*Original Article*

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# Study of Platelet Parameters in Non Dialysis Dependent CKD Patients

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**Abstract**

*Introduction:* Automated blood cell counters have made it easy to quantify RBC, WBC and platelet parameters. RBC & WBC parameters have been widely studied with the introduction of automated hematology analysers but platelet parameters have started receiving attention in the last few years only. Most important platelet parameters are plateletcrit (PCT), mean platelet volume (MPV) and platelet distribution width (PDW). Platelets dysfunctions are common in CKD. The present study was conducted with the primary aim of evaluating the platelet parameters in non-dialysis dependent CKD patients coming to our diagnostic centre. *Materials and Methods:* The present study was carried out in 100 CKD patients coming to our diagnostic centre from January 2015 to May 2015. All patients with a creatinine value of more than 1.5 mg/dl were included in the study. 100 age matched controls were used for the comparison study. Statistical analysis was performed by partial correlation test. Mean and SD of each platelet parameter was calculated for both patients and controls and the results were compared using students t– test. *Results:* In the CKD patients group, the mean platelet count was 264.4±91.3x $10^3$/µL, MPV was 7.6±0.9fl, PCT was 0.197±0.066%, PDW was 16.5 ±0.9, creatinine was 3.968±2.676 mg/dl. For the control group, the mean platelet count was 299.6±99.8 x$10^3$/µL, MPV was 7.8±1.0 fl, PCT was 0.230±0.067 %, PDW was 16.5 ±1.0, creatinine was 0.908 ± 0.246 mg/dl. T test was done for the control and CKD patients group which showed difference in values of platelet counts, PCT and creatinine values in both groups while MPV and PDW did not show much difference. *Conclusion:* CKD patients do not show much variation in platelet parameters as compared to age matched controls. However, a much larger study is needed to confirm the findings. MPV, PCT and PDW are simple platelet indices reported by all modern cell counters and need to be studied extensively in a larger study for a definite conclusion to be made..

**Keywords:** Beckman Coulter LH 750; PDW; PCT; MPV; CKD.

## Introduction

Automated blood cell counters have made it easy to quantify RBC, WBC and platelet parameters. RBC & WBC parameters have been widely studied with the introduction of automated hematology analysers but platelet parameters have started receiving attention in the last few years only. Most important platelet parameters are plateletcrit (PCT), mean platelet volume (MPV) and platelet distribution width (PDW) [1]. An automated cell counter like LH – 750 (Beckman Coulter) provides the MPV on each whole blood sample that is analyzed and it helps in studying the platelet parameters in different chronic diseases.

Chronic renal disease patients are known to have various haemostatic disorders [2]. Chronic kidney disease has emerged as a major global public health problem with a greater financial burden in developing countries [3]. Hematological profiles are known to be affected in CKD and become more evident with the

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advancing stage of the disease.

Normal renal function has a very important role to play in normal homeostasis. According to the National Kidney Foundation in India, CKD is ranked the 3rd life threatening disease after cancer and heart disease. It is estimated that approximately 2 lakh kidney patients progress to terminal stage of disease every year [4].

Chronic renal failure is characterized by progressive and irreversible deterioration of renal function because of slow destruction of renal parenchyma resulting in death when large numbers of nephrons are damaged.

Platelets dysfunctions are common in CKD and is related to decreased availability of platelet factor–3, defective platelet aggregation ,adhesiveness and prolonged bleeding time [5,6]. The mechanisms by which these occur are increased vessel wall prostacyclin, abnormal platelet arachidonic acid ,increased levels of parathyroid hormone, various plasma metabolites like urea, guanidinosuccinic acid and phenolic acid metabolism which inhibit the platelet functions[5,6]. MPV is a good marker of platelet function. The large platelets are more active than normal sized platelets. MPV, which is a measure of platelet size, changes with the rate of platelet production and the level of platelet stimulation [7,8,9]. Increased MPV may be due to increased number of large, hyper aggregable platelets or increased platelet activation.

The present study was conducted with the primary aim of evaluating the platelet parameters in non-dialysis dependent CKD patients coming to our diagnostic centre.

## Material and Methods

The present study was carried out in 100 CKD patients coming to out diagnostic centre from January 2015 to May 2015. The aetiology of CKD included diabetic nephropathy, hypertension, various glomerular diseases, polycystic kidneys and urinary tract infection. All patients with a creatinine value of more than 1.5 mg / dl were included in the study.

