ORIGINAL ARTICLE

Association of Mean Platelet Volume with different Stages of Chronic Kidney Disease in Comparison to Glomerular Filtration Rate at Hyderabad

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ABSTRACT

Objective: To assess the mean platelet volume (MPV) in diagnosed cases of chronic renal failure (CRF), and to compare mean platelet volume with estimated glomerular filtration rate.

Methods: This case control study was carried out at Diagnostic and Research Laboratory of LUMHS and department of Nephrology, Isra University and Liaquat University Hospitals Hyderabad, Sindh. One hundred and twenty subjects (N=120) were taken and were divided into two groups, Group I having controls (n=60), Group II having known cases of chronic renal failure patients (n=60). Blood (5ml) was taken in sodium citrate bottles and were sent to the laboratory for evaluation of MPV, urine albumin and serum creatinine levels.

Results: The present study reported elevated mean platelet volume in known cases of CRF (p=0.0001). This shows strong negative correlation between MPV and GFR (r= -0.829).

Conclusion: The present study showed progressive increase in MPV along with decreased level of GFR in patients with CRF, thus showing negative correlation of MPV with GFR.

Key Words: Mean Platelet Volume, Glomerular Filtration Rate, Chronic Kidney Disease

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INTRODUCTION:

The chronic kidney disease (CKD) is a global health hazard. In the USA, the incidence and prevalence of renal failure is increasing, and the outcomes are poor while the cost is also increasing.[1] The CRF is defined as an irreversible and progressive loss of renal function with residual glomerular filtration rate (GFR) of less than 30%. The true incidence and prevalence of CKD is not available for Pakistan because lack national registries[1,2]. The high socioeconomic status in Pakistan is a predisposing factor for infection-related glomerulonephritides and nephrolithiasis, that result in End stage renal disease (ESRD)[3]. The ESRD can be slowed with significant improvement of clinical outcome by detection of CKD, so urinary sediment examination and GFR estimation give useful information to measure the function of nephrons[1,4]. The filtration markers like inulin, creatinine clearance, cystatin c, radioactive or non-radioactive substances can assess the measurement of kidney clearance[1,4,5].

Currently platelet volume indices (PVI) have been studied for various diseases, including diabetes mellitus, coronary artery disease, and diabetic nephropathy[6-9]. One of PVI that is reported in above studies is the mean platelet volume (MPV). The MPV give the morphological information of platelet size variability and

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defines average size. The MPV is between 812 fL is considered as normal[10-11]. In states of significant vascular damage, considering the larger platelets circulating in activated form, the mean platelet volume increases which can be detected by platelet activation markers[12-14]. Several studies have reported MPV in renal failure however, association of MPV with glomerular filtration rate proved in only a few studies[15-17].

The rationale of present proposed study is to investigate the MPV in CRF cases and find out its association with estimated GFR and to evaluate the predictive significance of MPV.

METHODS:

It was a case control study and was carried out at Postgraduate Laboratory and Department of Medicine and Nephrology, Isra University and Liaquat University Hospitals Hyderabad, Sindh. One hundred and twenty subjects (N=120) were taken and were divided into two groups

- Group I_ Normal subjects taken as healthy controls(n=60)
- Group II _Diagnosed chronic renal failure patients (n=60)
  - *Stage 1 Disease- GFR > 90 ml/1.73m²*
  - *Stage 2 Disease- GFR 60-89 ml/1.73m²*
  - *Stage 3 Disease- GFR 30-59 ml/1.73m²*
  - *Stage 4 Disease- GFR 15-29 ml/1.73m²*
  - *Stage 5 Disease- GFR <15 ml/1.73m²*

Patient were selected in a meticulous manner and criteria of inclusion were diagnosed cases of chronic renal failure of both genders between age of 20-60 year and the patients of age less than 20 and more than 60 years, Patients taking drugs altering the functions of platelets, like aspirin and clopidogrel, and on anticoagulants e.g.; heparin and warfarin, having urinary tract infections were not included in the study.

A detailed patient history regarding duration, symptoms related to the renal failure was taken. The Blood samples were collected in bottles containing sodium citrate as an anticoagulant for performing CBC and were processed on automatic hematoanalyzer, Sysmex KX 21.

Biochemical Measurements

Serum Creatinine level: Venous blood samples were collected under aseptic conditions and serum creatinine was measured.

Urinalysis: For albuminuria and urinary creatinine concentration.

Measurement of Glomerular filtration rate

The GFR was typically recorded in units of volume per time.

