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Assessment of Inflammation, Comorbidity and Demographic Factors in Patients with Kidney Disease in Baghdad

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Abstract

Inflammation markers are significantly higher among hemodialysis (HD) patients, which have been associated with chronic activation of the immune system. Hemodialysis centers in Baghdad appear to be taking measures with low adequacy and frequency of dialysis sessions, which can be a reason for decreased kidney functions. Therefore, the objective of this study focuses on the assessment of different aspects of hemodialysis for regular HD patients in Baghdad, including inflammatory markers (serum C-reactive protein, CRP, and erythrocyte sedimentation rate, ESR), dialysis dose, comorbidities, and demographic factors for a period of one year (2018), the assessment covered four major hospitals in Baghdad namely (Al-Kindi, Baghdad Educational, Al-Imamain Al-Jwadian, and Al-Yarmouk). The study involved 320 adult (chronic kidney disease; non hepatitis virus) patients (55% male and 45% female) treated with regular hemodialysis. When compared with the normal values specified by manufacturers for the number of measurement of these indicators. Inflammation markers were high in HD patients were 66.2% of patients recorded elevated of CRP and 87.7% for ESR with no significant difference between males and females, but the origin of chronic inflammation in the patient's remains unclear. Moreover, the majority of HD patients were non-educated; illustring that higher education is possibly associated with lower disease incidence as compared to those who never finished high school. Finally, most of these hospitals, average hemodialysis treatment lasts about three hours and is done two times per week.

Keywords: Dialysis, hemodialysis patients, inflammation marker, C-reactive protein, Erythrocyte sedimentation rate.

تقييم علامات الالتهابات والأمراض المصاحبة والعوامل الديموغرافية لمرضى الفشل الكلوي في بغداد

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الخلاصة

علامات الالتهاب تكون أعلى بكثير بين مرضى غسيل الكلى (HD)، والتي ترتبط مع التنشيط المزمن للجهاز المناعي. تتخذ مراكز غسيل الكلى في بغداد تدابير غير كافية وتكرار محدود لعدد جلسات غسيل الكلى، والتي يمكن أن تكون سببًا لانخفاض وظائف الكلى. لذلك، يركز الهدف من هذه الدراسة على تقييم

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جوانب مختلفة من غسيل الكلى في بغداد لمرضى HD ، بما في ذلك علامات الالتهاب ، جرعة غسيل الكلى، والأمراض المصاحبة، والعوامل الديموغرافية. تم تقييم الالتهاب عن طريق قياس البروتين التفاعلي في الدم (CRP) ومعدل ترسيب كرات الدم الحمراء ESR والاعتلال المشترك في أربعة مستشفيات رئيسية في بغداد لمدة عام واحد (2018) (الكندي، بغداد التعليمي، الإمامين الجوادين، ومستشفى اليرموك). تم اختيار البالغين (مرضى الفشل الكلوي المزمن من غير المصابين بفايروس التهاب الكبد) الذين يتعاملون مع غسيل الكلى بانتظام. عدد المرضى المشاركين 320 مريضاً (55٪ ذكور و 45٪ إناث). أظهرت النتائج، عند مقارنتها بالقيم الطبيعية المحددة من قبل الشركات المصنعة لعدد قياس هذه المؤشرات، إن أدلة الالتهابات كانت عالية في مرضى HD مع عدم وجود فرق كبير بين الذكور والإناث، حيث سجل 66.2٪ من المرضى ارتفاع في CRP، 87.7% من المرضى ارتفاع في ESR. على الرغم من ذلك، فإن أصل الالتهاب المزمن في مرضى غسيل الكلى لا يزال غير واضح. كذلك لوحظ عدم وجود فروق معنوية للعديد من الأعراض العامة لمرضى الغسيل HD. حيث كان 77% من مرضى HD يعانون من ارتفاع ضغط الدم باعتباره أكثر الأعراض شيوعًا. علاوة على ذلك، أن غالبية مرضى الغسيل الكلوي غير متعلمين مما يتضح أن التعليم العالي يرتبط بارتفاع معدل البقاء على قيد الحياة لدى مرضى الغسيل الكلوي مقارنة بأولئك الذين لم يكملوا الدراسة الثانوية. وأخيراً، فإن متوسط علاج غسيل الكلى حوالي ثلاث ساعات ويتم خلال مرتين في الأسبوع في معظم هذه المستشفيات.

Introduction

Hemodialysis (HD) is a method of removing accumulated solute from a patient who has a loss of kidney function, the general principle of dialysis is an exchange between the blood and a dialysis fluid via a thin semipermeable membrane as the primary component of the dialyzer [1]. Kidney disease is a major health problem all over the world were considered 12th most prevalent cause of death with representing 1.1 million deaths worldwide in one year [2].

