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Assessment of Mean Platelet Volume and Neutrophil/Lymphocyte Ratio in Chronic Kidney Disease Patients with Proteinurea

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Abstract

Background: Chronic kidney disease is a chronic inflammatory process which is the main cause of developing atherosclerosis. The main reason of morbidity and mortality in Chronic Kidney Disease (CKD) is atherosclerosis. Mean Platelet Volume (MPV) and Neutrophil to Lymphocyte Ratio (NLR) have been reported as markers of systemic inflammation.

Aim of Study: To assess the value of Mean Platelet Volume (MPV) and Neutrophil to Lymphocyte (NLR) in chronic kidney disease patients with proteinurea.

Methods: The study was carried out on two groups: Group (I): 50 CKD patients and Group (II): 50 healthy individuals as a control group. The patients were from Outpatient Clinic of Nephrology in Tanta University Hospital. This study was carried out from August 2017 to February 2018. We excluded patients suffer from coronary artery disease, myocardial infarction and heart failure, patients suffer from active infection, patients suffer from diabetes mellitus and patients suffer from malignancy. Complete clinical examination including: Body Mass Index (BMI) and routine laboratory investigations and specific investigations including Neutrophil Lymphocyte Ratio (NLR) and Mean Platelet Volume (MPV) were done.

Results: NLR was statistical significance higher in patients group than control healthy groups (Z_{mw}=–7.38, p<.001) and there were statistically significant positive correlation were detected between NLR and proteinuria (p<.001*), CRP (p <.001*), fibrinogen (p<.001 *) and negative correlation with eGFR (p<.001 *). There was not statistical difference of MPV between patients group and control healthy group (t=–.510, p=.611) and there were not statistically significant correlation between MPV and proteinuria (p=.416), CRP (p=.641) and eGFR (p=.557).

Conclusion: NLR could be used as a marker of inflammation and proteinuria in CKD stages but MPV needs more researches in this field.

Key Words: *Neutrophil Lymphocyte Ratio (NLR) – Mean Platelet Volume (MPV) – Chronic Kidney Disease (CKD).*

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Introduction

CHRONIC Kidney Disease (CKD) is a disease that influence in kidney functions and cause disturbance in the level of the products of protein metabolism, blood pressure, fluid, acid base and electrolytes. Finally it may lead to renal failure and in some cases lead to dialysis or transplantation [1].

Chronic kidney disease is a chronic inflammatory process that will proceed to atherosclerosis and it is one of the main reasons of morbidity and mortality in CKD [2]. Cardio Vascular Diseases (CVD) in Chronic Kidney Disease (CKD) patients is about 9% which is 10-20 times greater than in the general population [3].

There are increasing in the levels of cytokines in the chronic kidney disease patients as: C-Reactive Protein (CRP), Interferon-y (IF-y), Tumor Necrosis Factor-a (TNF-a), Interleukin-1 (IL-1), Interleukin-6 (IL-6) and Interleukin-18 (IL-18) which are the most common causes for developing of micro vascular complications [4].

The White Blood Cell (WBC) count and its differentiations are one of the markers of inflammation especially in cardiovascular diseases. Ischemia and formation of thrombus are related to increasing the count of neutrophil [5].

The Neutrophil-Lymphocyte Ratio (NLR) is a marker of inflammation in cardiac and non-cardiac diseases which are the most common cause of atherosclerosis leading to morbidity and mortality in chronic kidney disease patients specially with dyslipidemia [6].

Mean Platelet Volume (MPV) is a marker of inflammation that is investigated in many inflam-

matory diseases. Mean platelet volume MPV used as prognostic marker in conditions such as sepsis, organ transplantation, and cancer interventions [7].

Clinical studies have reported that decreasing of proteinuria can delay the renal disease progression and protect kidney damage. Proteinuria is using as an indicator of arteriosclerotic cardiovascular diseases which can increase the risk of cardiovascular morbidity and mortality [8].

