

## Research article

# A comparison of platelet indices in children with urinary tract and tonsillitis infection

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## ABSTRACT

**Introduction and Aim:** Platelet indices are used as diagnostic markers in many diseases and disorders. Urinary tract infections and tonsillitis are common among children. In this study we aimed to investigate whether platelet indices could be used as a marker of UTI and tonsillitis in children.

**Materials and Methods:** This study included 120 children aged between 1-10 years, who were divided into 3 groups (G1-G3). The group G1 included children suffering from UTI (n=40), G2 with only tonsillitis (n=40) and G3 only healthy children (n=40). UTI and tonsillitis were diagnosed based on different parameters including C - reactive protein, erythrocyte sedimentation rate and complete blood counts. The platelet indices (PLT count, MPV, PDW, PCT, P-LCR, P-LCC) were measured using an automatic CBC blood counting and analysis machine.

**Results:** The results in this study showed a high significant increase in (127.22), (7.179), (0.122) platelet count, PDW % and PCT% respectively and non-significant increase of P-LCC count. The results also revealed a high significant decrease in values of MPV, PDW and P-LCR (2.210), (2.315) and (6.427) respectively.

**Conclusion:** Our study suggests the platelet indices could be used as a diagnostic marker in diagnosing urinary tract infection and tonsillitis in children.

**Keywords:** Platelet indices; tonsillitis; urinary tract infection; white blood cell and disease.

## INTRODUCTION

Platelets originate from cells called megakaryocytes are involved in biological functions that include inflammation, angiogenesis, wound healing and hemostasis (1). Platelet counts are affected by environmental factors, age, sex, ethnicity etc., (2). Platelet indices include: PDW, MPV, PCT and P-LCR which are used to determine cases of thrombocytopenia (3). In children, urinary tract infection (UTI) is most common disease caused by bacterial infections which could lead to severe morbidity and mortality (4). Mean platelet volume (MPV) is one of the platelet indices utilized as a marker in UTI (5). Chronic tonsillitis and adenoid hypertrophy are other prevalent disorders common in children that cause nocturnal hypoxia, and they have a link to atherosclerosis and cardiac disease (6). MPV levels may rise in a variety of diseases, including preeclampsia, hypertension, obesity, hyperlipidemia, stroke, and renal stenosis (7). Platelet hyperactivity is a risk factor for coronary artery disease, and an increase in MPV reflects sympathetic over activity (8). Increased MPV levels are associated with increased mortality in patients with coronary artery disease (9) and linked to an increased risk of coronary artery disease in hemodialysis patients (10). Platelet indices have also shown evidence for the early detection and assessment of diabetes (11) and in the study of thrombocytopenia (12). Leukocyte and

platelet counts are measured during diagnosis to determine the (BCR-ABL) copy type, which identifies a distinct phenotypic and biological condition (13). PLT, MPV, and PDW may have high sensitivity and accuracy in diagnosis, and platelets indices are thought to be effective predictors of UTI. They can also distinguish between two types of gram positive and gram-negative bacterium (14). Thus, in this study we aimed to investigate whether platelet indices could be used as a diagnostic marker for tonsillitis and urinary tract infections in children.

## MATERIALS AND METHODS

### Experimental design

The study included 120 children (male and female) aged between 1-10 years that were distributed into three groups. Group 1(G1) included children with UTI (n=40); Group 2 (G2) with children with tonsillitis (n=40) and Group 3 (G3) included healthy children (n=40). The sample size was calculated based on the described formula (15). The study was undertaken at the University of Baghdad/College of Sciences Iraq from January 2022 to May 2022. The Scientific Research Committee of the College of Sciences Department of Biology provided ethical approval (3/1871- 8/3/2022).

### Biochemical assays

Following an appropriate diagnosis by a specialized doctor, blood was drawn from each participant by vein puncture and used in assaying the biochemical parameters. Erythrocyte sedimentation rate (ESR) was detected by the Westergren method. The C - reactive protein (CRP) was measured by using latex-enhanced nephelometry (NHANES 2007–2008). Complete blood counts which included white blood cells (WBC) count, and platelets indices (Platelets count (PLT), Mean platelet volume (MPV), the platelet distribution width (PDW), platelet crit (PCT), platelet large cell corpuscle (P-LCC) percentage, platelet larger cell ratio (P-LCR) percentage) was measured using an automated CBC blood counting and analysis machine (Mindray, Canada).

### Urine analysis

The urine was examined for routine physical and chemical tests. The samples were also subjected to microscopic examination for UTI.

### Statistical analysis

Statistical analysis was performed using the SAS (2004) system program and LSD-test. The values obtained for control and experimental groups were compared and the significance measured at  $p \leq 0.05$  level.

