



(RESEARCH ARTICLE)



## Determination of neutrophils to lymphocytes ratio, platelets count and mean platelet volume among patients with renal failure in Khartoum State

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### Abstract

This is cross sectional study conducted in Khartoum state during the period from March 2019 to December 2019 to determine the effect of renal failure disease on Neutrophils to Lymphocytes Ratio, Platelets count and Mean Platelet Volume on Sudanese patients. One hundred and thirty-five 135 samples were collected from patients with renal failure disease 100 of them was chronic and 35 was acute, and thirty 30 samples from normal individuals as control, the age of patients between eighteen 18 and eighty 80 years, and not suffer from bleeding, heart diseases and liver diseases. 3 ml of venous blood samples were collected in ethylene diamine tetra acetic acid (EDTA) containers. The platelet count and Mean platelet volume were investigated using haematological analyser (sysmex KX-21N) and neutrophils to lymphocytes ratio (NLR) calculated by dividing the neutrophils by the lymphocytes, Data was analyzed by using statistical package for social science (SPSS) Version 20 and Excel worksheet. The neutrophils to lymphocytes ratio (NLR) was significantly increase among patients with renal failure when compared with normal individuals (P value=0.000). There were no significant differences in platelets count and mean platelet volume (MPV) between patients and normal individuals, P value (0.792) and (0.322) respectively. The study concluded that there is statistically significant increase in N/L ratio among patients with renal failure, so it can be used as a simple hematological marker for prognosis of disease, PLT count also showed significant difference between male and female in cases group.

**Keywords:** Neutrophils; Lymphocytes; Platelets; Renal Failure

### 1. Introduction

Renal failure is a condition in which the kidneys are unable to adequately filter toxins and waste products from the blood, classified into two forms of acute renal failure (ARF) and chronic renal failure (CRF). Acute renal failure describes as a syndrome by rapid decline in the ability of the kidney to eliminate waste products, regulate acid–base balance, and manage water homeostasis. When this impairment is prolonged and entered chronic phase, erythropoietin secretion by this organ is decreasing and toxic metabolic accumulates and causes hematological changes include decrease of HCT, MCV and RBC and platelet counts [1].

The major outcomes of CKD include progression to kidney failure as well as the complications of decreased kidney function, such as cardiovascular disease, anemia and bone disease. With the rising prevalence of diabetes and hypertension, the incidences of both earlier stages of CKD as well as its associated outcomes, including progression to kidney failure, are expected to rise [2].

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Renal diseases are associated with a variety of haemopoietic changes. Anemia parallels the degree of renal impairment and its most important cause is failure of renal erythropoietin secretion. Other factors include depressed red cell production and reduced red cell survival. Purpura and bleeding are predominantly due to platelet dysfunction and usually respond to dialysis. Cryoprecipitate and 1-deamino-8-d-arginine vasopressin may be of value in the bleeding patient. Abnormal coagulation with fibrin deposition in the microcirculation is now recognized as a mechanism of renal impairment. Plasma infusion and anticoagulants may be useful in the therapy of conditions in which this occurs. Plasma exchange is now used in the investigation and management of some varieties of immunologically mediated renal disease. Blood transfusion has been found to improve graft survival if given prior to renal transplantation and this effect is currently under active investigation [3].

Several studies have shown that the neutrophil/lymphocyte ratio (NLR) is a marker that reflects the state of systemic inflammation. A high NLR was reported to be associated with cardiovascular events and mortality. However, little is known about the association between NLR and kidney disease progression in patients with chronic kidney disease (CKD) [4]. Blood is a body fluid in humans and other animals that delivers necessary substances such as nutrients and oxygen to the cells and transports metabolic waste products away from those same cells. In vertebrates, it is composed of blood cells suspended in blood plasma. Plasma, which constitutes 55% of blood fluid, is mostly water 92% by volume and contains proteins, glucose, mineral ions, hormones, carbon dioxide (plasma being the main medium for excretory product transportation), and blood cells themselves[5].The blood cells are mainly red blood cells (also called RBCs or erythrocytes), white blood cells (also called WBCs or leukocytes) and platelets (also called thrombocytes).Platelets also called thrombocytes is a component of blood whose function along with the coagulation factors is to react to bleeding from blood vessel injury by clumping, thereby initiating a blood clot [6] .Platelets have no cell nucleus, they are fragments of cytoplasm that are derived from the megakaryocytes of the bone marrow which then enter the circulation., Circulating inactivated platelets are biconvex discoid (lens-shaped) structures 2–3  $\mu\text{m}$  in greatest diameter. [7]. Activated platelets have cell membrane projections covering their surface. Platelets are found only in mammals, whereas in other vertebrates (e.g. birds, amphibians) thrombocytes circulate as intact mononuclear cells [6]. Platelet count (PLT) a normal platelet count ranges from 150,000 to 450,000 platelets per microliter of blood. Having more than 450,000 platelets is a condition called thrombocytosis having less than 150,000 is known as thrombocytopenia. You get your platelet number from a routine blood test called complete blood count (CBC).