Subjects and Methods

The study was carried on 50 CKD patients. The patients were selected from Outpatient Clinic of Nephrology in Tanta University Hospital in the period from August 2017 to February 2018 and 50 healthy age and gender matched volunteers as control group. All participant provided informed written consent and the study was approved by Tanta Faculty of Medicine Ethical Committee.

The participants were divided into the following groups:

The subjects of this study were classified into two groups:

- *Group I:* 50 CKD patients.
- *Group II:* 50 healthy persons as a control group.
- *Subgroups of CKD patients:*
  - *Group (1):* Includes 7 patients with renal impairment stage 1 CKD.
  - *Group (2):* Includes 8 patients with renal impairment stage 2 CKD.
  - *Group (3):* Includes 12 patients with renal impairment stage 3 CKD.
  - *Group (4):* Includes 13 patients with renal impairment stage 4 CKD.
  - *Group (5):* Includes 10 patients with renal impairment stage 5 CKD.

Exclusion criteria:

Patients suffer from coronary artery disease, myocardial infarction and heart failure, patients suffer from active infection, patients suffer from diabetes mellitus and patients suffer from malignancy.

All participants in this study were subjected to: Thorough history taking, full clinical examination, laboratory investigations in the form of: Complete Blood Count (CBC), lipid profile (Triglyceride, Cholesterol, LDL and HDL), serum uric acid, kidney functions (urea and creatinine), urine analysis, fibrinogen, 24 hours urine protein collection, glomerular filtration rate, C-Reactive Protein (CRP), Neutrophil-Lymphocyte Ratio (NLR) and Mean Platelet Volume (MPV).

Sampling and laboratory investigations:

Sampling and all laboratory investigations were done in Clinical Pathology Department, Tanta University Hospitals.

Complete blood count was performed using ERMA INC (model PCE-210N) full automatic blood cell counter, with examination of Giemsa-stained peripheral blood smears for differential leucocyte count followed by calculation of Neutrophil-Lymphocyte Ratio (NLR) and estimation of Mean Platelet Volume (MPV).

Blood urea, serum creatinine, triglyceride, total cholesterol, HDL cholesterol, LDL cholesterol, Serum uric acid and C-reactive protein were performed by using Kone lab prime device.

Serum fibrinogen was performed by ELISA kit.

Statistical analysis of the data:

For quantitative data, the Shapiro-Wilk test for normality was performed. For data that were not normally distributed median and interquartile range (expressed as 25^{th}-75^{th} percentiles) were calculated and Mann-Whitney U and Kruskal-Wallis tests were used. For normally distributed data, values were expressed as mean ± standard deviation and Independent Samples *t*-test and One-Way ANOVA were performed for comparison between groups. For qualitative data, Pearson's Chi square test was used to examine association between two variables. Pearson's and Spearman's rank correlations were done to test associations of the studied variables with NLR and MPV. Significance was adopted at $p<0.05$ for interpretation of results of tests. All analyses were done using SPSS Version 20.

Results

Comparison between the studied groups showed statistical significance as regard to hemoglobin, neutrophil count, lymphocyte count, urea, creatinine, eGFR, 24h urine proteins, serum uric acid, CRP, serum fibrinogen.

In contrary comparison showed no statistical significance as regard age, sex, BMI, platelets and lipid profile (Triglyceride, Cholesterol, LDL and HDL) as shown in (Tables 1-7).

As for NLR, it was significantly higher in patients group in comparison to the control group as shown in (Table 3).

As for MPV, it was found that there is no statistical significance difference between both groups (p=0.611) as shown in (Table 3).

Table (1): Statistical comparison of control and patients groups as regard sex, age and BMI.

