INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 15, No. 3, p. 474-477, 2019

RESEARCH PAPER OPEN ACCESS

Biochemical changes in patients with chronic kidney failure in relation to complete blood count and anemia

Muhammad Naeem*[1], Arsalan Ashraf[1], Hafiz Muhammad Zeshan Safdar[1], Mahnoor Qayyum Khan[1], Shuja Ur Rehman[1], Rimsha Iqbal[1], Mohsin Raza[1], Jabir Ali[3], Ghafoor Ahmad[2]

[1]Department of Biochemistry, University of Agriculture, Faisalabad, Pakistan
[2]Institute of Chemical Sciences, Bahauddin Zakariya University, Multan, Pakistan
[3]Institute of Microbiology, University of Agriculture, Faisalabad, Pakistan

Key words: Anemia, Dialysis, Hemoglobin, Kidney failure, RBCs

http://dx.doi.org/10.12692/ijb/15.3.474-477 Article published on September 30, 2019

Abstract

Erythropoietin is a hormone made by kidney. Kidneys do not secrete erythropoietin when they get damaged and bone marrow makes a smaller number of red blood cells. Red blood cells indices assist in diagnosis to find out cause of anemia and to evaluate patient response to dialysis. The aim of this research was to assess RBCs indices that include MCV, MCHC & MCH in patients with Chronic Renal Failure. A descriptive study conducted about 100 patients from Nishtar Hospital and Medical University, Multan. 2-3ml of blood was drawn from patients of CKD prior to dialysis. Data analyzed by using statistical software such as SPSS 21. Out of 100 patients, 70% were males and 30% were females diagnosed with advanced chronic renal failure. Mean age data was 46.17 years. The mean value of MCV, MCHC & MCH was 76.05, 31.06 & 27.67 respectively. The values of MCV and MCHC were lower than the reference ranges (80-90fL and 33.3-35.5g/dL respectively) but the value of MCH lies within the reference range (27-33pg) in patients with chronic renal failure.

* **Corresponding Author:** Muhammad Naeem ✉ biochemist444@gmail.com

Introduction

The kidneys function as filters of the blood, removing waste products and controlling the balance of fluid and electrolytes. Filtration occurs via bundles of capillaries called glomeruli (singular, glomerulus). A reduction in the glomerular filtration rate (GFR) to <60ml/min/1.73m² indicates chronic renal failure (CRF), as do structural or functional renal abnormalities, which may be present in people with normal GFR.One of the lesser known functions of the kidneys is the production of erythropoietin, a signaling molecule that stimulates red blood cell production, in response to decreased oxygen levels in the blood (Prasad *et al.*, 2012). Any disruption of this process, e.g., secondary to a functional abnormality due to CRF, has the potential to produce anemia, a condition in which the number of circulating red blood cells, and therefore the level of hemoglobin, is lower than normal.

Although there are multiple mechanisms involved in the pathogenesis of anemia of chronic kidney disease, the primary cause is the diminished production of erythropoietin by the diseased kidney. Erythropoietin is produced in the peritubular cells of the kidney and is the major hormone involved in red cells synthesis (Nooten *et al.*, 2010). Low levels of erythropoietin lead to production of diminished number of oxygen-carrying red cells. Anemia causes decreased oxygen delivery to the tissues, leading to diminished exercise capacity, cognitive impairment and diminished quality of life. Other possible causes of anemia in CRF include iron deficiency, inflammation, and the accumulation of uremic toxins. Thus, the abnormal composition of blood or urine is an additional indicator of kidney damage. The anemia of CRF is typically normochromic and normocytic and there may be mild reticulocytosis. They are, however, seen less frequently in other cases of CRF especially in hypertensives.

Anemia causes decreased oxygen delivery to the tissues, leading to diminished exercise capacity, cognitive impairment and diminished quality of life. Other possible causes of anemia in CRF include iron deficiency, inflammation, and the accumulation of uremic toxins. Thus, the abnormal composition of blood or urine is an additional indicator of kidney damage. Red cell distribution width and mortality in hemodialysis patients seen in severe kidney failure diseases (Vashistha *et al.*, 2016).The anemia of CRF is typically normochromic and normocytic and there may be mild reticulocytosis. They are, however, seen less frequently in other cases of CRF especially in hypertensives. We hypothesized that in a large nationally representative cohort of incident HD patients in the United States, higher MCV levels would be associated with a higher risk of mortality (Kuttykrishnan *et al.*, 2015).

Red blood cell indices provide us information about the hemoglobin content and the size of red blood cells. Abnormal values of these indicate the presence of anemia and gives us idea about the type of anemia (Tsagalis, 2011). The RBCs indices are helpful in differentiating the cause of anemia. The aim of this research is to study the hemoglobin levels and reticulocyte count in patients with chronic Renal Failure.

Materials and methods

The research was carried out in field and laboratory to analyze various changes in blood diagnosed with chronic kidney failure. The methods and procedures for each experiment are given below. Here below a detail of area of study of time, sample collection and data analysis all discussed in materials and methods with proper methods.