Platelet indices circulatory platelets are very different in size, metabolism, and functional activity. The largest are more reactive and produce a great quantity of thrombogenic factor [8].The platelet parameter which includes the platelet distribution width, mean platelet volume, platelet large cell ratio and Platelet crit, have been available in the laboratory routine using blood cell counters[9].

When blood comes in contact with EDTA, platelet rapidly change shape from disk with diameters of 2 to 4 micron to spheroids covered with filamentous extension. The platelet spherical transformation is initially iso-volumetric, but within 1 to 2 hours, the volume progressively changes to reach an equilibrium condition [10,11].

Mean platelet volume (MPV) reflects megakaryocyte. It's increased in conditions associated with increased platelet turnover. The platelet mass remains constant in normal individuals. The MPV falls with increasing platelet counts in a non-linear manner. The effect of storage in EDTA on MPV depends on the method use to perform the platelet count. The MPV increase if measured in an impedance counter because of a change in volume of platelets [10].

### Objectives

- General objective
  - To determine the neutrophils to lymphocytes ratio, platelets count and mean platelet volume among patients with renal failure in Khartoum state.
- Specific objectives
  - To measurement of Platelets count, Mean Platelets Volume, and Neutrophils to Lymphocytes ratio in patients with acute and chronic renal failure disease.
  - To measurement of Platelets count, Mean Platelets Volume, and Neutrophils to Lymphocytes ratio in Control group (healthy individuals).
  - To compare the parameters between cases and control group.
  - To compare the parameters between the subgroups of cases, acute and chronic.
  - To compare parameters between genders, male and female.

## **2. Material and methods**

### **2.1. Study design**

This was cross sectional study.

### **2.2. Study area and duration**

The study was conducted in Khartoum, Sudan, during the period from February 2021 to April 2021.

### **2.3. Study population**

The study carried on Sudanese patients with acute and chronic renal failure in Khartoum state.

### **2.4. Ethical consideration**

Informed consent was taken from dr. Nageeb specialized hospital renal section, and approval from Alzaeim Alazhari University was obtained.

### **2.5. Inclusion criteria**

Case group were patients with acute or chronic renal failure.

### **2.6. Exclusion criteria**

Previous history of thrombosis, cardiovascular diseases hypertension and Liver diseases.

### **2.7. Sample collection**

Three millimeters of venous blood was drowned from each participant into EDTA containers. Platelets count and indices was done using CBC Automatic analyzer sysmex (KX-21).

### **2.8. Hematological profile**

Laboratory analysis was done within 2 hours from the time of collection. On each blood sample, PLT count and MPV were obtained by automated cell counter (KX-21), Neutrophils to Lymphocytes ratio was calculated by dividing the neutrophils by lymphocytes. A blood cell counter sysmex kx21 was used is an automatic multi -parameter cell counter for vitro diagnostic use in clinical laboratories. The kx-21 processes approximately 60 samples per hour. It gives data of 18 parameters, as the analysis of results. This is done in fast, accurate and precise way.

### **2.9. Data analysis**

Data was analyzed by using SPSS Version 20 and Excel worksheet. Independent T test was used to compare between cases and controls as well as cases with acute and chronic kidney disease. Results were presented as tables and figures.

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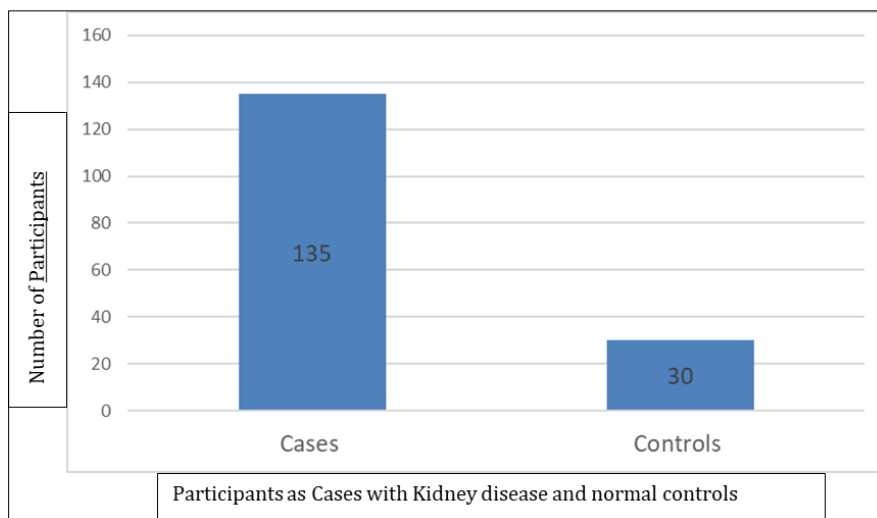
## **3. Results**