	Groups			Tests of significance	
	Study group N=50	Control group N=50	Total N=100	Test statistic	*p*-value
Sex:					
Female:					
• N	26	25	51	x^2=	.841
• %	52.0%	50.0%	51.0%	.040	
Male:					
• N	24	25	49		
• %	48.0%	50.0%	49.0%		
Age:					
• Minimum	38.00	35.00	35.00	Zmw=	.274
• Maximum	58.00	56.00	58.00	–1.095	
• Median	49.00	48.00	48.00		
• IQR	45.00-53.00	42.00-52.00	44.00-52.00		
• Mean rank	53.67	47.33			
BMI:					
• Minimum	21.60	23.70	21.60	*t*=	.583
• Maximum	34.90	33.70	34.90	–.551	
• Mean	27.62	27.92	27.77		
• SD	2.96	2.46	2.71		

Table (2): Statistical comparison of control and patients groups as regard triglycerides, serum cholesterol, LDL and HDL.

	Groups			Tests of significance	
	Study group N=50	Control group N=50	Total N=100	Test statistic	*p*-value
TG:					
• Minimum	65.00	50.00	50.00	Zmw=	.427
• Maximum	195.00	185.00	195.00	–.794	
• Median	144.50	150.00	149.00		
• IQR	90.00-175.00	80.00-180.00	82.50-180.00		
• Mean rank	52.80	48.20			
Cholesterol:					
• Minimum	45.00	111.00	45.00	*t*=	.813
• Maximum	255.00	230.00	255.00	.238	
• Mean	181.22	179.50	180.36		
• SD	40.07	31.81	36.00		
LDL:					
• Minimum	61.00	72.00	61.00	Zmw=	.699
• Maximum	153.00	144.00	153.00	.386	
•Median	107.50	105.60	106.00		
• IQR	80.00-134.00	89.00-133.00	85.00-133.50		
• Mean rank	49.38	51.62			
HDL:					
• Minimum	36.00	35.00	35.00	*t*=	.753
• Maximum	57.00	58.00	58.00	.315	
• Mean	46.22	45.82	46.02		
• SD	6.81	5.85	6.32		

Table (3): Statistical comparison of control and patients groups as regard hemoglobin, WBCs, platelets, MPV, neutrophil, lymphocytes, NLR.

	Groups			Tests of significance	
	Study group N=50	Control group N=50	Total N=100	Test statistic	*p*-value
Hb:					
• Minimum	9.00	11.00	9.00	5.424	<.001*
• Maximum	13.00	13.50	13.50		
• Median	11.25	12.25	11.80		
• IQR	10.70-11.90	11.70-12.60	11.20-12.40		
• Mean rank	34.78	66.22			
WBCs:					
• Minimum	6200.00	6000.00	6000.00	Zmw=	<.001*
• Maximum	10200.00	9800.00	10200.00	–5.706	
• Median	9000.00	7100.00	7550.00		
• IQR	7800.0-9600.0	6400.0-7500.0	6775.0-9150.0		
• Mean rank	67.04	33.96			
Platelets:					
• Minimum	180.00	184.00	180.00	Z_{mw}	.783
• Maximum	340.00	350.00	350.00	=.276	
• Median	250.00	253.00	250.50		
• IQR	220.0-290.0	224.0-295.0	220.0-292.50		
• Mean rank	49.70	51.30			
MPV:					
• Minimum	7.50	7.40	7.40	*t*=	.611
• Maximum	9.50	9.70	9.70	–.510	
• Mean	8.39	8.44	8.42		
• SD	.41	.47	.44		
Neutrophil:					
• Minimum	2140.00	2450.00	2140.00	Zmw=	<.001*
• Maximum	7585.00	5052.00	7585.00	-6.718	
• Median	5562.50	3633.50	4140.00		
• IQR	4256.0-6720.0	3146.0-3981.0	3586.50-5562.50		
• Mean rank	69.99	31.01			
Lymphocytes:					
• Minimum	1540.00	1550.00	1540.00	Zmw=	<.001*
• Maximum	2500.00	4200.00	4200.00	4.730	
• Median	2027.00	2519.50	2128.50		
• IQR	1860.0-2250.0	2090.0-2860.0	1910.50-2525.0		
• Mean rank	36.78	64.22			
NLR:					
• Minimum	1.70	.80	.80	Zmw=	<.001*
• Maximum	4.20	2.40	4.20	–7.387	
• Median	2.65	1.40	1.90		
• IQR	2.00-3.40	1.10-1.90	1.40-2.65		
• Mean rank	71.90	29.10			

Table (4): Statistical comparison of control and patients groups as regard urea, creatinine, GFR and 24h proteinuria.

