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Nature and Science

MARSLAND PRESS
Multidisciplinary Academic Journal Publisher

Relation between Mean Platelet Volume and Supraventricular Tachyarrhythmias

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Abstract: **Background:** Palpitation is considered one of the most common symptoms of patients presenting to the emergency department (ED). The diagnosis of palpitation is very difficult in the ED and the waiting time for first appointment with an arrhythmia clinic can be very long. **Aim of the study:** This study aimed to investigate the relation between mean platelet volume and supraventricular tachyarrhythmias. **Patients and Methods:** This study was conducted on two study groups, SVT group which came to the Emergency department with documented Supraventricular tachyarrhythmias (n=60) and healthy group. Blood samples were obtained from all patients for determining the hematologic counts and MPV during first hour in ED period. **Results:** The MPV was significantly higher in SVT Group (Group **I**) (12.11±1.36) fl than Control Group (Group **II**) (8.13±1.1) fl **(*P* <0.001)**. These results were statistically significant between two groups. **Conclusions:** In our study, mean platelet volume (MPV) was elevated in patients with documented supraventricular tachyarrhythmias (SVT). It was considered as a helpful marker in SVT patients.

[Rania Hassaan Elsayed Ebrahim Deif, Raghda Ghonimy El-sheikh, and Hatem Mohamed El-Sokary. **Relation between Mean Platelet Volume and Supraventricular Tachyarrhythmias.** *Nat Sci* 2019;17(12):366-369]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). http://www.sciencepub.net/nature. 44. doi:10.7537/marsnsj171219.44.

Keywords: Relation; Platelet; Volume; Supraventricular; Tachyarrhythmias

1. Introduction:

Supraventricular Tachyarrhythmias (SVT) is an abnormal fast heart rhythm arising from improper electrical activity in the upper part of the heart. There are four main types: atrial fibrillation, paroxysmal supraventricular tachycardia (PSVT), atrial flutter, and Wolff– Parkinson–White syndrome[1].

Mean platelet volume (MPV) is a machine-calculated measurement of the average size of platelets found in blood and is typically included in blood tests as part of the CBC. Since the average platelet size is larger when the body is producing increased numbers of platelets, the MPV test results can be used to make inferences about platelet production in bone marrow or platelet destruction problems[2].

A typical range of platelet volumes is 9.4–12.3 fl (femtolitre), equivalent to spheres 2.65 to 2.9 µm in diameter[3].

An elevated MPV means that the blood has a greater tendency to clot, which can increase the risk of thrombosis, stroke and cardiovascular disease [4].

Abnormal platelet activation has been reported in patients with A.F [5]. However, the exact mechanisms leading to platelet activation in atrial fibrillation are uncertain.

An increased MPV is an indicator of larger and more reactive platelets. Previous studies showed that increased mean platelet volume (MPV) is closely correlated with inflammation and to reflect inflammatory burden in different condition [6].

Inflammation is sufficient to facilitate the initiation of SVT, and recent evidence has demonstrated that an elevated inflammation markers may predict atrial tachycardia's in some patients[7].

Ethics of the study

An approval from Ethical Committee was obtained. An informed written consent was taken from each patient after explanation of benefits and risks. Privacy of all patients data was secured. There was a code number for every patient file that included all investigations.

2. Patients and Methods

This study was carried out in duration of one year. It was conducted upon total number 90 persons in Tanta University Hospitals classified into two groups**:**

Group I include sixty patients presented with palpitation with documented supraventricular tachyarrhythmia, they were 36 male (60%) and 24 female (40%) with a mean age of (50.3 ±13.1).

Group II (Control group**)** includes Thirty healthy persons, were 13 male (43%) and 17 female (57%) with a mean age of (47.3 ± 16.59). Patients

older than 18 years old with documented supraventricular tachyarrhythmias were included in our study. While patients with history of acute coronary syndromes within the previous 3 months, Major trauma or surgery within the previous 3 months, any chronic inflammatory diseases (including chronic rheumatologic diseases requiring immunosuppressive agents), chronic infectious diseases requiring treatment, active malignancy. acute rheumatologic or infectious diseases (including symptoms of a common upper respiratory tract infection), other condition that would be expected to cause fever, elevated white blood cell count, or elevated erythrocyte sedimentation rate. patients on immunosuppressive therapy (e.g. steroids), Patients with leukopenia of any etiology., Patients with congenital heart disease (corrected or not), Digitalis toxicity or Hyperthyroidism were excluded.

All patients were subjected to full history taking and vital signs including (HR, RR, BP, Temperature)

Routine laboratory investigations including CBC, RBS, LFT, RFT, CRP, ESR, TSH, T3 and T4.

