

# Assessment of the hemogram parameters in patients with paroxysmal supraventricular tachycardia: a retrospective study

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<http://dx.doi.org/10.1590/1806-9282.66.10.1371>

## SUMMARY

**OBJECTIVE:** Inflammation has been suggested as a potential mechanism in the pathogenesis of arrhythmia. Hemogram parameters such as monocyte count to high-density lipoprotein cholesterol ratio (MHR), neutrophil/lymphocyte ratio (NLR), and monocyte/lymphocyte ratio (MLR) have been considered to be markers of inflammation and new cardiovascular risk predictors. This retrospective study aimed to investigate the relationship between MHR, NLR, and MLR in patients with paroxysmal supraventricular tachycardia (PSVT).

**METHODS:** A retrospective study conducted at a university hospital in Bolu, Turkey, between 2017 and 2019. Our study included 196 patients who underwent electrophysiological study (EPS) due to palpitation or documented PSVT on electrocardiography (ECG). Patients having documented atrioventricular nodal re-entrant tachycardia (AVNRT) on ECG or inducible AVNRT on EPS were included in the PSVT group (n=130), and patients with palpitation but without inducible arrhythmia on EPS (n=66) were included in the control group. Routine biochemical and hemogram tests were performed before the EPS procedure.

**RESULTS:** When hemogram parameters were compared, there was no statistically significant difference in MHR values [0.010 (0.001-0.030) vs 0.010 (0.001-0.020)  $p=0.67$ ]. Additionally, both NLR [2.21(0.74-11.36) vs 1.98(0.72-24.87)  $p=0.13$ ] and MLR [0.25 (0.03-1.05) vs 0.24(0.07-1.39)  $p=0.41$ ] were not statistically significant between the two groups.

**CONCLUSION:** There is no significant difference in PSVT patients regarding hemogram parameters including white blood cell subtypes, MLR, NLR, and MHR. Therefore the evaluation of hemogram parameters may not be clinically relevant for PSVT patients.

**KEYWORDS:** Inflammation. Tachycardia, supraventricular. Blood cell count. Monocytes. Lipoproteins, HDL.

## INTRODUCTION

Paroxysmal supraventricular tachycardia (PSVT) is characterized by the sudden onset and abrupt termination of tachycardia<sup>1</sup>. Most patients have no associated structural heart disease. Enhanced automaticity, triggered activity, and re-entry are among

the mechanisms for PSVT<sup>2</sup>. The mechanism for tachycardia may be induced by pharmacologic and pacing maneuvers<sup>3</sup>. Atrioventricular nodal re-entrant tachycardia (AVNRT) is the most common type of PSVT<sup>2</sup>.

DATE OF SUBMISSION: 04-Feb-2020

DATE OF ACCEPTANCE: 21-Apr-2020

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Inflammation has been suggested as a potential mechanism in the pathogenesis of arrhythmia<sup>4,5</sup>. White blood cells (WBC) and their subtypes are among inflammatory markers and have been associated with cardiovascular disorders<sup>6</sup>. Recently, monocyte count to HDL-C ratio (MHR), which is obtained by dividing monocyte count by HDL cholesterol, has been reported to be a novel indicator in cardiovascular diseases<sup>7</sup>. There are few and contradictory reports about the association of PSVT and hemogram parameters<sup>8-10</sup>. And, as far as we know, there is no data for MHR and PSVT association.

## OBJECTIVE

In this study, we aimed to investigate the relationship between PSVT and hemogram parameters and MHR.

## METHODS

A retrospective cross-sectional design was used. After institutional approval, patients who underwent electrophysiological study (EPS) and catheter ablation of PSVT between December 2017 and September 2019 at our center were included. Patients' data were obtained from the computer records and files of our hospital. The study was approved by the institutional board (33443051-903.99).

We included 196 patients who underwent EPS due to palpitation or documented SVT on ECG. Patients having documented AVNRT on ECG or inducible AVNRT on EPS were included in the PSVT group, and patients with palpitation and without inducible arrhythmia on EPS were included in the control group.

The exclusion criteria included recent infection or surgery, morbid obesity (body mass index  $\geq 35$  kg/m<sup>2</sup>), severe renal or liver dysfunction, heart failure, coronary artery disease, moderate to severe valvular diseases, chronic obstructive pulmonary disease, peripheral or cerebral vascular disease, hematological disorders, malignancies, inflammatory diseases, and drug use (including antiarrhythmic agents).