	Groups			Mann-Whitney U-test	
	Study group N=50	Control group N=50	Total N=100	ZMW	*p*-value
Urea:					
• Minimum	47.00	25.00	25.00	–8.621	<.001*
• Maximum	174.00	44.00	174.00		
• Median	81.50	36.00	45.50		
• IQR	58.00-117.00	32.00-38.00	36.00-81.50		
• Mean rank	75.50	25.50			
Creatinine:				–8.622	<.001*
• Minimum	1.10	.60	.60		
• Maximum	6.80	1.12	6.80		
• Median	2.60	.89	1.11		
• IQR	1.60-3.80	.80-.90	.89-2.60		
• Mean rank	75.44	25.56			
GFR:				8.617	<.001*
• Minimum	13.52	96.41	13.52		
• Maximum	93.40	136.94	136.94		
• Median	39.99	119.00	94.91		
• IQR	27.72-63.75	106.48-127.50	39.99-119.00		
• Mean rank	25.50	75.50			
24h proteins:				–8.622	<.001*
• Minimum	145.00	15.00	15.00		
• Maximum	2400.00	29.00	2400.00		
• Median	1128.00	23.50	87.00		
• IQR	250.00-1625.00	19.00-26.00	23.50-1128.00		
• Mean rank	75.50	25.50			

Table (5): Statistical comparison of control and patients groups as regard serum uric acid, CRP and serum fibrinogen.

	Groups			Tests of significance	
	Study group N=50	Control group N=50	Total N=100	Test statistic	*p*-value
Serum uric acid:					
• Minimum	3.80	3.10	3.10	*t*=	<.001*
• Maximum	8.50	5.40	8.50	9.593	
• Mean	6.06	4.30	5.18		
• SD	1.17	.58	1.27		
CRP:					
• Minimum	6.00	2.00	2.00	Zmw=	<.001*
• Maximum	96.00	6.00	96.00	–8.662	
• Median	24.00	4.00	6.00		
• IQR	12.00-48.00	3.00-5.00	4.00-24.00		
• Mean rank	75.43	25.57			
Serum fibrinogen:					
• Minimum	278.00	185.00	185.00	Zmw=	<.001*
• Maximum	550.00	365.00	550.00	–8.074	
• Median	489.50	245.00	310.00		
• IQR	365.00-529.00	210.00-302.00	245.00-489.50		
• Mean rank	73.92	27.08			

Table (6): Statistical comparison of different stages of CKD patients as regard urine 24 hour urine protein, MPV and NLR.

	CKD						One-Way ANOVA and Kruskal-Wallis tests	
	Stage 1 N=7	Stage 2 N=8	Stage 3 N=12	Stage 4 N=13	Stage 5 N=10	Total N=50	Test statistic	*p*-value
Protein 24h:								
• Minimum	145.00	190.00	652.00	1300.00	1850.00	145.00	Zkw=	<.001*
• Maximum	185.00	273.00	1250.00	1655.00	2400.00	2400.00	46.670	
• Median	175.00	247.50	835.00	1565.00	2075.00	1128.00		
• IQR	168.00-181.00	230.00-258.50	750.00-1028.00	1527.00-1610.00	1950.00-2300.00	250.00-1625.00		
• Mean rank	4.00	11.50	21.50	34.00	44.50			
MPV:								
• Minimum	7.80	7.60	7.50	7.70	7.80	7.50	.037	.997
• Maximum	9.30	8.90	9.10	9.50	8.90	9.50		
• Mean	8.44	8.41	8.40	8.38	8.36	8.39		
• SD	.52	.42	.41	.46	.33	.41		
NLR:								
• Minimum	1.70	1.80	2.10	3.00	3.70	1.70	Zkw=	<.001*
• Maximum	1.90	2.10	2.90	3.50	4.20	4.20	45.696	
• Median	1.80	1.90	2.35	3.30	4.00	2.65		
• IQR	1.80-1.90	1.80-2.00	2.15-2.50	3.10-3.40	3.90-4.10	2.00-3.40		
• Mean rank	6.36	9.63	21.38	34.00	45.50			