Patient on angiotensin converting enzyme inhibitors and NSAIDS were excluded from the study as they are known to have adverse effects on platelet production and function. 100 age matched controls were used for the comparison study.

Blood samples were collected by venipuncture from patients and controls in K3 EDTA and gel tubes. Complete blood count including platelet count (N: 150 – 450x$10^3$ / µL ), MPV (8.6 – 15.5 fl), PCT (N: 0.15 – 0.62) and PDW (N: 8.3 – 25.0 fl) was estimated by running the EDTA samples in LH 750 (Beckman Coulter) haematology analyser. For all patients and controls, creatinine was also estimated simultaneously from samples collected in gel tubes on Dimension RXL MAX (Siemens) by alkaline picrate method.

Statistical analysis was performed by partial correlation test. Mean and SD of each platelet parameter was calculated for both patients and controls and the results were compared using students t – test.

## Results

100 patients and 100 controls were included in the study. The mean age of subjects and controls were 41±31 years and 40±30 years respectively. In the CKD patients group, the mean platelet count was 264.4±91.3x $10^3$ / µL, MPV was 7.6±0.9fl, PCT was 0.197±0.066%, PDW was 16.5 ±0.9, creatinine was 3.968±2.676 mg / dl.For the control group,the mean platelet count was 299.6±99.8 x$10^3$ / µL, MPV was 7.8±1.0 fl, PCT was 0.230±0.067 %, PDW was 16.5 ±1.0, creatinine was 0.908 ± 0.246 mg / dl. Table 1.

Table 2 shows the demographic data of patients. There were 72 males in the patient group and 28 females.29% patients were in 51 – 60yrs, 20% in 61-70 yrs, 17% in more than 70 yrs age group.

Table 3 shows the distribution of patients in different age groups and different creatinine concentrations. Maximum 63 % patients were in mild CKD group, 20% were in moderate group and 16% in severe CKD group.

T test was done for the control and CKD patients group which showed difference in values of platelet counts and PCT in both groups while MPV and PDW did not show much difference Table 1.

Age, sex and hematological profile of all patients are shown in table 3 at different creatinine concentrations.

**Table 1:** Platelet parameter profile of patients and control

| S. No. | Parameters | Subject Mean ±SD | Control Mean +-SD | T Test |
|---|---|---|---|---|
| 1 | Platelet count x 103 / ul | 264.4 ± 91.3 | 299.6 ± 99.8 | 0.008 |
| 2 | MPV fl | 7.6 ± 0.9 | 7.8 ± 1.0 | 0.075 |
| 3 | PCT % | 0.197 ± 0.66 | 0.230 ± 0.067 | 0.0006 |
| 4 | PDW | 16.5 ± 0.9 | 16.5 ± 1.0 | 0.861 |
| 5 | Creatinine | 3.968 ± 2.676 | 0.908 ± 0.246 | 0.00 |

**Table 2:**

| Age | Males | Females | Total |
|---|---|---|---|
| < 10yrs | | | 0 |
| 10-20yrs | 1 | 1 | 2 |
| 21-30yrs | 3 | 2 | 5 |
| 31-40yrs | 7 | 1 | 8 |
| 41-50yrs | 13 | 6 | 19 |
| 51-60yrs | 17 | 12 | 29 |
| 61-70yrs | 16 | 4 | 20 |
| > 70yrs | 15 | 2 | 17 |
| Total | 72 | 28 | |

**Table 3:** Demographic data of patients at different creatinine concentrations

| AGE | Creatinine Values 1.5 - 3.0 (Mild CKD) | 3.1 - 6.0 (Moderate CKD) | 6.1 - 10.0 (Severe CKD) | >10 |
|---|---|---|---|---|
| 10-20yrs | **2** | | | |
| 21-30yrs | **4** | | **1** | |
| 31-40yrs | **6** | **1** | **1** | |
| 41-50yrs | **8** | **5** | **5** | |
| 51-60yrs | **16** | **7** | **4** | |
| 61-70yrs | **15** | **3** | **2** | |
| > 70yrs | **12** | **4** | **3** | **1** |
| Total | **63** | **20** | **16** | **1** |
| Males | 72 | | | |
| Females | 28 | | | |