One hundred and sixty-five Sudanese individuals were participating in this study, divided into two groups 135 case with mean  $\pm$  STD and 30 control with mean  $\pm$  STD, all participant was in age ranged of 18-80 years old, group the age to see the effect of it and compared with parameters, the most frequent group fall in age range 38–48-year (55%), according to gender (52%) was male and (48%) female.

The result of neutrophils to lymphocytes ratio in cases was higher than controls, significant decrease in N/L ratio (P.value =0.001), while PLT count (P.value =0.792) and MPV (P.value =0.322) showed no significant difference between cases and controls.

The group of cases divided to two subgroups, Acute and chronic and there is no significant difference between them in PLT count (P.value =0.989), MPV (P.value =0.445) and N/L ratio (P.value =0.407).

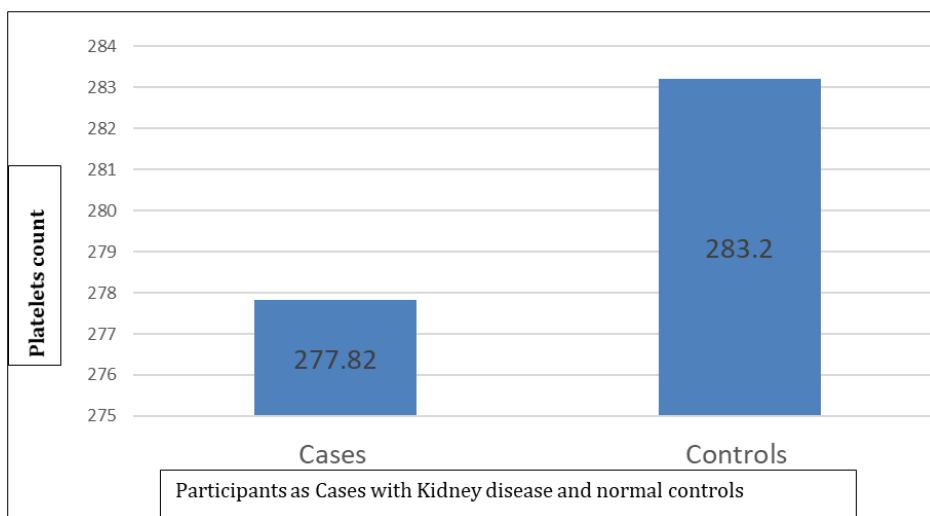
According to gender PLT count of females in cases group was lower than males, significant decrease in PLT count (P.value = 0.047) and no significant difference in MPV (P.value= 0.857) and N/L ratio (P. value= 0.150).



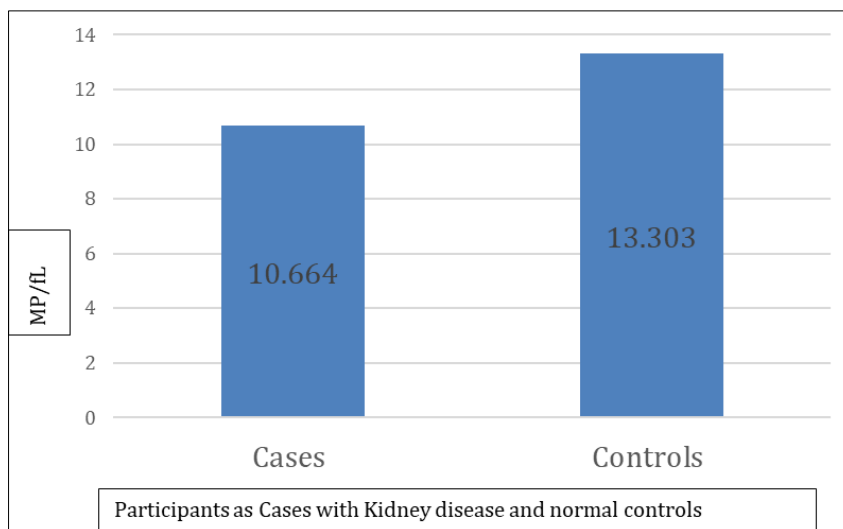
**Figure 1** Distribution of Participants as Cases with Kidney disease and normal controls without any evidence of kidney disease

**Table 1** Comparison between cases and controls in Platelet’s cell/cumm counts, MPV/ fL and N/L ratio % (P-value is significant at level equal or less than 0.05)

