Association of Creatine Level and Hematological Parameters among Kidney Patients at Rwamagana Provincial Hoapital

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Abstract

Kidney disease is characterized by the presence of renal damage and/or decreased renal function. It is categorized as acute kidney injury or chronic kidney disease (CKD) based on disease duration and progressiveness. Staging of CKD is based on glomerular filtration rate and albuminuria. This study was carried out at Rwamagana provincial hospital in a span of 3 months from September to November 2019. The main objective was to assess the hematological parameters among patients with kidney diseases attending the hospital. Forty-eight participants were recruited based on inclusion criteria. Blood samples were collected to perform full blood count. Hematological parameters were measured using Sysmex XS 500i. Data analysis was carried out using statistical package for social science (SPSS). The results showed that males were highly affected (70.8%) by kidney diseases in comparison to females (29.2%). Anemia, thrombocytopenia and leukopenia were the commonest associated complication to kidney diseases. The overall association with creatinine levels and hematological parameters was statistically significant (x^2 = 49.67, P < 0.00001). The effect of creatinine to hematological parameters at the level of creatinine (< 53 μmol/l) was statistically significant (x^2 = 42.18, P = < 0.00001). All hematological parameters were partially affected by creatinine levels. Thus, people at high risk for kidney diseases should be screened as it is asymptomatic in early stage.

Keywords: White blood cell, Hemoglobin, Kidney disease, Hematological parameters, Rwamagana provincial hospital

1. Introduction

Kidney disease is an umbrella term for various disorders that affect the anatomy and function of the kidney [1]. It is regarded as worldwide health issue whose management should begin in its early stages [2]. It was found to be associated with haemopoietic changes [3]. It can also be detected with simple laboratory tests [4]. In Rwanda, CKD was reported to be ranged from 4 to 24% based predominantly on proteinuria as a marker [5]. As reported by Levey et al. [4], the benefits of kidney disease treatment may include delaying its complications, minimizing the risks of cardiovascular diseases, and slowing down its progression. It has greater burden and very high cost of care, especially in developing countries like Rwanda.

Hematological parameters are commonly affected in kidney diseases. Of all the parameters, red cell indices are the ones commonly and severely affected. This is because with kidney disease, there is inadequate production of erythropoietin (EPO) [6]. Iron deficiency prevalence in CKD is around 49-55%, and together with the comparative EPO deficiency, they represent the two main causes of anemia in CKD [7]. The alterations in red cell indices are attributed to numerous factors besides erythropoietin production.

Studies from Sub-Saharan Africa countries highlighted that the majority of kidney failure could presumably be ascribed to infections and hypertension. Malaria, Streptococcus, and tuberculosis are arguably among the important infectious causes [8]. Most patients with chronic kidney disease become anemic due to failure to erythropoietin secretion. Therefore, they should be periodically checked for anemia by measuring the serum hemoglobin level [9]. The assessment of the hematological changes in kidney disease patients attending Rwamagana provincial hospital in Rwanda is thus necessary. Habib et al. [10] reported that hematological and biochemical parameters are mostly and frequently affected in CKD. This becomes more prominent as the disease advances which further complicates the condition of the patient.

Limited data are available on hematological parameters of patients with kidney diseases in Rwanda. Hematological and biochemical parameters in patients with chronic kidney disease were studied by Domina and Niyonzima [11] at Kigali university teaching hospital. Available data has put much emphasize on anemia, but there are other affected hematological parameters including leucocytes and platelets counts. Therefore, it is of great importance to assess the hematological parameters among patients with CKD in other regions of Rwanda. In the present study, the hematological parameters among patients with kidney diseases attending Rwamagana provincial hospital were assessed.

2. Materials and Methods

2.1 Study area and design

This present study was carried out in medical laboratory of Rwamagana provincial hospital located in Rwamagana district, East province of Rwanda. The hospital accepts samples from different health centers and hospital including Gahengeri, Munini, Karenge, Rubona, Ruhunda, Avega, Muyumbu, Nzige, Nyakaliro, and Rwamagana health center and Kiziguro hospitals. It was a cross-sectional study that was conducted in 3 months, from September to November 2019. It involved patients already diagnosed with kidney diseases.