Creatinine clearance (Ccr):

$$Ccr = \frac{\text{Urine concentration x Urine flow}}{\text{Plasma concentration}}$$

Data analysis: Data was analyzed using SPSS version 21.0 (IBM corporation, USA). The continuous variables were analyzed using student's t-test and analysis of variance, and were presented as mean ± SD. The categorical variables were analyzed using Chi-square test and were presented as frequency and percentages. Pearson's and Spearman's correlation were used for analyzing correlation of variables. The results were presented as tables, graphs and charts. Statistical significant p-value was defined as ≤ 0.05.

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RESULTS

In the current study we evaluate 60 cases of chronic renal failure and 60 normal control subjects were evaluated. Mean age among control group was 39.32 years and among CRF it is 42.18 years. The serum creatinine, GFR and urinary albumin was estimated in all the subjects as shown in table.1 and 2. Serum creatinine levels are 1.02 and 18.04 in both groups respectively.

GFR is estimated to be 120.8 in control group whereas it's reduced in CRF group to 38.85. Urinary albumin was positive in 37 cases out of 60 patients in CRF group, while in control group the urinary albumin was negative.

DISCUSSION:

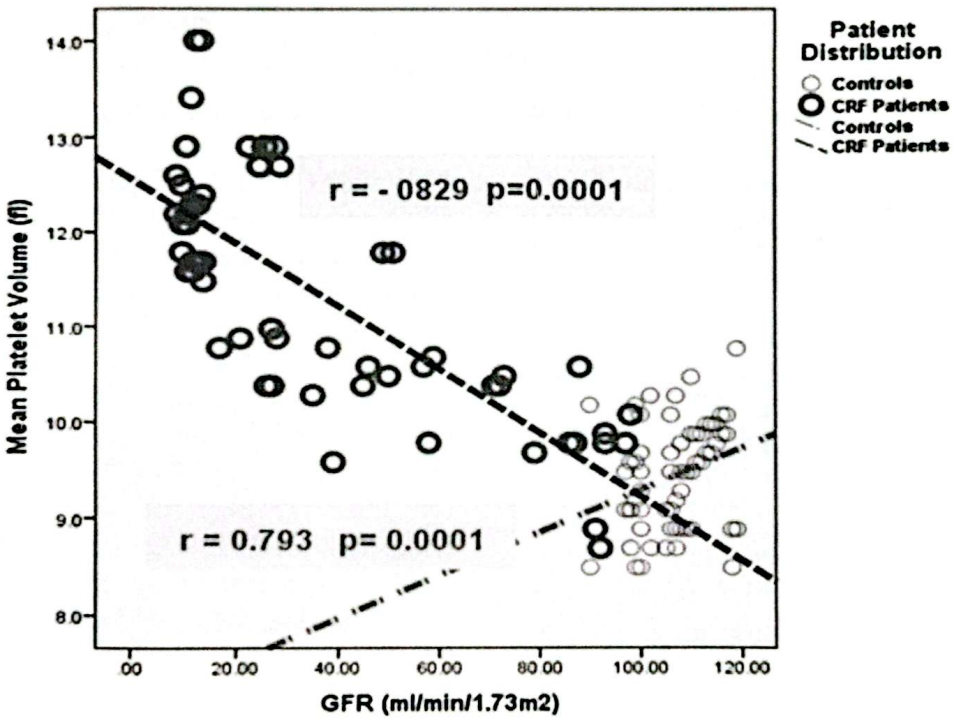
The present study analyzed the interrelationship between MPV and GFR in chronic renal failure patients. The mean platelet volume was increased in chronic renal failure patients especially in stage iv and v, however mean platelet volume was also observed to be increased in acute myocardial infarction, unstable angina pectoris and constrictive cardiac failure. The increased level of MPV was independent of other

Table-I: Showing Comparison between Both Groups Using T-Test

S. No	Variable	Control (n=60)	CRF* (n=60)	T-Value	P-Value
1.	Age	39.32±7.9	42.18±8.6	0.720	0.46
2.	Serum Creatinine	1.02±0.20	18.04±7.51	59.08	0.0001
3.	Estimated GFR	120.80±7.21	38.85±19.13	66.2	0.0001