Inflammation markers consider biological indicator in HD patients where most dialysis research noticed elevated of C-reactive protein CRP and erythrocyte sedimentation rate ESR level in patient before dialysis sessions [3]. The traditional dialysis regimen consists of 3 to 4 hours of treatment session for three times a week, which was reported to be associated with decreased levels of inflammation markers [4].

The nature of the association between inflammation and HD can be bidirectional; the inflammation can be both a cause and a consequence in HD patients [5].

Inflammation markers are a reliable, early indicator of active systemic inflammation, as they can help differentiate inflammatory from noninflammatory conditions and also reflect the severity of the inflammatory insult [6]. Starting with the assumption that kidney disease in these patients is characterized by increased procoagulant, an inflammatory marker, coagulation hormone, cardiovascular morbidity and mortality [7].

In Iraq, there are 36 dialysis centers distributed in all the 18 provinces [8]. In Baghdad alone, there are approximately 320 ±61 patients who are regularly registered in those dialysis centers. Each center includes an average of 37 ±8 hemodialysis machines, and the total production capacity for each center varies between 1.5–4.5 m^3/d depending on their daily operating hours, which ranges from 18 to 24 hours. Water treatment units in those centers work in a uniform manner; i.e. using Reverse Osmosis (RO) units that are usually used for municipal water desalination [9]. These units have the same basic components, but the key differences are the quality of the filters and the number of membranes inside each unit.

The purpose of this study was to assess inflammation, comorbidity and demographic variables in Baghdad patients with kidney disease on regular hemodialysis.

Materials and Methods

Work Strategy

This study was carried out from January 2018 to December 2018 with voluntary participation of 320 HD patients' (with no hepatitis virus infection) on regular hemodialysis in four hemodialysis centers in Baghdad-Iraq, namely; Al-Kindi, Baghdad Educational, Al-Imamain Al-Jwadian, and Al-Yarmouk hospitals.

Ethical Considerations

This research was approved by the local ethics committee of the Ministry of Health and Environment. Written permissions were taken from relevant authorities based on a description of the study and its aims, and a signed agreement was made to treat all the individual clinical information as confidential.

Clinical Information

Clinical information was surveyed for each patient, including age, gender, weight, blood pressure (BP) (it was measured with the help of a sphygmomanometer), fever, frequency and duration of HD sessions per week, medical history, smoking habit, and patients' educational level. In addition, comorbidity symptoms such as abdominal pain, bleeding, diabetes, diarrhea, hypertension, nausea, rash, and vomiting were monitored and recorded during the dialysis sessions of the patients. These data were collected using a questionnaire and were verified with the information of the patients' medical records.

Blood tests

Blood samples were collected from the venous port of the hemodialysis catheter before adding heparin to the entire blood of regular HD patients. The first 5 IU/ml of blood were discarded to avoid activation of coagulation due to the puncture trauma [10] while the second 5 IU/ml were collected and divided into two parts for the following tests:

1. C-reactive protein (CRP): measured by (CRP kit, Humen/ Germany) after separation of serum from blood samples.
2. Erythrocyte sedimentation rate (ESR): blood samples were transferred into tubes with EDTA and used for ESR test according to Biosigma, Italy.

Statistical Analysis

Statistical analysis was performed using analysis of variance (ANOVA) test to compare different factors of the studied parameters. Independent sample t-test was utilized to evaluate the significant difference between any two independent groups. P-value level of 0.05 was considered for the significant differences between the compared groups. All the statistical analyses were implemented using Excel application 2010 and the evaluated data were expressed as Mean ± SD and percentage (%) [11].

Results and Discussion

Patient's Characteristics

As indicated in Table-1 for patient's characteristics, there was in general no significant difference between males and females in the obtained basic health information, except for the age and weight ($P<0.05$). The results show that HD patients comprise 178 ±5.8 males and 152 ±5.8 females, with an age of 53 ±13 for males and 49 ±16) for females. Similar results, i.e. higher number of males with higher age values, were reported in HD patients from several studies in other parts in the world, such as USA [10] and Greece [12].

Furthermore, the results of HD patients' weight showed that the weight ranges from 37 to 135 kg (76 ±16.9) for males, and from 35 to 120 kg (66 ±16.6) for females. Most of the patients showed normal or even lower weight, which might be due to the hospitalization of HD patients which was reported to have a negative nutritional impact [13].

In respect to the HD patients' body temperature, there was a slight difference as compared to normal body temperature, however, the differences were not significant. Patients' body temperature showed similar characteristics for both genders and ranged from 36-38 °C (37 ±0.6). Nevertheless, low body temperatures for patients with hemodialysis are not uncommon [14].

