BioChemMed

Technium BioChemMed Vol. 2, Issue 1 pp.32-40 (2021)
ISSN: 2734-7990
www.techniumscience.com

Hematological parameter of the blood count in patients undergoing hemodialysis therapy

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Abstract

Anemia is a common complication of chronic kidney disease (CKD) and is associated with a decline in patients' quality of life, a rise in morbidity and mortality, and acceleration in CKD progression. The objective of investigating some hematological parameters like Hb, MCH, WBC , monocyte, lymphocyte, neutrocyte and platelet and other parameters as HCV in the blood of CKD patients on hemodialysis pre-dialysis. Sample of 50 (54% male and 46% female) cases which consist of the patient with CKD in Baghdad Educational Hospital, their mean ages were 55±16.3 years with ranged from 16-76. Furthermore, maintenance hemodialysis therapy not less than three months. Evidently, 40 healthy subjects were selected as (control) for comparison. The data were retrieved from the laboratory information system in hospital, and the t-test independent was used for statistical analysis. All patients suffered anemia in HD patients. Most of the patients' WBCs and platelet count were normal. Anti-HCV infection was positive in 15 (30%) of these patients with non-significant differences in both genders. According to the results of this study, there were weak correlations between MCH, WBC count, lymphocyte, monocyte, enterocyte, platelet count, HCV with Hb in CKD patients on regular hemodialysis therapy, while RBC showed a strong correlation coefficient with Hb for blood samples collected.

Key words: Anemia; Chronic kidney disease; Hemodialysis; Hepatitis

1. Introduction

Chronic kidney disease (CKD) is a form of kidney disease that causes a gradual loss of kidney function over time [1]. CKD affects 5-10% of the world's population and it impacts on health-related quality of life and imposes a high economic burden [2].

Kidney disease is the 12th most prevalent cause of death, representing 1.1 million deaths worldwide per year [3]. In Iraq without the Kurdistan region, kidney disease is the fourth among the top ten causes of death (5.3 %), with 6.01% for males and 6.4% for females [4].

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Anemia is a predictable result of chronic renal insufficiency and occurs typically well before the end-stage renal disease (ESRD) and underlies other symptoms associated with decreased kidney function, including fatigue, depression, diminished exercise tolerance, and dyspnea [5]. Anemia is also associated with increased morbidity and mortality due to cardiovascular disease, and increased risk of hospitalization and length of stay [6].

Anemia is almost common in end-stage renal disease (ESRD) which is the last stage (stage five) of CKD and based on the WHO definition, approximately 90% of glomerular filtration (GFR) patient's < 25–30 mL/min will have anemia and many patients with Hb rates below 10 g/dL will have anemia [7]. In those patients, there is a primary deficiency of erythropoietin production leading to anemia. It was reported, however, that erythropoietin deficiency is not the only cause of renal anemia and that hematological parameters are one of the causes involved in the pathophysiology of this form of anemia, especially in patients with renal failure and dialysis at the end stage [8].

Hepatitis viruses' infection is a major cause of morbidity and mortality in hemodialysis (HD) patients [9]. In developing countries, the prevalence of anti-HCV seropositivity among HD maintenance patients varies from 5% to 60%. HD patients are at high risk for HCV, with an infection rate many times greater than that of non-uremic patients [10].

This study was carried out to observe some of the hematological parameters as contribute to anemia in patients suffering from chronic kidney disease.

2.1 Patients and Methods

This was a cross-sectional study carried out at the dialysis unit of Baghdad Educational Hospital, with voluntary participation of 50 (27 males; 23 females) HD patients, it is providing an average of 2 dialysis sessions per week for each patient compared to control group (40 people non-hepatitis virus and without CKD). Inclusion criteria include maintenance HD patients older than 17 years and duration of hemodialysis for more than three months.

2.2 Ethical Considerations

This study was approved by the Ethics and Scientific Committee of the Ministry of Health and Environment, Iraq. Written permissions were obtained from the competent authorities on the basis of a description of the study and its objectives, and a signed agreement was reached to treat all individual clinical information as confidential.

2.3 Blood Collection

Blood samples were collected from the venous port of the hemodialysis catheter before heparin was added to the blood of regular HD patients. The first 5 IU /ml of blood were discarded to prevent the activation of coagulation due to puncture trauma [11], while the second 5 IU/ml were collected and divided into two parts for the following tests:

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1. Hematology tests: blood samples were transferred into tubes with EDTA and used for following parameters by hematology analyze (China): red blood cell count (RBC), Hb concentration, red blood indices – mean corpuscular hemoglobin (MCH), white blood cell count (WBC), WBC differential (lymphocyte, monocyte, neutrocyte), and platelet count.
2. Rapid Hepatitis C virus test: measured by (SD BIOLINE/ India) after separation of serum from blood samples.