## RESULTS

The Mean  $\pm$  SE values obtained for age, CRP, ESR, WBC, lymphocyte, and granulocyte in groups G1, G2 and G3 in this study are presented in Table 1. As seen from Table 2 no-significant difference was observed for age among participants included in the three

groups (G1-G3). The CRP Mean  $\pm$ SE values were  $12.37 \pm 1.44$ ,  $34.53 \pm 11.69$ , and  $3.42 \pm 1.22$  mg/dL for groups G1, G2, and G3, respectively, which was statistically significant.

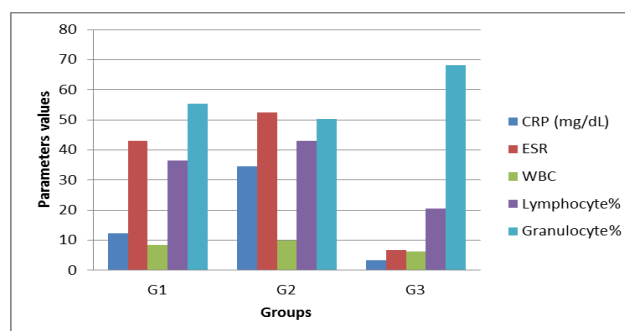
The ESR also increased significantly in the G1 and G2 groups as compared to the control G3 group. There was no significant difference in WBC count between groups G1, G2, and G3 (Table 1). The results also demonstrated a considerable increase in lymphocyte % in G1 ( $36.42 \pm 7.78$ ) and G2 ( $42.95 \pm 3.09$ ) in contrast to control G3 ( $20.60 \pm 1.40$ ). However, a considerable decrease in granulocyte percentage in G1 ( $55.40 \pm 7.27$ ), G2 ( $50.17 \pm 4.11$ ), and control G3 ( $68.28 \pm 2.55$ ) was observed (Table 1). The concentration of CRP, ESR, WBC, lymphocyte and granulocyte in urine samples in the three groups are also shown (Fig.1). Microscopically leucocyte, RBC and epithelial cells were observed in urine samples of patients (Fig.2).

The results for platelet indices PLT, MPV, PDW, PCT P-LCC and P-LCR studied groups G1, G2 and G3 are presented in Table 2. Results show a significant increase in PLT counts in G1 and G2 groups in comparison to controls. Significant decreases in MPV and PDW values were observed in G1 and G2 groups as compared to healthy control groups (Table 2). Furthermore, the results showed a substantial increase in PDW% in the examined groups G1, G2, and G3, with values of  $37.42 \pm 1.53$ ,  $37.90 \pm 3.42$ , and  $12.00 \pm 1.06$ , respectively (Table 2). The result observed a significant decrease of P-LCR% in studied groups G1, G2 in comparison to G3, while no significant increase of P-LCC count between studied groups G1, G2 and G3 was observed. Platelet indices levels in studied groups G1, G2 and G3 are depicted in Fig.3.

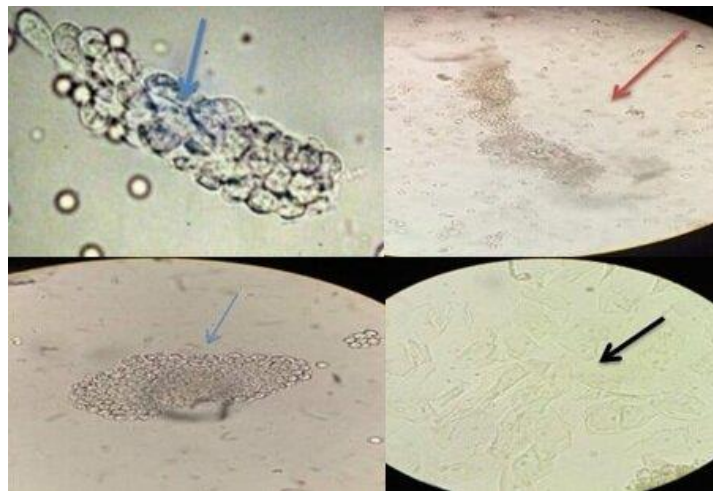
**Table 1:** The Mean  $\pm$  SE values for age, CRP, RSR, WBC, lymphocyte and granulocyte in groups G1, G2 and G3 in this study

Group	Mean $\pm$ SE					
	Age (year)	CRP (mg/dL)	ESR (mm/hr)	WBC count	Lymphocyte%	Granulocyte %
G1	$4.40 \pm 1.53$	$12.37 \pm 1.44$	$43.00 \pm 4.61$	$8.47 \pm 1.08$	$36.42 \pm 7.78$	$55.40 \pm 7.27$
G2	$5.00 \pm 1.87$	$34.53 \pm 11.69$	$52.50 \pm 7.50$	$9.72 \pm 1.04$	$42.95 \pm 3.09$	$50.17 \pm 4.11$
G3	$3.80 \pm 0.66$	$3.42 \pm 1.22$	$6.67 \pm 2.72$	$6.32 \pm 0.92$	$20.60 \pm 1.40$	$68.28 \pm 2.55$
LSD value	4.32 NS	17.86 **	17.12 **	2.208 NS	16.15*	13.29*
P-value	0.837	0.010	0.002	0.0406	0.0299	0.0414

