحصائي الى ان عملية الديلزة الدموية ادت الى حدوث انخفاض معنوي($P<0.05$) في تركيز كلا من اليوريا والكرياتنين. كما اشارت الدراسة الى ان لبعض العوامل المستقلة تأثير كبير في احداث العجز الكلوي المزمن.