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Determination of Platelet Count and Platelet Indices among Sudanese Patients with Chronic Kidney Disease

Azza Abdelrahim[1], Husham O. Elzein[2*]

[1]*Faculty of Medical Laboratory Sciences University of Gezira, Sudan*
[2]*Department of Medical Laboratory Technology, Faculty of Applied Medical Sciences, Northern Border University, Arar, Saudi Arabia*

Abstract

Background: Patients with chronic kidney disease (CKD) are at a considerably higher risk of thrombotic and hemorrhagic challenges. Platelet function studies in CKD are contradictory, ranging from decreased platelet function to normal or even increased platelet reaction. Our study aims to evaluate the change in platelet count (PC) and platelet indices (platelet distribution width [PDW], platelet large cell ratio [PLCR], and mean platelet volume [MPV]) among Sudanese patients with CKD.

Methods and Results: This case-control study was conducted from February to August 2014 at East Nile Hospital, Khartoum, Sudan. The study involved 75 patients diagnosed with CKD (mean age 52.43±18.4 years) and 75 healthy individuals (mean age 50.3±14 years) as a control group.

PC, PDW, PLCR, and MPV tests were conducted using a Sysmex KX-21N Automated Hematology Analyzer (Sysmex Corporation, Japan), and creatinine level was measured by Roche/Hitachi Cobas C311 analyzer (Basel Switzerland). The creatinine level was significantly higher in CKD patients than in the control group: 7.91±4.8 mg/dL and 1.4±1.3 mg/dL, respectively (P=0.000). We found an insignificant difference between CKD patients and the control group in terms of PC, MPV, PDW, and PLCR; an insignificant difference in PC and all PI between CKD patients with creatinine levels <6 mg/dL and >6 mg/dL; and an insignificant difference in PC and all PI between the group with CKD duration <2 years and >2 years and between CKD patients on hemodialysis and without hemodialysis.

Conclusion: This study found no difference in PC and studied platelet indices in CKD patients, compared to the control group and no difference in PC and PI (MPV, PDW, and PLCR) in patients on hemodialysis versus patients not on hemodialysis. **(International Journal of Biomedicine. 2024;14(1):41-44.)**

Keywords: chronic kidney disease • platelet count • platelet indices

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Abbreviations

CKD, chronic kidney disease; **GFR**, glomerular filtration rate; **MPV**, mean platelet volume; **PC**, platelet count; **PI**, platelet indices; **PDW**, platelet distribution width; **PLCR**, platelet large cell ratio.

Introduction

Chronic kidney disease (CKD), defined as kidney damage or an estimated glomerular filtration rate (eGFR) <60 ml/min per 1.73 m^2, persisting for 3 months or more, increases the risk of other health problems.[1-4] A reduction in kidney function and structure for more than 3 months distinguishes CKD from acute renal disease. According to Kidney Disease: Improving Global Outcomes (KDIGO), CKD is defined by markers of kidney damage or decreased GFR persisting for >3 months and is classified according to cause, GFR, and albuminuria criteria (CGA classification).

Disease manifestation varies according to etiology, severity, and degree of progression.[5-7] Early CKD treatment is critical for eliminating disease progression.[8,9] Kidney

***Corresponding author**: Dr. Husham O. Elzein, PhD. Department of Medical Laboratory Technology, Faculty of Applied Medical Sciences Northern Border University, Arar, Saudi Arabia. E-mail: hushamelzein@hotmail.com*

disease has been estimated to kill 5-10 million individuals annually.[10] The prevalence of CKD varies between 7% and 12% globally.[11] Adult prevalence was reported as 1.7% in China,[12] 3.1% in Canada,[13] 5.8% in Australia,[14] and 6.7% in the United States.[15] In Europe, the frequency ranges from 2.3% in Germany[16] to 2.4% in Finland,[17] and in England, the rate ranges from 9.2% to 5.2%.[18] CKD is a public health problem throughout Africa, with a prevalence range from 2% to 41%.[19] In Sudan, the overall prevalence of CKD was estimated to be from 8% to 11%.[20]

CKD patients are at a considerably higher risk of thrombotic challenges.[21-24] However, they also have an increased risk of hemorrhagic consequences. Along with thrombocytopenia, CKD has been associated with platelet abnormalities. Platelet function studies in CKD are contradictory, ranging from decreased platelet function to normal or even increased platelet reaction.[25-27] Our study aims to evaluate the change in platelet count (PC) and platelet indices (platelet distribution width [PDW], platelet large cell ratio [PLCR], and mean platelet volume [MPV]) among Sudanese patients with CKD.

Materials and Methods

This case-control study was conducted from February to August 2014 at East Nile Hospital, Khartoum, Sudan. The study involved 75 patients (main group) diagnosed with CKD (mean age 52.43±18.4 years) and 75 healthy individuals (mean age 50.3±14 years) as a control group.

Exclusion criteria included patients who had recent blood loss or transfusion, patients who had previous or current thrombosis, and patients with an infection that might affect the investigation parameters.