2.2 Inclusion and exclusion criteria

Participants included in this study were in and outpatients known to have kidney disease admitted in medical laboratory of the hospital. This study excluded pregnant and lactating women, patients who were suffering from any disease other than kidney disease that will affect their hematological parameters such as hematological malignancy, inherited or acquired blood disease, acute or chronic inflammation, dehydration or recent hemorrhagic episodes. The patients awaiting for renal transplantation were also excluded as a result of recent hemodialysis that could affect the results.

2.3 Ethical consideration

Protocol for this study was approved by both INES and hospital research committees prior to being done. The principal of confidentiality and respect of patient privacy were the rules as the research was carried out in health sector. Laboratory

numbers were used as unique identifiers corresponding to the visit numbers of the hospital information system.

2.4 Data collection and processing

Data were collected using questionnaire that assisted in knowing the status information (sex, age, previous kidney disease history) and inclusion and exclusion criteria for the patients. Random sampling method was used to select study participants. For samples collection, the anatomical area of choice was cleaned with alcohol and allowed to air dry completely. Needle was inserted into the vein visible using the tourniquet. 4 ml of blood was drawn into EDTA tube and shaken well. It was labeled with patients track net and then transported to the testing area of hematology service. The full blood count was performed using Sysmex XS 500i. It utilizes electrical impedance, flow cytometry and fluorescent flow cytometry techniques. RBCs, PLT and WBCs were identified from the performed full blood count. The descriptive statistic (chi square, measure of frequency) and tables were used for data presentation. Data were analyzed with SPSS version 22 software. The significance level was considered when p value was < 0.05.

3. Results

3.1 Social characteristics of the study population

The hematological parameters among patients with kidney diseases attending Rwamagana provincial hospital were investigated. In the present study, compared to females, males were highly affected by kidney diseases. The patients in the age range of [41-60] years were more affected. They were followed by [20-40] years range (Table 1)

Table 1: Social characteristics of study population. n = 48

Age group	Sex	
	Male	Female
<20	4 (8.3%)	1 (2.1%)
[20-40]	11 (22.9%)	6 (12.5%)
[41-60]	15 (31.2%)	5 (10.5%)
>60	4 (8.3%)	2(4.2%)
Total	34	14

3.2 Hematological parameters of the study participants

Table 2 shows hematological parameters in kidney disease patients by gender. Indeed, red blood cells, platelets and white blood cells were highly reduced in males compared to females.

Table 2: Hematological parameters in kidney disease patients by gender. RBCs are red blood cells, PLT is platelet and WBCs are white blood cells

	Male		Female	
	Below normal range	Above normal range	Below normal range	Above normal range
RBCs	20	1	8	0
Hb	20	1	8	0
PLT	10	1	6	4
WBCs	11	1	3	1

3.3 Association of creatinine and hematological parameters

The association with creatinine and hematological parameters among the study participants with kidney diseases was determined. The overall association with creatinine and hematological parameters was statistically significant ($x^2 = 49.67$, P < 0.00001). There was statistical significance association ($x2=42.18$, P = < 0.00001) with creatinine level (< 53 µ mol/l) and all hematological parameters. Creatinine level at creatinine >120 µ mol/l was not statistically significant ($x^2 = 7.49$, P = 0.379701). All hematological parameters were partially affected by creatinine levels (Table 3).

Table 3: Association of creatinine and hematological parameters. RBCs is red blood cells, PLT is platelet and WBCs is white blood cells

	Red blood cells		Haemoglobin		Platelets		White Blood Cells		Total	x^2	P
	< 4.5$10^6$ cells/µl	≥ 6$10^6$ cells/µl	13.5 g/dl	17.5 g/dl	< 150 cells/µl	≥ 450 cell/µl	< 4500 cells/µl	> 11000 cells/µl			
Creatinine < 53 µmol/l	0(3.53)	1(0.25)	0(3.53)	1(0.25)	1(2.14)	5(0.75)	1(1.8)	4(0.63)	13	42.18	<0.00001
Creatinine >120 µmol/l	28(24)	1(1.7)	28(24)	1((1.7)	16((14.8)	1(5)	14(13)	1(4)	90	7.49	0.379701
Total	28	2	28	2	17	6	15	5	103	49.67	<0.00001
Chi Square (x^2)	16.06		16.06		13.7969		10.7556				
P value (P)	<0.00001		<0.00001		0.000204		0.00104				