Venous blood samples were drawn from the antecubital vein at the initial presentation before the EPS procedure. In order to determine hemogram parameter values, the blood samples were analyzed in the Beckman Coulter Device (Beckman Coulter Inc.; Bre CA) within 15 minutes. Basic biochemical tests and

several hemogram parameters like WBC, leukocyte subtypes [neutrophil (NEU), monocyte (MONO), and lymphocyte (LYM) counts], hemoglobin (HGB), hematocrit (HCT), mean corpuscular volume (MCV), red blood cell distribution width (RDW), platelet (PLT) count, platelet distribution width (PDW), mean platelet volume (MPV), plateletcrit (PCT) were measured, and neutrophil/lymphocyte ratio (NLR), platelet/lymphocyte ratio (PLR), RDW/platelet ratio (RPR), mean platelet volume/platelet ratio (MPR), and monocyte/lymphocyte ratio (MLR) and monocyte count/HDL cholesterol ratio (MHR) were calculated.

## STATISTICAL ANALYSIS

Data were evaluated using SPSS version 16.0 (SPSS 16.0; SPSS Inc., Chicago, IL, USA). The normality of the variables was tested with the Kolmogorov-Smirnov method. The student t-test was used for the comparison of normally distributed variables, and these data were expressed as mean  $\pm$  standard deviation (SD). The Mann-Whitney U test was used for the comparison of non-normally distributed variables, and these data were expressed as median (min-max). The Chi-square test was used for the comparison of categorical variables.  $P < 0.05$  values were considered statistically significant.

## RESULTS

A total of 196 patients were included in the study. There were 130 patients in the PSVT group (Group 1) and 66 patients in the control group (Group 2). Baseline demographic variables including age, sex, frequencies of hypertension, and diabetes were not significantly different between the groups (Table 1).

**TABLE 1.** DEMOGRAPHICS AND CLINICAL

Characteristics of the patients			
	Study Group	Control Group	P-value
Number of patients (n)	130	66	
Age (years)	51 $\pm$ 15	48 $\pm$ 18	0.24
Gender			0.48
Male	56 (%43.0)	25 (%38.0)	
Female	74 (%57.0)	41 (%62.0)	
Comorbid Disease			
Hypertension (%)	40 (31%)	23(35%)	0.56
Diabetes mellitus (%)	17(13%)	15(23%)	0.08

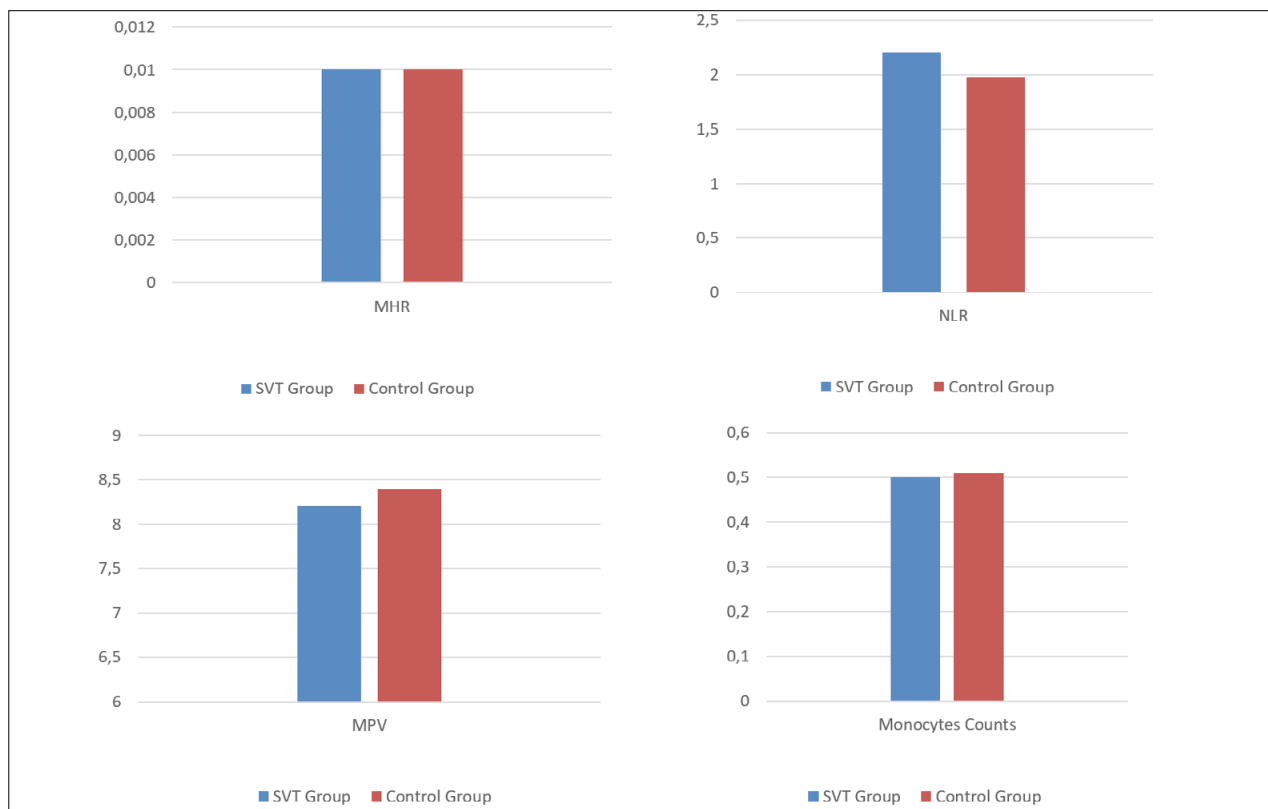
Values are expressed as mean (SD) or n (%).