ECG and MPV values were detected. The MPV In all patients, venous blood samples were collected into tubes containing ethylene diaminetetra acetic acid (EDTA), and processed within 1 hour after venipuncture. For the measurements of the hematologic counts and MPV, samples were analyzed within 20 min after collection.

A normal measurement for MPV is typically in the range of 9.4–12. 3 fl (femtolitre) equivalent to spheres 2.65 to 2.9 μm in diameter [3].

Statistical analysis

Data were analyzed using Statistical Program for Social Science (SPSS) version 15.0. Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage. The following tests were done: Chisquare test was used when comparing between nonparametric data. A one-way analysis of variance (ANOVA): when comparing between more than two means.

3. Results

This prospective study was carried out in duration of one year. It was conducted upon total number 90 persons in Tanta University Hospitals classified into:

Group I: Sixty patients (60) presented with palpitation with documented supraventricular tachyarrhythmias.

Group II (Control group): Thirty healthy persons (30). Age and sex matched.

In Group I: there were 32 patients presented with atrial fibrillation (AF) and 28 patients presented with supraventricular tachycardia (SVT) (Table 1.)

Table (1): Correlation of MPV with ECG changes in group I.

		MPV				T-Test or ANOVA	
		N	Mean	±	SD	T or F	P-value
ECG	AF	32	12.519	±	1.298	1.806	0.082
	PSVT	28	11.650	±	1.333		

Multivariate analysis technique is used for assessing multiple significant variables including age, sex and laboratory investigations in relation to SVT.

The results indicated that there is positive significant relation between MPV (highly significant), ESR & CRP (less significant) with SVT, while no significant relationship found with other factors (Table 2).

Table (2): Correlation of SVT with demographic data, vital Signs and laboratory investigations (multivariate analysis of SVT).

	SVT						T-Test	
	AF			PSVT				
	Mean	±	SD	Mean	±	SD	t	P-value
Age	47.625	±	12.992	53.429	±	13.001	-1.220	0.233
SBP	128.125	±	21.438	132.857	±	31.238	-0.489	0.629
DBP	78.750	±	14.549	77.143	±	18.576	0.265	0.793
Pulse	174.000	±	24.133	178.714	±	36.020	-0.426	0.673
RR	30.063	±	4.878	33.214	±	5.873	-1.606	0.120
Temp	37.126	±	0.455	37.043	±	0.323	0.566	0.576
RBS	190.313	±	77.743	178.571	±	73.526	0.423	0.675
Hb	11.769	±	2.299	10.836	±	1.511	1.292	0.207
Platelets	265.250	±	70.944	293.857	±	73.011	-1.087	0.286
TLC	8.606	±	1.831	8.521	±	1.734	0.130	0.898

	SVT						T-Test	
	AF			PSVT				
	Mean	±	SD	Mean	±	SD	t	P-value
HCT	33.250	±	7.019	29.000	±	7.494	1.603	0.120
MCV	82.750	±	8.004	85.643	±	6.617	-1.069	0.294
Lymphocytes	33.000	±	8.124	32.857	±	9.388	0.045	0.965
Neutrophils	60.688	±	12.414	56.786	±	12.879	0.844	0.406
AST	36.188	±	15.056	39.357	±	19.762	-0.498	0.623
ALT	32.500	±	13.856	39.214	±	13.740	-1.329	0.195
Urea	26.875	±	10.301	29.214	±	15.636	-0.490	0.628
Creatinine	1.119	±	0.685	1.264	±	0.588	-0.620	0.541
Na	137.750	±	4.754	131.629	±	28.703	0.842	0.407
K	4.325	±	0.694	3.950	±	0.807	1.368	0.182
Mg	1.844	±	0.429	1.800	±	0.491	0.260	0.796
MPV	12.763	±	1.151	11.371	±	1.230	3.198	**0.003***
Free T3	150.375	±	29.193	136.429	±	26.550	1.361	0.184
Free T4	1.419	±	0.497	1.779	±	0.525	-1.927	0.064
TSH	1.625	±	0.908	1.236	±	0.897	1.178	0.249
CRP	5.106	±	2.591	3.064	±	1.984	2.396	**0.02***
ESR	4.594	±	2.498	2.400	±	1.584	2.823	**0.09***

The MPV was significantly higher in SVT Group (Group **I**) (12.11±1.36) fl than Control Group (Group **II**) (8.13±1.1) fl (***P* <0.001**).