For study purposes, 5 ml of blood samples were collected: 2.5 ml into the EDTA blood containers for analysis of PC, PDW, PLCR, and MPV tests conducted using a Sysmex KX-21N Automated Hematology Analyzer (Sysmex Corporation, Japan) and 2.5 ml into the heparin containers for measurement of creatinine level by Roche/Hitachi Cobas C311 analyzer (Basel Switzerland).

Statistical analysis was performed using statistical software package SPSS version 16.0 (Chicago: SPSS Inc.). For descriptive analysis, results are presented as mean (M) ± standard deviation (SD). Inter-group comparisons were performed using Student's t-test. A probability value of $P<0.05$ was considered statistically significant.

The study was conducted by the ethical principles stated in the Declaration of Helsinki (1964, ed. 2013) and was approved by the Scientific Ethics Committee of Sudan University Science and Technology, Khartoum, Sudan. All participants provided written informed consent.

Results

The creatinine level was significantly higher in CKD patients than in the control group: 7.91±4.8 mg/dL and 1.4±1.3 mg/dL, respectively ($P=0.000$). We found an insignificant difference between CKD patients and the control group in terms of PC, MPV, PDW, and PLCR (Table 1); an insignificant difference in PC and all PI between CKD patients with creatinine levels <6 mg/dL and >6 mg/dL (Table 2); and an insignificant difference in PC and all PI between the group with CKD duration <2 years and >2 years (Table 3) and between CKD patients on hemodialysis and without hemodialysis (Table 4).

Table 1.

Mean levels of PC, PI, and blood creatinine in the main and control groups.

Parameter	Main group (n = 75)	Control group (n = 75)	*P*-value
PC, $\times10^3/\mu L$	274.01±102.5	286.60±76.5	0.395
MPV, fL	9.27±1.1	9.57±1.6	0.183
PDW, fL	11.58±2.3	11.85±1.8	0.425
PLCR, %	21.07±8.0	22.50±4.7	0.184
Creatinine, mg/dl	7.91 ± 4.8	1.4±1.3	0.000

Table 2.

PC and PI in CKD patients with creatinine levels <6 mg/dL and >6 mg/dL.

Parameter	Creatinine level		*P*-value
	< 6 mg/dL (n = 32)	> 6 mg/dL (n = 43)	
PC, $\times10^3/\mu L$	290.06 ± 112.1	262.07 ± 94.5	0.245
MPV, fL	9.37 ± 1.1	9.20 ± 1.2	0.532
PDW, fL	11.60 ± 2.2	11.57 ± 2.5	0.957
PLCR %	21.52± 7.7	20.76 ± 8.4	0.689

Table 3.

PC and PI in patients with CKD duration <2 years and >2 years.

Parameter	CKD duration		*P*-value
	<2 years (n = 62)	>2 years (n = 13)	
PC, $\times10^3/\mu L$	275.73 ± 102.7	265.85 ± 105.6	0.754
MPV, fL	9.32 ± 1.2	9.07 ± 0.8	0.476
PDW, fL	11.58 ± 2.4	11.77 ± 2.5	0.797
PLCR, %	21.32 ± 8.4	19.96 ± 8.5	0.598

Table 4.

PC and PI in CKD patients on hemodialysis and without hemodialysis.

Parameter	Patients on hemodialysis (n = 45)	Patients without hemodialysis (n = 30)	*P*-value
PC, $\times10^3/\mu L$	266.80 ± 100.6	284.83 ± 106.2	0.460
MPV, fL	9.25 ± 1.2	9.30 ± 1.1	0.856
PDW, fL	11.67 ± 2.5	11.47 ± 2.2	0.723
PLCR, %	21.0 ± 8.2	21.20 ± 7.9	0.917

Discussion

Our study revealed an insignificant difference in PC among CKD patients compared to the control group. There was no relation between PC and serum creatinine level. This study also showed no significant difference in PC according to the duration of CKD. The present result showed an insignificant difference in PC among patients on hemodialysis and those who were not; this result agrees with a study by Arogundade et al.[28] in India and Mohamed et al.[29] in Sudan. On the other hand, our findings disagree with the study conducted by Shittu et al.[30] in Nigeria. They found in their study a significant reduction in PC in CKD patients, and this may be due to the use of erythropoietin therapy, which potentiates the effect of megakaryocyte colony-stimulating factors, platelet-activating factor acetylhydrolase, and paraoxon.

Our study revealed insignificant differences in all PI (MPV, PDW, and PLCR) among CKD patients, compared to the control group. There was no relation between MPV and the serum creatinine level and the duration of CKD. The present result revealed an insignificant difference in MPV among patients on hemodialysis and those who were not, which agrees with a study by Bilen et al.[31] There was no relation between PDW, PLCR and the serum creatinine level, as well as the duration of CKD. The present result revealed insignificant differences in PDW and PLCR among patients on hemodialysis and those who were not, which agrees with a study by Schoorl et al.[32]

Further research with a high sample size is required, particularly on platelets in CKD patients, such as platelet function, because there is evidence of an effect of uremia on platelet function.

In conclusion, this study found no difference in PC and studied PI in CKD patients, compared to the control group and no difference in PC and PI (MPV, PDW, and PLCR) in patients on hemodialysis versus patients not on hemodialysis.

Competing Interests

The authors declare that they have no competing interests.

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