In addition, the high blood pressure level during the tradialytic period in the patients was found to range from 90-198 mm Hg (150 ±20) for males and 90-195 mm Hg (145 ±21) for females. The low blood pressure level in tradialytic period ranged from 54-130 mm Hg (85 ±13) for males and 54-119 mm Hg (84 ±12) for females. The results came in agreement with those reported for a patient's population in the United States [12].

Moreover, the present study showed a small percentage of cigarette smoking HD patients (only 4% of the male and no smoking females). This is a small percentage when compared to another study conducted in USA where the percentage of cigarette smoking was estimated between 14 and 15 % in HD patients [15].

Finally, as related to the level of education, the results showed that only 18% (58 ±2) of the HD patients, mostly males, had an education level of high school or higher, while the majority of the patients were non-educated. The study of Khattak *et. al* [10] showed that college education is associated with higher survival rate in dialysis patients compared to those who never finished high school. They founded that the 33.5% of the patients with less than 12 years of education, 34.9% high school graduates, 16.7% with some college education, and 14.9% with a college education and higher education levels.

Table 1-General patients' characteristics and their comparison according to gender.

Variables and categories	Value of males	Value for females	Significant difference at 0.05
Gender No. of Patients ±SD (Percentage)	178 ±5.8 (55.62%)	142 ±5.8 (44.37%)	-
Age (mean ±SD)	(53±13)	(49 ±16)	*
Weight range in kg (mean ±SD)	37-135 (76±16.9)	35-120 (66 ±16.6)	*
Temperature ºC range (mean ±SD)	36-38 (37 ±0.6)	36-38 (37 ±0.6)	(NS)
High blood pressure mm Hg range (mean ±SD)	90-198 (150 ±20)	90-195 (145 ±21)	(NS)
Low blood pressure mm Hg range (mean ±SD)	54-130 (85 ±13)	54-112 (84 ±12)	(NS)
Current smoking % (number ±SD)	4% (12 ±0.9)	0% (0 ± 0)	-
Education level (High school+)	10% 32	8% 26	(NS)

* (P<5%), NS: Non-Significant.

Patients Symptoms

Table- 2 summarizes the symptoms of the 320 HD patients. In general, there were no observed significant differences between patients' symptoms among studied hospitals at P<0.05. The results showed that the most common basic symptom among the HD patients was hypertension, which was recorded in 77% of the patients (245±1.95). Similarly, a previous study conducted by Chavers and colleagues in the USA showed hypertension in more than 79% of the studied HD patients [16].

The second most common symptom in the patients was diabetes, which was present in 39% of the patients (125 ±2.6), which, importantly, can be probably due to a loss of glucose in the dialysate [17]. However, the observed diabetes incidence in the present study was less than the percentage recorded in a previous study which showed that 50.5% HD patients had diabetes [10].

Other symptoms included abdominal pain, which was recorded in 33% (105 ±3) of the HD patients. Clinically, the administration of several drugs was related to abdominal pain in HD patients [18].

In addition, 13% of HD patients (43 ±1.6) showed diarrhea symptoms and, therefore, they could also have an increased risk of antibiotics associated with diarrhea [19]. Total bleeding events in HD patients in our sampling centers were only 4% (12 ±1). Bleeding was also less than that reported by Galbusera *el al*. study [20].

Also, the results showed that the incidence of nausea and vomiting during hemodialysis were 21% (67 ±2.8) and 24% (76 ±2.8), respectively. Vomiting percentage is very high when compared to a study conducted by Asgari and colleagues [21] in Tehran, which showed that percentages of patients with nausea and vomiting during hemodialysis were 28.3% and 11.7%, respectively.

Finally, the results showed that 7% of HD patients suffered from rash (23 ±1.6), which is probably due to the presence of wastes in the bloodstream that the dialyzer membranes could not remove from the blood [22].

Table 2-General patients' symptoms and their comparison among the hospitals studies

Symptoms	Number ±SD of patients	Percentage of patients	Significant difference at 0.05
Hypertension	245 ±1.95	77%	(NS)
Abdominal pain	105 ±2.98	33%	(NS)
Diabetes	125 ±2.6	39%	(NS)
Diarrhea	43 ±1.6	13%	(NS)
Bleeding	12 ±1	4%	(NS)
Nausea	67 ±2.8	21%	(NS)
Vomiting	76 ±2.8	24%	(NS)
Rash	23 ±1.6	7%	(NS)

NS: Non-Significant.

C – Reactive Protein (CRP)

The results of CRP concentration in hemodialysis patients are show in Table- 3. The number of patients who had a CRP concentration below a detection level of ≤6 mg/l was 59 ±7.07 (33%) male and 49 ±7.07 (34.5%) female patients. The maximum positive concentration of CRP (≥48 mg/l) was 74 ±8.5 (41.5%) in male and 62 ±8.5 (43.6%) in female patients. Statistical analysis showed no significant differences between male and female groups.