In this study MPV showed no statistical correlation with serum fibrinogen, CRP, 24h urine protein, serum creatinine and eGFR (Tables 7,8), Fig. (1).

In this study NLR showed positive correlation with statistical significance with serum fibrinogen, CRP, 24h urine protein and serum creatinine and showed negative correlation with statistical significance with eGFR (Tables 7,8), Fig. (2).

Table (7): Correlation between NLR and MPV with 24 hour urine protein, eGFR, urea, serum creatinine.

	CKD patients	
	NLR	MPV
24h protein:		
• rs	.981	–0.118
• p-value	<.001*	.416
eGFR:		
• rs	–.970	0.085
• p-value	<.001*	.557
Urea:		
• rs	.845	–0.003
• p-value	<.001*	.984
Serum creatinine:		
• r_s	.937	–0.066
• p-value	<.001*	.648

Table (8): Correlation between NLR and MPV with serum uric acid, fibrinogen and serum C-reactive protein.

	CKD patients	
	NLR	MPV
Serum uric acid:		
• rs	.580	.041
• p-value	<.001*	.776
Serum fibrinogen:		
• r_s	.973	–0.126
• p-value	<.001*	.384
CRP:		
• r_s	.965	–0.118
• p-value	<.001*	.641

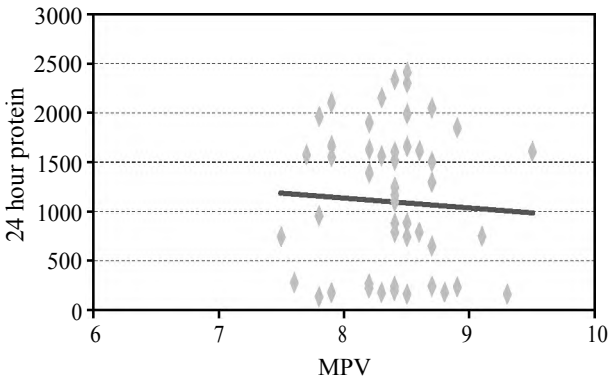

Fig. (1): Scatter plot showing correlation between MPV and 24 hour urine protein.

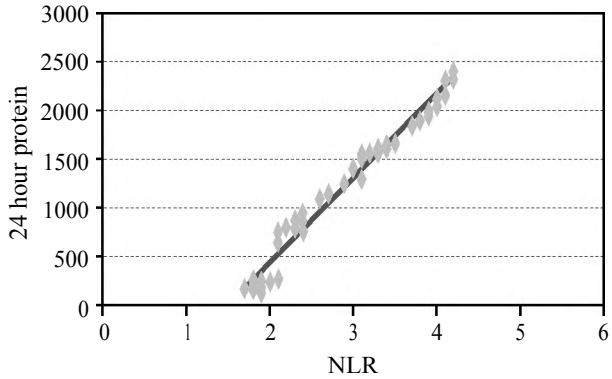

Fig. (2): Scatter plot showing correlation between NLR and 24 hour urine protein.

Discussion

CKD is a worldwide health problem because of the significant rate of morbidity and mortality. The most important cause of mortality in CKD is atherosclerosis which is mostly due to inflammation that develop in early stages of CKD **[2]**.