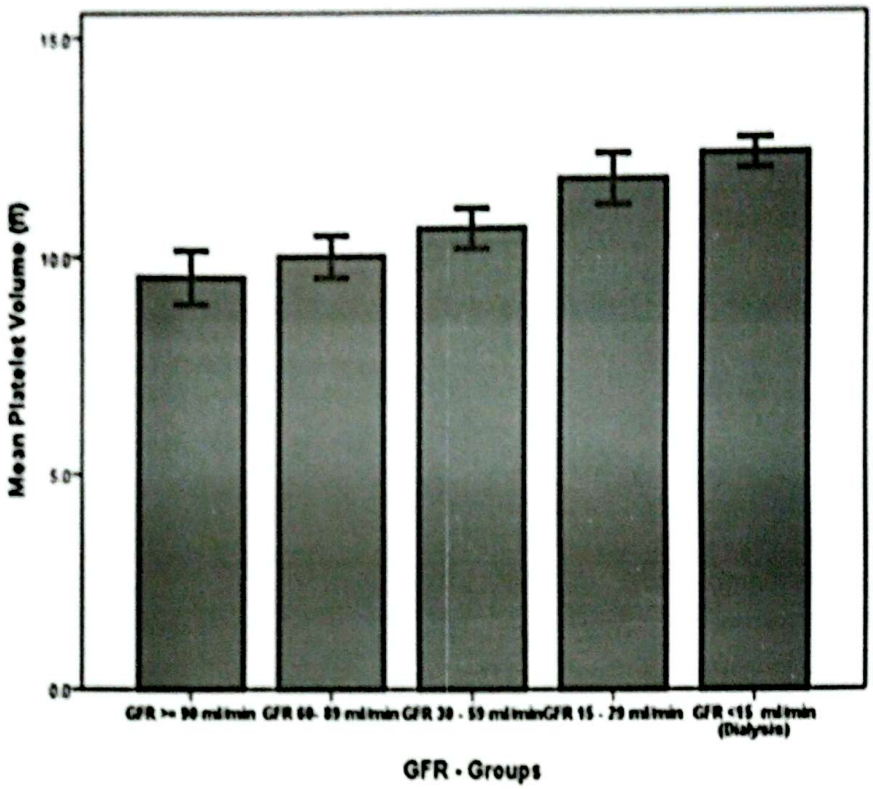
Table .2 Urinary albumin of study population

Groups	Negative	Positive	X^2	df	p-value
Control (n=60)	60	0	53.4	118	0.0001
CRF* (n=60)	23	37			



Graph I. Scatter plot showing correlation of Mean platelet volume and Glomerular filtration rate (GFR)

risk factors such as diabetes, obesity, hypertension and smoking which is in contrast with present study as the patients were known cases of the disease.[18] The K2 or K3-EDTA is the recommended anticoagulant for CBC determination including platelet indices. The shape of platelets is rapidly changed from disc with diameter of 2-4 um to spheroid shape, when blood comes in contact with EDTA. The platelet spherical shape remains same (isovolumetric) initially but the volume progressively changes to reach an equilibrium condition within 1-2 hours. This results an increase in MPV (from 7.9% within 30 minutes to 13.4% over 24 hours). In



Graph II: Bar graph showing MPV in study population

present study bottles containing sodium citrate were used as anticoagulant instead of EDTA, as with the use of EDTA the MPV is not achieved as a very reliable index.[19] In the present study out of 60 patients studied 18.3%, 25%, 33.3% were in stage 3, 4, and 5 respectively. The few patients were also in stage 1 and 2 which is in contrast with other study where none of patient was in stage 1 and 2 CKD.in present study maximum patients were in stage 4 and 5 which is similarly shown in other study.[20] Large platelets are more reactive, so release more prothrombotic factors and pile up easier. So, MPV is recognized as the indicator of platelet activation[21]

In humans, a reduced platelet survival and an increased renal platelet sequestration, suggests a role of platelets in the pathogenesis of glomerular injury[22]. The Platelet and MPV has been studied in diabetic nephropathy[23], cellulitis[24], acute pancreatitis[25], acute peritonitis[26], erectile dysfunction[27], thalassemia minor in pregnant women[28] and hepatitis B infection[29] A recent study has been reported the association of MPV with GFR in CKD patients. A sample of 553 CKD patients was evaluated for MPV and GFR. MPV values were found to be elevated in proportion to a decline in GFR, rising from Stage I CKD to stage IV. Buch.N et al studied 140 type 2 diabetics and 30 healthy controls and reported elevated MPV and elevated selectins levels on platelet surface, hence concluded that platelets having over expressed selectins may play role in the micro vascular complications like glomerulopathies[30]. The results of present study are in agreement with this study. The study of Langham has shown an increased platelet derived growth factor (PDGF) expression in renal biopsies of diabetic nephropathy that reveals role of platelet in glomerular injury. Above findings are in agreement with present work. The findings of present study supports possible role of platelet in glomerular injury in CRF patients. Reported the vascular risk factors in diabetics like atherosclerosis which can stimulate the megakaryocyte in bone marrow causing increased circulatory platelet consump-tion during atherognesis and micro vascular injury in kidney tissue; however present

study observed the same results of increase in MPV levels in CRF patients. The platelet functions and size are determined primarily during or before mega-karyocyte fragmentation in the bone marrow.

CONCLUSION:

The present study was conducted to derive some clue of CRF by estimating MPV, so as it might be used as simple and cost effective laboratory investigation, such conclusions are similar to a previous study.

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