(CRP =C-Reactive protein; ESR =Erythrocyte sedimentation rate; WBC= white blood cell)



**Fig. 1:** Concentrations of CRP, RSR, WBC, lymphocyte, and granulocyte in the studied groups (G1, G2 and G3)

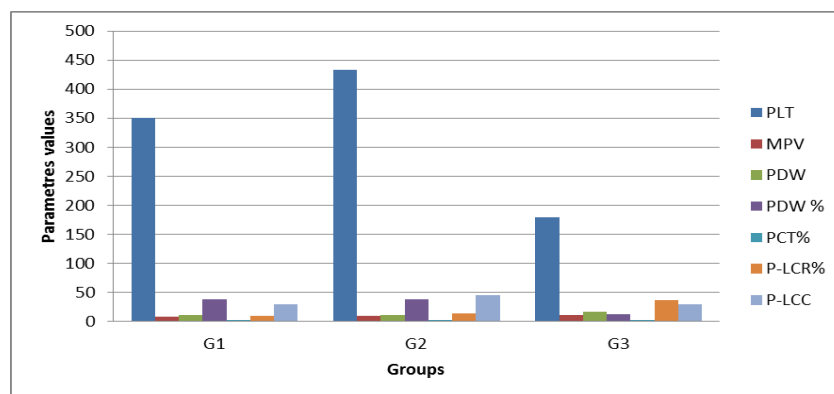


**Fig. 2:** Microscopic examination of urine samples. blue, red and black arrows point to leucocyte, RBC and epithelial cells respectively in urine samples

**Table 2.** Comparison between platelet indices in the groups G1, G2 and G3

Group	Mean $\pm$ SE						
	PLT Count	MPV (FL)	PDW (FL)	PDW %	PCT%	P-LCR%	P-LCC count
G1	349.80 $\pm$ 58.84	7.47 $\pm$ 0.22	10.32 $\pm$ 0.16	37.42 $\pm$ 1.53	0.260 $\pm$ 0.05	9.03 $\pm$ 1.46	29.00 $\pm$ 12.86
G2	433.75 $\pm$ 34.68	8.82 $\pm$ 1.23	10.63 $\pm$ 0.75	37.90 $\pm$ 3.42	0.385 $\pm$ 0.04	13.06 $\pm$ 2.05	44.33 $\pm$ 13.29
G3	178.80 $\pm$ 7.47	10.84 $\pm$ 0.33	15.30 $\pm$ 0.94	12.00 $\pm$ 1.06	.182 $\pm$ 0.01	35.25 $\pm$ 3.93	28.83 $\pm$ 10.58
LSD value	127.22**	2.210*	2.315**	7.179 **	0.122**	6.427 **	42.60 NS
P-value	0.0033	0.021	0.0015	0.0001	0.011	0.0001	0.643

Significant at \* ( $P \leq 0.05$ ), \*\* ( $P \leq 0.01$ ). Femtoliters (FL), PLT Count ( $10^3/\text{ml}$ )



**Fig. 3:** Platelet indices and their levels in groups G1, G2 and G3.

## DISCUSSION

Platelets are actively involved in host defense mechanisms and therefore considered a critical link between inflammation and several disease conditions (9, 11, 16). Platelets and cells such as leukocytes, endothelial cells have been shown to contribute to an inflammatory response leading to pathophysiological effects (16). Anemia, thrombocytosis, and neutrophilia are just a few disorders caused by inflammation that can modify blood cell levels and therefore frequently used as instruments to assess the severity of a disease (17). Thrombocytosis, which is defined as a disorder wherein the body produces too many platelets ( $>400,000/\text{mm}^3$ ) has been frequently associated with underlying infections including UTI

infections (12, 14). UTI caused by many microorganisms (18-21). In our study, we found a significant increase in PLT counts in children with UTI and tonsillitis and a high incidence of thrombocytosis as compared to healthy children. Our findings support previous studies that hypothesized that such increased platelet counts in children could be a host response to bacterial infection (22). The mean platelet volume (MPV) has been used as a platelet activation marker in infective illnesses (23). In children, MPV has been considered as either a positive (23) or negative (24) marker of inflammation, depending on whether there is an increase in platelet production and/or destruction. The MPV in children with UTI and tonsillitis was found to be significantly decreased than controls.

Decreased MPV values in children with chronic tonsillitis and gastroenteritis have been reported earlier (24, 25). Thus we presume that MPV could be used as a negative marker in children with UTI and tonsillitis.

## CONCLUSION

UTI and tonsillitis are most common among children that require early diagnosis and prompt treatment. Our results suggest the platelet indices could be used as a diagnostic marker in diagnosing urinary tract infection and tonsillitis in children.

## ACKNOWLEDGMENT

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## CONFLICTS OF INTEREST

None.

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