

Mean Platelet Volume and Red Blood Cell Distribution Width as Predictors of Post-Tonsillectomy Hemorrhage

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ABSTRACT

Objective: Post-tonsillectomy hemorrhage (PTH) is one of the most common sources of postoperative morbidity especially in children. Gender, age, tonsillectomy indication, surgical technique, surgeon's skill level, INR (International Normalized Ratio) and aPTT (activated Partial Thromboplastin Time) values, localized and systemic conditions have been described as risk factors for PTH. This study focuses on determining the effect mean platelet volume (MPV) and red blood cell distribution width (RDW) levels have on PTH.

Material and Methods: A retrospective, case-control study was conducted involving 40 patients with PTH and 40 patients without PTH. The patients who had diseases that might affect the levels of MPV or RDW, were excluded. Median MPV and RDW values were compared for the two groups.

Results: The MPV median value was 7.73±0.93 fL in the hemorrhage group and 8.38±1.27 fL in the control group (p=0.038). The RDW median value was 15.4%±1.61 in the hemorrhage group and 14.6%±1.21 in the control group (p=0.007). It was determined that high RDW levels increased PTH and high MPV levels decreased PTH.

Conclusion: Low MPV value and high RDW values can be useful in predicting the risk of PTH. However, more research is needed to better understand the association between RDW values, MPV values, and PTH.

Keywords: Post-tonsillectomy hemorrhage, tonsillectomy, postoperative complications, RDW, MPV

INTRODUCTION

Otolaryngologists conduct tonsillectomy as one of the most common surgical procedures (1). Obstructive sleep apnea and recurrent tonsil infections are the most prevalent indications for tonsillectomy. Velopharyngeal insufficiency, hemorrhage, dehydration, post-obstructive pulmonary edema, and nasopharyngeal stenosis are among the post-operative complications after tonsillectomy (2). With a reported prevalence of 1–5%, post-tonsillectomy hemorrhage (PTH) is a serious complication that causes postoperative morbidity (3). PTH remains a fatal complication despite all attempts to

decrease it, including innovations in surgical methods and additional instruments and materials for effective hemostasis. Gender, age, tonsillectomy reason, surgical method, surgeon's competence level, and INR and aPTT levels are all reported risk factors for PTH (4–9).

Several recent research studies have looked at the relationship between hemorrhage and numerous blood. Red blood cell distribution width (RDW) and mean platelet volume (MPV) are the two that stand out the most among these parameters (10–13). Coagulation requires platelets, which are composed of megakaryocytes in the form of a disc. The importance of

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the MPV level in determining platelet activity may be shown in enzymatic and metabolic processes, where it was shown that bigger platelets were more effective than their smaller counterparts. This finding suggests that larger platelets have a greater impact on platelet activity. Evidence suggesting an increased MPV value results in a shortened bleeding period is conclusive (10).

When analyzing the erythrocyte population, the RDW value is what is used to determine variability (14). RDW is frequently present in the majority of diseases wherein reticulocytes are released into circulation prior to maturation. Increased RDW values have been a common denominator in cardiovascular disease instances, intestinal inflammation, heart failure cases, and cases of celiac disease not to mention being the differential diagnosis for anemia (15). In addition, an increase in RDW has been linked to increases in inflammatory markers (16,17).

To the best of our knowledge, the association between the RDW value and PTH as well as a link between MPV value and PTH has not been investigated thus far. In this study, our aim is to analyze the relationship between PTH, RDW, and MPV values.

MATERIAL AND METHODS

The records of participants who had a tonsillectomy in the Otolaryngology Department of a Tertiary Training and Research Hospital between January 1, 2008, and December 31, 2016 were analyzed for this retrospective, case-controlled research. All of the procedures that were utilized in the research that included human subjects were carried out in a manner that was compliant with the ethical standards that were established by the institution and/or the national research committee. In addition, all of the procedures were carried out in accordance with the original Helsinki statement of 1964 and any subsequent revisions or other ethical standards that were comparable. The hospital’s ethical committee accepted the trial (number: B.10.1.TKH.4.34.H.GP.0.01/120). Each participant in the research gave their own written informed consent, and this consent was collected individually.

A total of 1519 patient charts were analyzed. 9 of the patients were not included in the study due to lack of the blood test results and 155 of the patients due to having a disease effecting RDW and MPV values, thus, there were a total of 1355 participants in the research. 1315 patients had no PTH complication. 40 patients who had PTH were defined as the

Hemorrhage Group, and the median RDW and MPV values were calculated for this group.

The upper limit of normal (ULN) and lower limit of normal (LLN) of RDW and MPV data collected from 1315 patients was calculated with the mean±2 standard deviations (SD): this range of values was regarded as normal. Forty patients of similar age and sex to the Hemorrhage Group, whose rdw and mpv values are within the normal range were defined, were randomly selected as the Control Group.