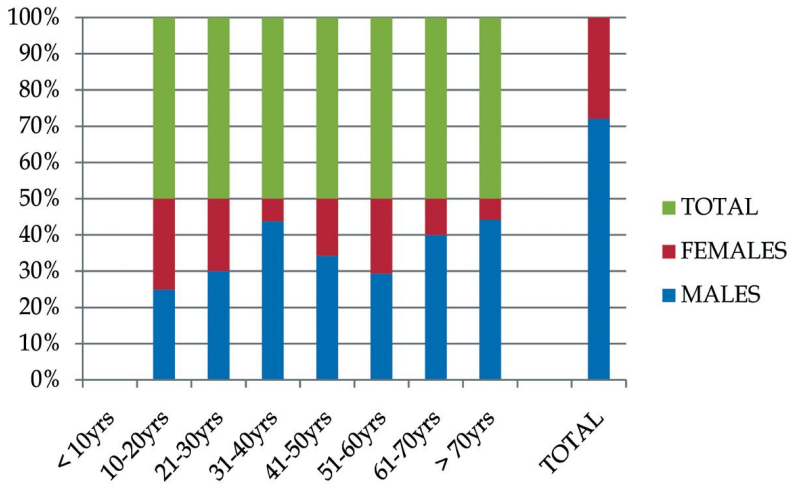


**Fig. 1**

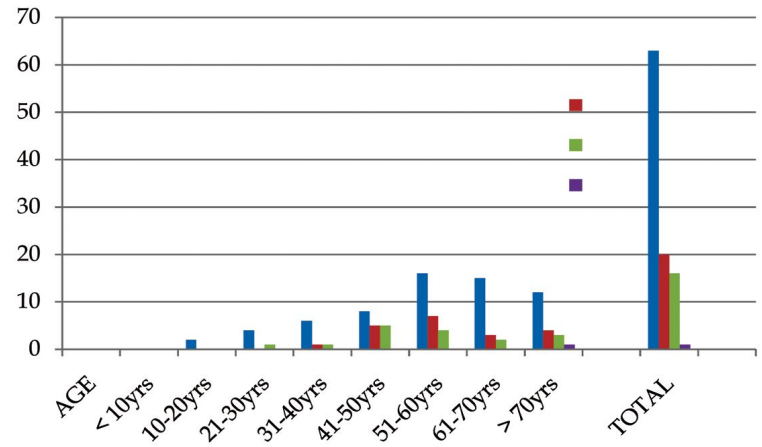


**Fig. 2**

## Discussion

Platelets are anucleate cells of the blood and are highly complex in function. They are derived from bone marrow megakaryocytes. Since ages, platelets were evaluated by studying a well made peripheral blood film in terms of number, morphology, size and distribution and structure. But a peripheral blood film examination has many drawbacks including subjective variability, artifacts which may lead to misdiagnosis and pre analytical factors. The fully automated hematology analysers available now give a more precise information regarding different platelet parameters and can be used to evaluate their role different in kidney diseases and other clinical conditions. Platelets play a major role in haemostatic disturbances in CKD. Platelet count is used by clinicians to monitor CKD patients but the role of MPV, PCT and PDW in managing CKD patients is still under evaluation. Very few studies have been carried out so far in this regard. MPV has a physiologically important role in homeostasis [10,11,12]. Larger platelets are more reactive and aggregate more easily. They also contain dense granules and release more serotonin as compared to small platelets [13,14]. The density and volume of platelets is determined during thrombopoiesis and platelets do not change in size when in circulation [15,16,17]. The mechanisms that control platelet production are not fully understood but it has been suggested that both platelet counts and MPV are under dependent hormonal control [17,18].

Erythropoietin potentiates the effect of megakaryocyte colony stimulating factors, acetylhydrolase (PAF–AH) and paraoxonase (PON–1). In CKD, impaired erythropoietin secretion causes platelet counts to decrease. There is a considerable homology between erythropoietin and thrombopoietin and hence erythropoietin acts as a major humoral regulator of platelet mass.

A total of 100 patients and 100 controls were studied for evaluating platelet parameters in CKD. There were 72 % males and 28 % females. Maximum patients were in 51 to 60 years age group (29 %) followed by 61 – 70 years age group (20 %) and 17 % in more than 70 years age.There was minor difference in values of platelet counts and PCT in both groups while MPV and PDW did not show much difference group. No correlation was found between rising creatinine values and different platelet parameters including platelet count.

## Conclusion

From the present study it can be concluded that CKD patients do not show much variation in platelet parameters as compared to age matched controls. However, a much larger study is needed to confirm the findings. MPV, PCT and PDW are simple platelet indices reported by all modern cell counters and need to be studied extensively in a larger study for a definite conclusion to be made.

*Conflict of Interest*

None

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