2.5 Statistical Analysis

The statistical research was carried out using the independent sample t-test was used to evaluate the significant difference between the two independent groups. The P-value level of 0.05 was considered to be significant differences between the groups compared. All statistical analyzes have been carried out using Excel [12].

3. Results and Discussion

3.1 Hematology Parameters

Results of the current study revealed significant differences in blood hemoglobin level, MCH, WBC count, monocyte, lymphocyte and platelet count in patients with CKD on HD therapy compared to healthy control at $P<0.05$, Table 1. In addition, there were no significant differences between males and females in CKD patients undergoing HD therapy.

The results show that HD patients comprise 27 males and 23 females, with an age of 58 ±13.9 for males and 50 ±17.7 for females. Similar results, i.e. a higher number of males with higher age values were reported in HD patients from several studies in Iraq [13, 14].

With respect to RBCs in HD patients, the majority of patients (96%) (3.06±0.67 10^{6}µL) were lower than in the healthy control group (4.7±0.68 10^{6}µL). RBCs of patients showed small differences in 3.2±0.56 10^6µL for males and 2.98 ±0.77 10^{6}µL for females in both sexes. In previous a previous study most of the findings showed that low RBCs are common in patients with hemodialysis [9].

Results also appeared all HD patients with Hb levels had anemia (9.05±1.40 g/dL) compared to (13.7±2.7g/dL) in healthy control group. Hb levels in males (9.2±1.34 g/dL) were found to be slightly higher than the females' dialysis (8.4±1.44 g/dL). Whereas local standard references are (12 g/dL).

Moreover, the present study showed hemoglobin was a difference as compared to normal value, which might be due to the kidney are not making enough of a hormone called erythropoietin that can help the body to make red blood cells [8]. In addition, there were differences that dominated both males and females. Low levels of Hb in females may be due to menstruation every month. In addition for males, the dominant sex hormone is testosterone, and in females, sex hormones are primarily estrogen.

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Testosterone can increase the rate of metabolism, thereby increasing the rate of Hb formation [15].

Furthermore, the results of HD patients' mean corpuscular hemoglobin showed that healthy control and hemodialysis patients tend to have normal MCH counts of 27.8±4.0 pg and 29.6±2.5 pg respectively (29.7±2.76 pg males and 29.0±2.2 pg females) relative to the local reference standard (27-33 pg).

In light of the MCH results study, it can be concluded that normal value in patients during the HD process due to the administration of several drugs that makes mean capsular hemoglobin normal in HD patients [16]. Also, in a previous study done in Chittagong HD patients, Chowdhury *et al*. showed that MCH was 28.79±3.77 pg [17].

Furthermore, the results of HD patients with WBC tend to have decreased by 5.3±2.31 10^^{3}µL (4.4±2.25 10^^{3}µL for males and 5±2.35 10^^{3}µL for females) relative to 9.3±2.17 10^^{3}µL for healthy control. There were 11 (22%) patients with low WBCs, 34 (68%) patients with normal range, and 4 (8%) patients with high WBCs compare to the local standard reference 4-10 10^^{3}µL. Previous research in agreement with Kahdina *et al* [15], which found that most patients had normal or even lower WBC. In addition, HD patients continue to vary the body's defenses WBC differential count, which can be inflammatory [15].

Moreover, the majority of patients (68%) of the lymphocyte value (20.6±8.31% for males and 23.7±9.61% for females) were within normal range, based on local control percentage (20- 40 %). Also, the results show that there is a decrease in monocyte in 44% of HD patients than local standard reference count (2-8 %). HD patients have a monocyte value of 8.15±3.42 % (8.6±3.66% for males and 7.7 ±3.05% for females) which was higher than 6.03±1.7% in healthy controls. In addition, the results showed that (34 %) of patients had a neutrocyte value (68±21.62 % for males and 68.6±11.17 % for females) above the normal local standard percentage range (40%-60%) in HD people. And there were slight differences in HD patients and healthy controls group.

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Finally, in HD patients platelet count tends to be reduced in the mean 176.5±66.5 10^^{3}µL, with (166±2710^^{3}µL of males and 187±70.6710^^{3}µL of females) compared with 342±66.9 10^^{3}µL in healthy controls. There were 34% below the local standard reference count (150-4010^^{3}µL).

In previous study, platelet findings were a small percentage compared to another study in which the number of platelets in HD patients was reported to be 50% [18].

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3.2 Hepatitis C virus in hemodialysis patients

Table 2 shows the results of hepatitis C virus in CKD patients on hemodialysis therapy in Baghdad Educational hospital. In general, there were no observed significant differences between both sexes at ($P < 0.05$).