The surgeries were performed by several otolaryngology specialists, using cold dissection. Operations were performed under general anesthesia in the Rose position with orotracheal intubation. Boyle–Davis gag was used to expose the tonsils. Hemostasis was achieved using bipolar electrocoagulation.

Statistical analysis

The SPSS Version 2.0 application (IBM Corporation; Armonk, NY, USA) was used to conduct the statistical analysis. A descriptive statistical analysis was carried out (mean, median, and standard deviation). The Independent Sample T Test was performed to compare the two groups for normal distribution of quantitative variables. The ULN and LLN of RDW and MPV values were computed using the mean 2±SD values within this range were regarded normal, and the mean 2±SD of logarithmic converted data values outside this range were considered abnormal.

RESULTS

The study comprised 40 hemorrhage and 40 control cases in total. The Hemorrhage Group had 26 patients, 65 percent of whom were male; similarly, the Control Group included 26 patients, 65 percent of whom were male. The Hemorrhage Group had a median age of 21.6±15.95 years, whereas the Control Group had a median age of 21.5±14.93 years. No statistically significant difference existed between the groups (p=0.897). Table 1 shows the demographic characteristics of the patients.

Analysis of total blood count factors discovered MPV values to be 7.73±0.93 fL in the Hemorrhage Group and 8.38±1.27 fL in the Control Group. The difference between the groups was statistically significant (p=0.038). Similarly, RDW median value was 15.4%±1.61 in the Hemorrhage Group and 14.6%±1.21 in the Control Group. A statistically significant difference between the groups was also found (p=0.007) (Table 2).

Table 1: Demographic data of study population

		Gender	Age (median value)	
Hemorrhage group	Male	26(65%)	21.6±15.95	p=0.897
	Female	14(35%)		
Control group	Male	26(65%)	21.5±14.93	
	Female	14(35%)		

p< 0.05

Table 2: Comparison of MPV and RDW between hemorrhage group and control group

	Hemorrhage group (median value)	Control group (median value)	
MPV	7.73±0.93 fL	8.38±1.27 fL	p=0.038
RDW	15.4%±1.61	14.6%±1.21	p=0.007

MPV: Mean platelet volume, RDW: Red cell distribution width

DISCUSSION

This study concluded that value of MPV in patients with PTH was lower than in patients without PTH, however, the value of RDW in patients with PTH was more elevated. Therefore, we think that MPV and RDW levels may be used as indicators for PTH. Thus, a shorter bleeding time is a consequence of an increased MPV value.

MPV is a very important marker used to clarify the platelets activity and function of the platelets. Platelets with a larger volume include a greater number of prothrombotic components, including beta-thromboglobulin, thromboxane A₂, and adhesion molecules. Thus, a shorter bleeding time is a consequence of an increased MPV value (10,18). The literature forwarded evidence of an association between elevated MPV values and cerebrovascular diseases, congestive heart failure, myocardial infarction and hypertension (19–21). Increased MPV levels are linked to a greater risk of mortality from ischemic heart disease, according to Slavka et al., with hazard ratios equivalent to smoking or obesity (22). On the other hand, reduced MPV levels are linked to a longer bleeding period and a higher risk of bleeding (10,18). In the same vein, the current study indicated that the levels of MPV in the PTH group were significantly lower than those in the control group.

RDW details the percentage change in the size and volume of a red blood cell in the peripheral blood. Higher RDW values suggest more variance in red blood cell size and volume. Several studies have found a link between RDW levels and vascular events. RDW values were greater in individuals with stable coronary artery disease compared to those with normal coronary angiography, according to a research by Çetin et al (23). Patients with higher RDW values were shown to have a greater likelihood of suffering from coronary artery disease and carotid plaque in a study conducted by Wen and colleagues (24). According to some experts, a high value of RDW might be a sign of persistent inflammation, which could lead to vascular events (16,17). Additionally, inflammation may have an effect on the process of erythropoiesis as well as the half-life of erythrocytes in circulation, leading to an increase in RDW levels. (25). According to the findings of Karabulut and colleagues, adult patients with epistaxis had a greater RDW value than the general population (10). In our study, we reported that the RDW value was significantly higher in the Hemorrhage Group than in the Control Group. Chronic inflammation could increase erythropoiesis which might explain the presence of high RDW in these patients.

The present research has two flaws: first, it is a retrospective study conducted at a single center; second, the data used in the study was taken from patient files. As a result, the results

need to be corroborated in prospective studies conducted at many centers.

CONCLUSION

In conclusion, low value of MPV and high value of RDW can be useful in predicting the risk of post-tonsillectomy hemorrhage. Further study is needed, however, to better understand the link between RDW, MPV, and post-tonsillectomy bleeding.

Ethics Committee Approval: This study was approved by University of Health Sciences, Umraniye Training and Research Hospital Clinical Research Ethics Committee (Date:17.10.2018, No: B.10.1.TKH.4.34.H.GP.01/120).

Informed Consent: Written informed consent was obtained.

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