Proteinuria causes elevation in morbidity. Glomerulopathies that linked to proteinuria lead to abnormal protein pathway through the glomerular capillary barrier, which also causes intrinsic toxicity and it is affecting the progression of the disease. Evidence for this includes the elevated amount of protein in the urine and is accompanied with increased of tubulointerstitial inflammatory cells **[9]**.

There is many mechanisms for the tubulointerstitial damage caused by proteinuria. One of these mechanisms is inflammation that is linked to proteinuria causes receptors for T-lymphocyte CD 40 in proximal cells which is normally found on the basal wall to reach to the tubular walls. Proximal cells that connected to T lymphocytes are producing more inflammatory cytokine **[10]**.

Neutrophil to Lymphocyte Ratio (NLR) can be calculated by the ratio of absolute neutrophils to absolute lymphocytes in peripheral blood. NLR was introduced as a novel inexpensive marker that showed the severity and prognosis of systemic inflammation and atherosclerosis, and estimated survival in cardiac and non-cardiac diseases **[11,12]**.

MPV refers to the average volume of platelets in blood. It reflects abnormal variations in platelet size, which may be caused by platelet diseases. MPV is blood test that helps to determine the average size of platelets in blood and diagnose of platelet disorders and blood clotting disorders. It is a good platelet function index that can reflect platelet activation and its production rate in bone marrow **[13,14]**.

MPV and NLR are indicators of inflammation in many disorders. They are very valuable, cost effective and easy markers as they can be evaluated by a simple blood count.

In the present study, it was found that there was significant elevation in urea, serum creatinine and proteinuria between patients group as compared with healthy control group and there was significant decline of eGFR in patients group as compared with healthy control group.

This was in agreement with KDIGO **[15]** that reported prognosis of Chronic Kidney Disease (CKD) by decreasing Glomerular Filtration Rate (GFR) and increasing proteinuria. Also Cravedi and Remuzz **[16]** demonstrated that chronic kidney diseases is beginning with kidney injury that lead to glomerular hyperfiltration, proteinuria, progressive scarring of kidney and renal function loss. Proteinuria accelerates kidney disease progression through induction of tubular chemokine expression and complement activation that lead to inflammatory cell infiltration in the interstitium and sustained fibrogenesis. Proteinuria is widely recognized as a marker of the prognosis of chronic kidney disease **[10,16]**.

In the present study, it was found that there was significant elevation in fibrinogen and CRP in patients group compared with healthy control group.

This was in agreement with Goicoechea **[17]** who demonstrated that high CRP and high serum fibrinogen provide prognostic information in CKD patients. It is due to chronic inflammation of chronic kidney disease which leads to increase the amount of inflammatory markers.

Mean platelet volume is a marker of platelet activation and morphology. It is associated with different of inflammatory diseases. High MPV is associated with different conditions, like sepsis, cardiovascular and cerebrovascular disorders **[18,19]**. Low MPV is predicted as inflammatory marker in both high-grade and low-grade inflammatory disease, like attacks of familial Mediterranean fever, rheumatoid arthritis and asthma **[20,21]**.

In the present study, it was found that MPV was decreased in patients group compared with control group but not significant and we observed decreasing of MPV value with progression of CKD stages but not significant. We found no correlation between MPV, C-reactive protein and fibrinogen.

This was in agreement with Yilmaz **[22]** who reported that MPV was lower in patients with CKD compared to healthy individual but this was not statistically significant. Also, Bilen **[7]**, showed that the study with 200 patients with CKD (50 kidney transplantation, 50 hemodialysis, 50 peritoneal dialysis, 50 and stage 3-4 CKD reported no statistical difference of MPV between all groups. In contrast, Ju **[4]** showed that there is a negative linear correlation between GFR and MPV in patients with chronic kidney failure, but that MPV is increasing in patients with cardiovascular or cerebrovascular disorders. Another study, Tamadon **[23]** showed that only in CKD patients with high blood pressure, the changes in serum creatinine level have an inverse relationship with MPV. Also, Sharpe **[24]** reported that erythropoietin has an effect on thrombopoiesis in patients with chronic renal failure and increase MPV and, Yenigun **[25]** showed that his study might suggest that there were higher MPV values with diabetic male patients with CKD. Moreover, Bilen **[26]** showed that CKD patients had a decreased MPV compared with normal individuals and that it normalized at the end of the 2nd year after renal transplantation.