4. Discussion

The slow progression and loss of kidney function are both characteristics of kidney diseases that occur over time. Kidney diseases are associated with different risk factors that contribute to its increase in addition to natural aging of kidney [12]. Males were highly affected by kidney diseases compared to females. Similarly, males were high (75%) than females (25%) in a study carried out by Habib et al. [10] at HAHC hospital in New Delhi (India). The majority of patients that were affected was in the [41-60] age range. Habib et al. [10] also reported the maximum number of patients were in the age group of 41-60, followed by 21-40 age group. The results of the current study are consistent with a study conducted by Asif et al. [13] that revealed that the difference in affected age group might be due to kidney function which tend to be lost by 1% every year after the age of 40 as people grow older, and also because kidney diseases can develop at any age. Anemia that parallels the degree of kidney dysfunction can be developed as soon as kidney function is starting to be lost. Gender difference might be due to metabolic adaptation, high alcohol intake, and smoking of males compared to females. Indeed, the mostly affected group were both young and old, who are at the productive age in the society.

The greatest importance of hematological parameters is demonstrated by their ability to provide information on the balance between production and destruction of blood cells in the circulatory system [14]. Hematological parameters were highly reduced in males than females (Table 2). Similarly, anemia and thrombocytopenia were statistically high in acute kidney injury and CKD patients in a study conducted by Dorgalaleh et al. [15]. Inadequate production of EPO by the kidneys is found to be the main cause of anemia in patients with CKD [10]. Due to the fact that participants might have some degree of CKD, hematological parameters are affected corresponding to the severity of CKD. This study also agrees to the one done by Iseki [16] that showed that white blood cells (WBCs) and platelet (PLT) tend to decrease as people grow old and on the basis of gender. Indeed, old people tend to develop drinking habit instead of eating a healthier food. For this reason, bone marrow hematopoiesis is suppressed, as a result of reduced hematopoietic growth factors. It can also be due to some other chronic infections that are present in old ages hinder bone marrow blood cell production, hence promoting extramedular hematopoiesis (EMH) that produce immature blood cells [13].

The RBCs count, Hb concentration, and PLT count are decreased in kidney disease patients. There is a association between serum creatinine level and all hematological parameters, and the severity of the kidney disease determines the extent of changes [14]. A significant association was observed between creatinine and hematological parameters in study participants with kidney diseases. According to the study conducted at Kigali university teaching hospital by Domina and Niyonzima [11], anemia was identified as a CKD complication that becomes more severe in proportion to kidney dysfunction. This matches with this study where anemia was present in the study population. Brugnara and Eckardt [14] revealed that microcytic anemia (MCV< 80 fl) is associated with CKD as a result of poor EPO secretion, blood loss and low serum iron. Iseki [16] revealed that anemia correction by blood transfusion didn't reveal any improvement in CKD patients.

Kidney plays an important role in EMH from which platelets regulating hormone thrombopoietin

is partially produced [17]. According to Jalal et al. [18], platelets reduction is associated with CKD as it becomes more severe. It is in agreement with the study conducted in HAHC hospital in India (New Delhi) by Habib et al. [10]. They mentioned that platelets tend to be decreased in both predialysed and hemodialyzed patients even though thrombocytopenia is regarded as a consequence of hemodialysis. This study is in correspondence with other studies, where platelets were decreased in the study population [19]. Anemia in kidney disease participants might be caused mostly by iron deficiency as a result of appetite loss. Therefore, study participants might have other chronic disease that can cause anemia.

5. Conclusion

The aim of the research was to assess the hematological parameters among patients with kidney diseases attending Rwamagana provincial hospital. Kidney diseases present changes in various hematological parameters of which anemia was more common. The RBCs, Hb, PLT and WBCs revealed association with serum creatinine. As kidney diseases develop at any age, kidney disease patients should be screened for different predisposing factors that endanger their life including mostly diabetes, CVD and hypertension. There is a need for kidney disease patients to change their lifestyle by reducing alcohol intake, quit smoking, and improve physical activity.

Conflict of Interest

The authors report no form of conflict of interest in this work. No form of funding was received from any funding organization /agency for this work.

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