These results were statistically significant between two groups. **(Table 3).**

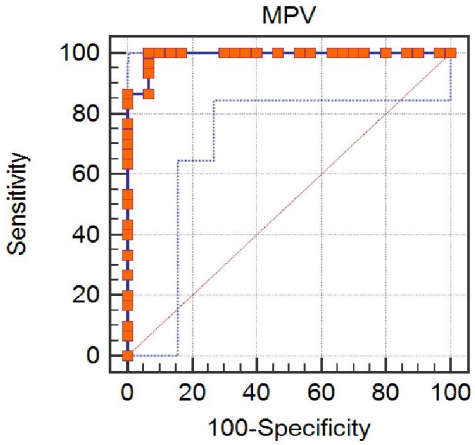
Table (3): Comparison of MPV between group I and group II.

MPV	Groups						T-Test	
	Group I			Group II			T	P-value
Range	9.5	-	14	5.9	-	10.1	12.439	**<0.001***
Mean ±SD	12.113	±	1.365	8.130	±	1.102		

In our study, the best mean platelet volume cut-off point that diagnosed supraclavicular tachycardia was > 9.4 with a diagnostic accuracy of 99.1%, positive predictive value of 93.7%, negative predictive value of 100%, sensitivity of 100%, and specificity of 93.33%.

Table (4): Sensitivity and accuracy of Mean Platelet Volume (MPV) in Supraventricular Tachyarrhythmias.

ROC curve between group I and group II					
Cutoff	**Sens.**	**Spec.**	**PPV**	**NPV**	**Accuracy**
>9.4	100.0	93.33	93.7	100.0	99.1%



4. Discussion

In this study, we aimed to investigate the relation between MPV and supraventricular tachyarrhythmias in patient attending emergency department.

Our results showed that MPV in SVT Group (Group **I**) was (12.11±1.36) While it was (8.13±1.1 in Control Group (Group **II**) and these results were statistically significant between two groups. MPV was 100% sensitive, showed 93.33 % specificity and 99.1accuracy.

These results are similar to those of **Buttarello, *et al*** [8], which indicates that the MPV levels of patients in AF are higher than those of individuals in sinus rhythm. Patients in the AF+TE group were in a hypercoagulable state. Thus, their platelet volumes

were larger, and the platelet activity and aggregation were stronger.

Ocak, et al [9]. Reported that MPV values in patients with documented SVT were significantly higher than the control group. The mean platelet volume was measured in 122 consecutive patients (46 men, 76 women) with (mean age ± SD= 32.9 ± 8.4). The control group consisted of 100 healthy subjects (mean age ± SD= 32.2 ± 8.6). The patients had significantly higher MPV values (mean ± SD=9.11 ± 1.21 fl) compared with the healthy subjects (mean± SD=8.64±0.89 fl), (P<0.001).

Weymann, Alexander, et al [10]. Study showed that MPV was also considerably higher in cases with new-onset AF compared to those with Sinus rhythm. According to our subgroup analysis, there was also a direct relationship between MPV and new-onset AF in both chronic and non-chronic AF. Sample sizes of the studies, differences in treatment with anticoagulants, and type of AF appeared to be factors of heterogeneity. Owing to insufficient number of studies on the association between Platelet distribution width (PDW) and MPV with recurrent AF, no analysis was performed in this regard.

But **Varol E [11],** was against our study as they mentioned that the method of MPV measurement is correct. However, it has to be kept in mind that there are significant associations of MPV with type 2 diabetes mellitus, pre-diabetes, smoking, hypertension, hypercholesterolemia, obesity, coronary heart disease, metabolic syndrome, statins, antihypertensive drug use and atrial fibrillation. The authors did not mention body mass index, blood pressure and levels of glucose and lipids in patients with SVT and control subjects. It has been demonstrated that obesity, type 2 diabetes mellitus, pre-diabetes, hypertension, hypercholesterolemia and metabolic syndrome increase MPV.

Recently, **Atalar et al[12]**. demonstrated that there was no platelet activation in patients with SVT during tachyarrhythmia but significantly increased platelet activity in patients with paroxysmal atrial fibrillation and chronic atrial fibrillation by measuring beta-thromboglobulin and platelet factor 4 during tachyarrhythmia attacks.

These finding was against our results which demonstrated that MPV increased in both AF and PSVT.

Conclusions and Recommendations:

In our study, mean platelet volume (MPV) was elevated in patients with documented supraventricular tachyarrhythmias (SVT). It was considered as a helpful marker in SVT patients.

Our study recommends using MPV as a marker for patients with SVT, because it considered simple and cheap test.

More studies are needed to evaluate the role of mean platelet volume in management of patients with SVT.

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