In the present study we did not found significant correlation between MPV with C-reactive protein, fibrinogen or proteinuria.

This was in agreement with Yilmaz **[228]** who reported that MPV was not correlated with proteinuria in CKD patients. In contrast, Sakalli **[27]** showed that in amyloidosis in familial Mediterranean fever the study which consisted of 63 pediatric patients (Group 1), 50 adult patients (Group 2), 50 healthy children (Group 3), and 43 healthy adults (Group 4) that MPV levels were significantly elevated in patients with proteinuria than patients without proteinuria in both pediatric and adult groups. Also, Bayram **[28]** reported that mean platelet volume values of diabetic patients were higher than those of non-diabetic, the highest levels being in diabetic with microalbuminuria. Moreover, Ates **[29]** reported that the platelet indices PCT, PDW, and MPV were significantly higher in patients with proteinuria than in those without it in hypertensive patients.

In the present study we excluded the patients with the known diseases that may affect MPV such as the cardiovascular diseases, cerebrovascular, malignancy, active infection and diabetes. We found in our study the decline of MPV was not significant and it may be due to the effect of uremic toxins according to the degree of renal impairment

and hormonal therapy and we did not found relationship between MPV and proteinuria.

NLR is a marker used for assessing the inflammation. NLR has been used widely to evaluate the patients with different illness. NLR is a marker that related to immune pathways. It calculated from differential WBC counts [30].

In the present study we found significant elevation of neutrophil lymphocyte ratio between patients group compared with healthy control group and we found positive correlation between NLR with C-reactive protein, fibrinogen and proteinuria with progression of CKD stages.

This was agreement with Afsar [31] that showed in 80 patients who were newly diagnosed with type 2 diabetes mellitus found a positive correlation between NLR and 24h urine protein excretion. Another study, Kahraman [32] showed that study in 112 patients with type-2 diabetes mellitus with proteinuria found positive correlation between NLR and 24h urine protein excretion. Also, [33] showed that study in 200 diabetic patient found NLR and PLR can predict inflammation and albuminuria in patients with diabetes. Also, Binnetoglu [34] showed that study in 69 patients with stage 3 and 4 CKD not diabetic or malignant found NLR is a marker with prognostic value for the presence and degree of proteinuria. Also, Yilmaz [22] showed that study in fifty-three stage (3-4) CKD patients and 30 healthy controls. Patients with diabetes mellitus, active infection, malignancy, and coronary artery disease were excluded and found that NLR is high in CKD patients and is correlated with proteinuria. Also, Okyay [35] showed that study included 30 predialysis, 40 hemodialysis, 35 peritoneal dialysis patients, and 30 healthy subjects found that NLR ratio might provide significant information regarding inflammation in CKD including predialysis and dialysis patients. Moreover, Pineault [36] showed that study included 550 patients found NLR seems to be a good inflammatory biomarker in dialysis.

Inflammation causes activation of the immune system and elevation of white blood cell counts. Increased white blood cells and its neutrophil component were significant predictors of CVD mortality [37].

Most forms of progressive kidney disease lead to a common histological results. Mesengial cells, glomeruli and tubules contact with constituents of plasma and react with blood-borne inflammatory cells cause regulation of the glomerular filtration rate and lead to glomerular sclerosis by producing macrophages, prostaglandins, neutrophils and mediators of inflammation. Neutrophils produce chemotactic substances (e.g., interleukin 8) which cause migration of neutrophil to the kidney and activation of neutrophil that increase glomerular damage. Glomerulo sclerosis and decline of renal function are associated with inflammatory cells that infiltrate the interstitium [38,39].