Laboratory findings and studied hemogram parameters were also not significantly different between the groups (Table 2, Figure 1).

### DISCUSSION

In this study, we have found that hemogram parameters including MPV, NLR, monocyte count, and MHR were not significantly different in the PSVT

**FIGURE 1.** MHR, NLR, MPV AND MONOCYTE COUNT DISTRIBUTION OF THE SVT AND CONTROL GROUPS



MHR, monocyte/high-density lipoprotein cholesterol ratio; NLR, neutrophil/lymphocyte ratio ; MPV, mean platelet volume.

**TABLE 2.** LABORATORY DATA OF THE STUDY COHORT

	Study Group	Control Group	P-value
Hemoglobin (gr/dl)	13.7±1.5	13.5±1.6	0.31
Platelet counts (k/mm3)	247±56	253±56	0.48
RDW	14.64±1.28	15.72±1.43	0.69
PDW	17.6±1.2	17.5±1.4	0.68
MPV	8.2±1.3	8.4±1.4	0.39
PCT	0.21±0.04	0.21±0.05	0.38
Monocytes, ×109/L	0.50(0.04-0.92)	0.51(0.23-0.94)	0.62
NLR	2.21(0.74-11.36)	1.98(0.72-24.87)	0.13
MHR	0.010(0.001-0.030)	0.010(0.001-0.020)	0.67
MLR	0.25(0.03-1.05)	0.24(0.07-1.39)	0.41
MPR	0.03(0.02-0.11)	0.03(0.02-0.07)	0.84
PLR	117.2(38.5-656.08)	108.5(48.3-1492.2)	0.34
Creatinine (mg/dl)	0.80 (0.57-1.48)	0.79(0.45-1.44)	0.88
Fasting plasma glucose (mg/dl)	90(70-240)	91(71-216)	0.31
HDL-cholesterol (mg/dl)	50(27-89)	49(32-84)	0.82

Values are expressed as mean (SD) or Median (Min-Max). HDL, High-density lipoprotein; LDL, Low-density lipoprotein; TG, triglyceride; WBC, White blood cell; RDW, Red blood cell distribution width; PDW, Platelet distribution width; MPV, Mean platelet volume; PCT, Plateletcrit; NLR, Neutrophil/lymphocyte ratio; PLR, Platelet/lymphocyte ratio; MPR, Mean platelet volume/platelet ratio; MLR, Monocyte/lymphocyte ratio; MHR, Monocyte/high-density lipoprotein cholesterol ratio.

patient and control groups. Inflammation is a common condition seen in many pathological states. Inflammatory pathogenesis has also been claimed for coronary artery disease, heart failure, and arrhythmias<sup>5,11</sup>. Likewise, inflammation has been suggested to have an important role in PSVTs<sup>12</sup>.

Several mechanisms have been accused of an association between systemic inflammation and arrhythmogenesis. Inflammatory cytokines may play a particular role in arrhythmogenesis through a potential reduction in the arrhythmogenic threshold in arrhythmia-prone patients<sup>4,13,14</sup>. For instance, TNF- $\alpha$  was suggested to exert its arrhythmogenic effects at the cellular level through electrophysiological abnormalities, which may be associated with enhanced automaticity and reentrant loops, like the hyperactivation of sodium channels with abnormal calcium handling and increased action potential duration<sup>15</sup>.

Currently, hemogram parameters are, in general, recognized as inflammatory markers and prognostic determinants in a wide spectrum of diseases. These hemogram parameters have been evaluated as new predictors of cardiovascular risk<sup>6,7</sup>.

It has been suggested that increased MPV was correlated with inflammation in several conditions<sup>16</sup>. Ocak et al.<sup>9</sup> demonstrated that MPV was significantly higher in patients with documented SVT. In this retrospective study, 122 patients arriving at the emergency department with documented SVT on ECG and 100 healthy adults were analyzed. They found that, among hemogram parameters, hemoglobin, neutrophil count, MCV, RDW, platelet, WBC, and lymphocyte counts were similar to the control group, whereas MPV was significantly higher in SVT patients. However, we couldn't confirm their finding in the present study.