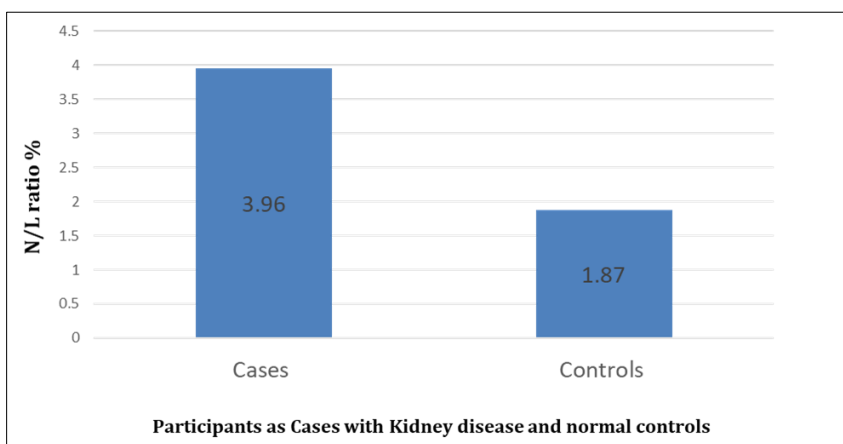
Variable	Participants	Mean	Std. Deviation	P-value
Platelets cell/cumm	Cases	277.82	100.502	0.792
	Controls	283.20	101.520	
MPV/ fL	Cases	10.664	10.7049	0.322
	Controls	13.303	21.1139	
N/L ratio %	Cases	3.960	5.1127	0.000
	Controls	1.870	1.8208	



**Figure 2** Comparison between cases and controls with Platelet’s cell counts



**Figure 3** comparison between cases and controls with MPV/ fL



**Figure 4** Comparison between cases and controls with N/L ratio %

**Table 2** Comparison between cases in Platelet's cell/ cumm counts MPV/ fL and N/L ratio % according to their gender (P-value is significant at level equal or less than 0.05)

Variable	Gender	Mean	Std. Deviation	P-value
Platelets cell/cumm	Male	260.54	92.677	0.047
	Female	294.85	105.580	
MPV/ fL	Male	10.831	11.9726	0.857
	Female	10.499	9.3771	
N/L ratio%	Male	3.321	4.1910	0.150
	Female	4.590	5.8452	

**Table 3** Comparison between patients with chronic and acute kidney diseases in Platelet's cell/cumm counts, MPV/ fL and N/L ratio % P-value is significant at level equal or less than 0.05)

Variable	Participants	Mean	Std. Deviation	P-value
Age/years	Chronic Kidney disease	42.36	17.831	0.042
	Acute Kidney disease	49.51	17.644	
Platelets cell/cumm	Chronic Kidney disease	277.89	103.010	0.989
	Acute Kidney disease	277.63	94.399	
MPV/ fL	Chronic Kidney disease	11.082	12.4121	0.445
	Acute Kidney disease	9.469	1.0352	
N/L ratio%	Chronic Kidney disease	4.177	5.4088	0.407
	Acute Kidney disease	3.340	4.1598	

#### 4. Discussion

The study revealed significant increase in N/L ratio due to acute and chronic renal failure (P.value =0.000), this result agreed with (Yuan Q, *it al*) who stated that N/L ratio was significantly increased in patients with renal failure disease (P. value = 0.002). (12)also agreed with (Verdoia M, *it al*) which showed statistically significance in N/L ratio (P. value = 0.001).(12) PLT count and MPV showed that there was no difference between acute or chronic patients and normal individuals (P.value =0.792)(P.value =0.322) respectively, which disagreed with study by (Dorgalaleh A, *it al*)who revealed that PLT count is significantly decreased in renal failure patients (P. value = 0.001), this disagreement maybe due difference in number of samples, and variation in analysis time[13]. The result of mean platelet volume MPV showed that there were no differences between renal failure patients and normal individuals (P.value =0.322), this is similar to the result of (Dodds A, *it al*) who reported that there were no significant differences in MPV between both [3.] Also disagreed with (Yousef P, *it al*) which said that there is significant increase in MPV in renal failure patients (P. value = 0.02), this disagreement may be due to number of samples [14]. The result of PLT count in female showed significant increase when compared with male in cases group (P.value = 0.047).

#### 5. Conclusion

The study concluded that there is statistically significant increase in N/L ratio among patients with renal failure, so it can be used as a simple hematological marker for prognosis of disease, PLT count also showed significant difference between male and female in cases group.

#### Compliance with ethical standards

##### *Acknowledgments*

Grateful thank to the patients and healthy who agreed to participate in this study.

##### *Disclosure of conflict of interest*

There was no conflict of interest in this study.

##### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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