Inflammation that present in CKD has been demonstrated in several studies through increase the pro-inflammatory markers. Inflammation cause cardiovascular mortality through calcification and endothelial dysfunction [40,41].

Increasing of neutrophils and decreasing of lymphocytes can predict inflammation and affection of immune system, so NLR and proteinuria in patients with CKD suggests that they have immune inflammatory basis.

Limitations of the study:

There were certain limitations of this study. One was the small number of the study population. Second some of our patients were treating with erythropoietin which may influence on MPV. Third we did not investigate the effect of smoking in the study. Fourth the study was cross sectional design. It is recommended large number of populations and prospective study are needed to provide more definite conclusions.

Conclusion:

NLR is significant higher in CKD patients and it is positively correlated with the progression of CKD stages and positively correlated with proteinuria.

MPV is not statically significant between CKD patients group and healthy control group and it is not correlated with proteinuria.

The results of this study suggest that NLR is a simple marker of proteinuria and inflammation in CKD patients, but MPV needs more researches in this field.

Recommendations:

- It is recommended to screening for chronic kidney disease in adults of any age who have risk factors like obesity, dyslipidemia and first degree family history.
- There is a need to improve the chronic kidney disease patients and general population awareness of CKD complications, risk factors and the importance of life style modifications to early protect

themselves from the complications of this disease so, they will not face future adverse consequences.

- NLR should be measured annually in patients who are risky to develop CKD and for detection of proteinuria and the prognosis of CKD stages in CKD patients.
- MPV needs more researches in CKD patients.
- Further researches are required to investigate other factors affecting NLR across a broader range of populations.

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تقدير متوسط حجم الصفائح الدموية ونسبة خلايا الدم البيضاء المتعادلة إلى الخلايا الليمفاوية فى مرضى الكلى المزمن المصاحب لوجود الزلال فى البول

نفذت الدراسة على مجموعتين:

- المجموعةالأولى: ٥٠ مريض مصاب بإعتلال الكلى المزمن.
- المجموعة الثانية: ٥٠ شخص أصحاء كمجموعة مراقبة.

تم تقسيم المجموعة الأولى إلى خمسة مجموعات:

- المجموعة الأولى: تتكون من ٧ مرضى فى المرحلة الأولى من الإعتلال الكلوى المزمن.
- المجموعة الثانية: تتكون من ٨ مرضى فى المرحلة الثانية من الإعتلال الكلوى المزمن.
- المجموعة الثالثة: تتكون من ١٢ مريض فى المرحلة الثالثة من الإعتلال الكلوى المزمن.
- المجموعة الرابعة: تتكون من ١٣ مريض فى المرحلة الرابعة من الإعتلال الكلوى المزمن.
- المجموعة الخامسة: تتكون من ١٠ مرضى فى المرحلة الخامسة من الإعتلال الكلوى المزمن.

تمت الدراسة على المرضى المترددين على العيادة الخارجية للكلى بمستشفى طنطا الجامعى. وتم تنفيذ هذه الدراسة من أغسطس ٢٠١٧ إلى فبراير ٢٠١٨ وتم أخذ الموافقات من جميع المشاركين والخصوصية.

وقد خلصت الدراسة بإمكانية إستخدام نسبة الخلايا الدم البيضاء المتعادلة إلى الخلايا الليمفاوية فى هؤلاء المرضى كدلالة لمعرفة نسبة البروتين بالبول على مدار ٢٤ ساعة ومعرفة مدى تطور المرض ويوصى بعمل أبحاث أخرى لمعرفة تأثير العوامل الآخرى على نسبة الخلايا الدم البيضاء المتعادلة إلى نسبة الخلايا الليمفاوية وعمل مزيد من الأبحاث الآخرى على متوسط حجم الصفائح الدموية فى مرضى الكلى المزمن.