Area and time of study

A descriptive study was conducted at Department of Pathology, Nishtar Hospital and Medical University; Multan from July 2017 to July 2018.This hospital is primary care hospital and provides medical information to all patientssuch as chronic kidney failure. This hospital receives a lot of samples from all diseases associates with kidney and its treatment. This hospital also provide facility to patients especially dialysis patients and proper diagnosis and laboratory testing.

Collection of samples

Samples from 100 patients of Chronic Renal Failure were collected. 2-3ml of peripheral venous blood was drawn using standard procedure.2.0ml of blood was

transferred into a test tube containing dried EDTA for complete blood count and using Hematology Cell Counter (SysmexKX21). Sample collection is done by trained laboratory technician working in hospital and lead to proper testing for further analysis.

Data analysis

The obtained data were analyzed by the statistical software SPSS v.21. A p-value less than 0.05 were taken as significance level and p value greater than 0.05 was not statistically significant. This software provided most accurate statistically results. The data analysis used to estimate results in patients with chronic kidney failure.

Results and discussion

Our study was on six age groups as shown in tabling no 1. In this study, it was found that the MCV values were high. With increasing age, MCV values were found mostly high in males as compared to females. With increasing age, MCHC values were also found increasing in males as compared to females. While the MCH values were on an average the samein both males and females with increasing ages.

Table 1. MCV, MCHC and MCH values in six age groups.

Age Group	Mid point	Gender	MCV (fL)	MCHC (g/dL)	MCH (Pg)
20-30	25	Males 8%	67.94	29.55	28.16
		Females 4%	78.9	33	24.5
30-40	35	Males 14%	74.87	30.14	26.9
		Females 3%	76.62	30.86	26.4
40-50	45.com	Males 17%	76.75	30.46	25.50
		Females 12%	78.46	31.38	28.46
50-60	55	Males 15%	73.74	31.42	27.2
		Females 9%	79.48	31.19	29.76
60-70	65	Males 5%	76.23	29.75	29.76
		Females 1%	76.04	30.64	27.76
70-80	75	Males 1%	76.5	32.15	27.75
		Females 1%	77.1	32.25	27.95

It has been observed in our study that concentrations of hemoglobin are decreased in chronic renal failure patients. This findings also in agreement with study obtained by other authors (Suresh *et al.*, 2012). The cause of decreased of red blood cell concentration count and deceases in hemoglobin concentrations and packed cell volume in chronic renal failure is impaired erythropoietin production and other factors which suppress down the process of erytropoiesis and shortened life span of red blood cell and also their survival rate Thee essential anemia is most common severe form of hematological abnormalities .Although anemia may be found at different stages of CKD ,a strong correlation exist between incidence of anemia and degree of severity of CKD (Clellan *et al.*, 2004).

Renal failure is a condition due to inadequate removal of toxins and waste products by kidneys from the blood. It classified into two types of acute and chronic. According to the latest WHO data published in April 2011, kidney disease deaths in Sudan reached 8,782 patients or 2.38% of total deaths, ranked the renal failure in 7th top 20 causes of death in Sudan. Anemia is a cardinal feature of chronic kidney failure and classically it is normochromic normocytic Erythropoietin deficiency is most common causes of anemia in patients with CRF (Prasad *et al.*, 2012). This study aimed to investigate hemoglobin and reticulocyte among patients with CRF. This current study showed that a significant increase in reticulocyte. This finding was agreed with (Abdulrahaman Y1 *et al*,) who observed a significantly higher reticulocyte count compared to the non-renal controls and explained this finding might due the recombinant human erythropoietin (rhEPO) and other hematologic growth factors stimulation erythropoiesis in Sudanese CRF patient. In accordance with study done by Zhian Sh. Hayder *et al.* 2009, who observed no significant differences in reticulocyte count among 111 patients with CRF compared to the non-renal controls. Our study contributed the higher result of reticulocyte count might due to the contribution of EPO therapy. The interesting result of this study was insignificancy of reticulocyte results

according to the gender of patients. These mentioned finding was in agreement with Abdulrahaman Y1 *et al* in 2013, who reported no gender effects in the reference ranges for reticulocyte parameters in chronic renal failure (Abdulrahman *et al.* 2013).

Current study showed that a significant decrease in hemoglobin concentration which shows relationship to chronic kidney failure (Hseih *et al.*, 2017) This findings were agreed with Zhin SH Hader *et al.* and several recent studies, who reported that hemoglobin levels were decreased during the period of chronic renal failure and they explained this might be due to erythropoietin deficiency in chronic renal failure (Zhein *et al.*, 2009).

Conclusion

This study helps us to investigate the values of RBCs Indices in patients of Chronic Renal Failure. The values of MCV and MCHC were higher than reference ranges (80-90fL and 33.3-35.5g/dL respectively) in patients diagnosed with chronic renal failure. The values of MCH lie within the reference range (27-33pg) in patients diagnosed with chronic renal failure. This study also helps to the medical scientists, young clinical pathologists, and laboratory scientists for diagnosis of kidney disease by finding parameters found in blood and also biochemical changes in functions of kidney through measure the glomerulus filtration rate.

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