NLR has been suggested as an indicator of inflammation<sup>17</sup>. Aydın et al.<sup>10</sup> studied 150 patients who underwent catheter ablation of SVT and 98 healthy subjects. In this retrospective cross-sectional study, they reported that higher values of NLR were associated with SVT. Furthermore, NLR values were higher in patients in whom tachycardia was induced during EPS than those in whom tachycardia was not induced. However, Küçük et al.<sup>8</sup> recently studied 33 SVT patients and 26 control subjects who underwent EPS and suggested that NLR and MLR values were not significantly different. In accordance with Küçük et al.<sup>8</sup>, we have also found similar NLR values in PSVT patients and in the control group.

Monocytes are the largest type of WBC and have a major role in the inflammatory process of atherosclerosis<sup>18</sup>. High-density lipoprotein cholesterol (HDL-C) shows anti-inflammatory and anti-oxidant properties by inhibiting the transmigration of monocytes. Higher levels of HDL-C are associated with reduced cardiovascular disease risk<sup>19</sup>. Therefore, the integration of these two measurements as MHR can be used as an indicator of inflammation<sup>6,20-23</sup>. Accordingly, MHR has been suggested as a new prognostic marker in several cardiovascular disorders<sup>23-25</sup>. Regarding monocyte counts, Küçük et al.<sup>8</sup> have found no significant difference in SVT patients. In the present study, we have also found that MHR was not increased in SVT patients.

### Limitations

This is a single-center, retrospective small study. Lack of measurement of other inflammation markers like CRP, TNF- $\alpha$ , and interleukins is another major limitation.

### CONCLUSION

We have found no significant difference in PSVT patients regarding none of the hemogram parameters including WBC subtypes, MPV, NLR, and MHR. Therefore, the evaluation of hemogram parameters may not be clinically relevant for PSVT patients.

### Potential Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

### Sources of Funding/ Study Association

There were no external funding sources for this study.

This study is not associated with any thesis or dissertation work.

### Author's Contribution

Concept and design of the research: Cosgun M. Acquisition of data and financing: Cosgun M. Analysis and interpretation of the data, statistical analysis, and critical revision of the manuscript for intellectual content: Cosgun M, Yilmaz Gunes, Isa Sincer, Asli Kurtar Mansiroglu. Writing of the manuscript: Cosgun M, Yilmaz Gunes.

Place or institution where the work was developed, city and country: Bolu Abant Izzet Baysal University, Gölköy, Bolu/Turkey

## RESUMO

**OBJETIVO:** A inflamação tem sido sugerida como um mecanismo potencial na patogênese da arritmia. Parâmetros do hemograma, como contagem de monócitos e razão de colesterol lipoproteína de alta densidade (MHP), proporção de neutrófilos / linfócitos (NLP) e proporção de monócitos / linfócitos (MLR), foram considerados marcadores de inflamação e novos preditores de risco cardiovascular. Este estudo retrospectivo teve como objetivo investigar a relação entre MHP, NLP e MLP em pacientes com taquicardia paroxística supraventricular (PSVT).

**MÉTODOS:** Estudo retrospectivo realizado em um hospital universitário em Bolu, Turquia, entre 2017 e 2019. Nosso estudo incluiu 196 pacientes submetidos a estudo eletrofisiológico (EPS) devido a palpitações ou PSVT documentada na eletrocardiografia (ECG). Os pacientes com taquicardia nodal atrioventricular reentrante (AVNRT) no ECG ou AVNRT indutível no EPS foram incluídos no grupo PSVT ( $n = 130$ ) e os pacientes com palpitações sem arritmia induzível no EPS ( $n = 66$ ) foram incluídos no grupo controle. Testes bioquímicos e de hemograma de rotina foram realizados antes do procedimento de EPS.

**RESULTADOS:** Quando os parâmetros do hemograma foram comparados, não houve diferença estatisticamente significativa nos valores de MHP (0,010 (0,001-0,030) vs 0,010 (0,001-0,020)  $p = 0,67$ ). Além disso, tanto o NLP (2,21 (0,74-11,36) vs 1,98 (0,72-24,87)  $p = 0,13$ ) quanto o MLP (0,25 (0,03-1,05) vs 0,24 (0,07-1,39)  $p = 0,41$ ) não foram estatisticamente significantes entre os dois grupos.

**CONCLUSÃO:** Não há diferença significativa nos pacientes com PSVT em relação aos parâmetros do hemograma, incluindo os subtipos de glóbulos brancos, MHP, NLP e MHP. Portanto, a avaliação dos parâmetros do hemograma pode não ser clinicamente relevante para pacientes com PSVT.

**PALAVRAS-CHAVE:** Inflamação. Taquicardia supraventricular. Contagem de células sanguíneas. Monócitos. Lipoproteínas HDL.

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