The advantages of CRP test are the lower cost and availability, particularly in developing countries [23]. Serum CRP concentration does not change with the changes in kidney function, but in the early stage of kidney disease, serum CRP may be associated with serum albumin levels that are affected by the inflammatory response [24].

Erythrocyte Sedimentation Rate (ESR)

The results of ESR concentration in hemodialysis patients are shown in Table-3. The ESR value for the investigated HD males was found to be 91% (71±37) and this value was slightly higher than that in females which was 85% (65±34). Statistical analysis showed no significant difference between male and female groups, and there was no significant difference between ESR and CRP at $P<0.05$. In addition, a strongly positive correlation coefficient (0.99) was found between ESR and CRP.

There are very few reports in the medical literature on the usual range and clinical importance of ESR measurement in the HD patients. This is probably because the sedimentation of red cells is greatly influenced as a result of changes in plasma volume caused by the dialysis machines [25]. However, the elevated value of ESR in hemodialysis blood was 87.7% while Alsomaili *et.al* recorded 79.5% on patients with chronic kidney disease [26].

Table 3-Inflammation markers (CRP and ESR) for hemodialysis patients and their comparison according to gender

C –Reactive protein mg/l	**Value for Males Number ± SD (%)**	**Value for Females Number ±SD (%)**	**Significant difference at 0.05**
< 6 negative	59 ±7.07 (33.1%)	49 ±7.07 (34.5%)	
≥ 6 positive	13 ±4.24 (7.3%)	7± 4.24(4.9%)	
≥12 positive	15 ±5.56 (8.4%)	7± 5.65(5.9%)	(NS)
≥24 positive	17 ±0 (9.5%)	17 ±0 (11.9%)	
≥48 positive	74 ±8.5 (41.5%)	62 ±8.5 (43.6%)	
Normal valueESR mm/hr	**Value for Males (0-22) mm/hr**	**Value for Females (0-29) mm/hr**	**Significant difference at 0.05**
Mean ± SD	71±37	65±34	
Number (negative %)	16 (8.9%)	22 (15.5%)	(NS)
Number (positive %)	162 (91%)	120 (84.5%)	
Coefficient correlation between CRP and ESR			**Significant difference at 0.05**
0.99			(NS)

NS: Non-Significant; SD: Standard Deviation.

Frequency and Duration Time of Dialysis Sessions

In the present study, the mean duration of hemodialysis in patients on hemodialysis was calculated to be 17.25 months (Table- 4). In Baghdad Educational Center, the majority of the HD patients (94%) usually take only two sessions per a week for 3 hours. Similar trend was found in Al-Imamain Al-Jwadian center, where 60% of the patients take two sessions per a week. In Al-Kindi center, almost half the patients (49%) take 3 sessions per week, while Al-Yarmouk Center serves 70% of the patients with 3 sessions per week for 2-3 hours per session.

Thus, the problem with increasing dialysis session time and/or frequency is generally not possible to be solved in the current situation due to the limited number of machines and dialysis centers needed to treat the increasing number of patients [8]. Also, dialysis scheduling is a procedure that some hospitals use to reduce the session's period due to lack of resources.

Table 4-Comparison of both frequency and duration time of dialysis sessions among studied hospitals

Dialysis	**Al-Kindi**	**Sig. diff. at 0.05**	**Baghdad Educational**	**Sig. diff. at 0.05**
Onset of dialysis in months - median (range)	12 (1-48)	(NS)	5 (1-48)	(NS)
One times of dialysis sessions in week	3%		3%	
Two times of dialysis sessions in week	48%	(NS)	94%	(NS)
Three times of dialysis sessions in week	49%		3%	

Length of dialysis sessions in hours	3 (3)	*	3 (3-3.30)	*
Dialysis	**Al-Imamain Al-Jwadian**	**Sig. diff. at 0.05**	**Al-Yarmouk**	**Sig. diff. at 0.05**
Onset of dialysis in months median (range)	19 (1-120)	*	33 (1-132)	(NS)
One times of dialysis sessions in week	0%		14%	
Two times of dialysis sessions in week	60%	*	16%	(NS)
Three times of dialysis sessions in week	40%		70%	
Length of dialysis sessions in hours	3 (3-3.30)	*	3 (2-3)	(NS)

* ($P<0.05$), NS: Non-Significant.

Conclusions

It is concluded that the levels of the inflammation markers (CRP and ESR) in the HD patients of dialysis units in Baghdad hospitals are high. The present data showed that the inflammation markers can be used as bioindicators in these pientes.

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