According to Table 2, in a previous study in the same hospital, the anti-HCV was positive for 12 (7.1%); five (4.9%) were male and seven (10.4%) were female HD patients [9]. Whereas, similar results i.e. the prevalence of HCV infection were reported with HD patients in Saudi [19]. In addition, these results are in agreement with the results of Sinjari *et al* [20] who showed the same prevalence of HCV in both male and female hemodialysis patients. In general, hemodialysis patients are more vulnerable to such diseases than the general population, which could be returned to blood transfusion is an important factor in the transmission of HCV infection in HD patients, needle sticks, and dialysis workers (if appropriate precautions are not followed) [21].

3.3 Correlation of Hematology Parameters between Non-Hepatitis and Hepatitis in Blood of HD Patients

Results of the current study show significant differences between kidney failure anemia and some inflammation, namely RBC, MCH, WBC, lymphocyte, neutrocyte, and platelets in patients on regular HD therapy. The correlation coefficient was strong only in RBCs, while HCV infection showed a no correlation coefficient for blood samples collected from HD patients at ($P<0.05$), Table 3.

In a previous study by Al-Khayat *et al.* (2016) found that anemia for kidney failure was closely associated with hematological parameter (WBC count and granulocyte) [8]. While Fouad *et al.* (2015) found in Egypt research in hemodialysis patients with hepatitis C infection appears to have higher hemoglobin [22]. Therefore, further studies with larger sample sizes are recommended to investigate other hematological parameter and their role in renal anemia.

4.Conclusion

Anemia is a leading cause of morbidity in CKD patients and worsens as the disease progresses. Hemoglobin parameter was found to be weakly correlated with MCH, WBC count, WBC differential, platelet count, and HCV infection, while RBC showed a strong correlation coefficient with Hb.

Acknowledgements

Authors would like to thanks the staff of central labs and dialysis centers for their continuous support during the study. The authors have declared that no conflicts of interest in this work.

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Technium BioChemMed Vol. 2, Issue 1 pp.32-40 (2021)
ISSN: 2734-7990
www.techniumscience.com

Table 1. Clinical and demographic characteristics in HD patients and control group

Parameters	Mean±SD		P value <0.05	Mean±SD		P value <0.05
	Control Group (n=40)	All HD patients (n=50)		Male HD patients (n=27)	Female HD patients (n=23)	
Age years	53±13.9	55±16.3	NS	58±13.9	50±17.7	NS
RBCs 10^{6}µL	4.7±0.68	3.06±0.67	Yes	3.2±0.56	3.7±0.59	NS
MCH pg	27.8±4.0	29.6±2.5	Yes	29.7±2.76	29.0±2.2	NS
HB g/dL	13.7±2.7	9.05±1.40	Yes	9.2±1.34	8.4±1.44	NS
WBCs 10^{3}µL	9.3±2.17	5.3±2.31	Yes	4.4±2.25	5±2.35	NS
Lymphocyte %	28.3±9.9	21.9±8.84	Yes	20.6±8.31	23.7±9.61	NS
Monocyte %	6.03±1.7	8.15±3.42	Yes	8.6±3.66	7.7±3.05	NS
Neutrocytes %	68±21.62	68.15±17.83	NS	68±21.62	68.6±11.17	NS
Platelets 10^{3}µL	342±66.9	176.5±66.5	Yes	166±62.27	187±70.67	NS

NS, non-significant; Yes, significant.

Table 2. Hepatitis C virus measures for hemodialysis patients

Parameters	All patients (n=50)	Male patients (n=27)	Female patients (n=23)
	Number (%)	Number (%)	Number (%)
Non Hepatitis C virus	35 (70%)	20 (74 %)	15 (65.2%)
Hepatitis C virus	15 (30%)	8 (29.7%)	7 (30.1%)

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ISSN: 2734-7990
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Table 3. Correlation of hemoglobin level with some hematology parameters in blood of HD patients

Parameters	Hemodialysis Patients		Control Group	
	Correlation Coefficient-r	Level of Significant	Correlation Coefficient-r	Level of Significant
Hb vs. RBC	0.82	Yes	0.56	Yes
Hb vs. MCH	-0.10	Yes	0.16	Yes
Hb vs. WBC count	0.20	Yes	0.11	Yes
Hb vs. Lymphocyte	0.03	Yes	-0.16	Yes
Hb vs. Monocyte	0.22	NS	-0.44	Yes
Hb vs. Neutrocyte	0.07	Yes	0.19	Yes
Hb vs. Platelets	-0.20	Yes	-0.20	Yes
Hb vs. in non-hepatitis and hepatitis of HD patients	-0.12	NS	-	-
P<0.05				

NS, non-significant; Yes, significant.