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Relation of mean platelet volume with obstructive adenoid hypertrophy in children

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ABSTRACT

Objective: Adenoid hypertrophy (AH) is a common etiology of chronic upper airway obstruction. Upper respiratory tract obstruction may cause chronic alveolar hypoventilation and pulmonary vasoconstriction. In one previous study in patients with obstructive sleep apnea (OSA), it has been claimed that mean platelet volume (MPV), an indicator of platelet activation is increased and that MPV has an important role in the pathophysiology of cardiovascular diseases. We investigated in our study if MPV can be used as an indicator of obstruction due to adenoid hypertrophy.

Methods: Our study includes 61 children that underwent adenoidectomy with a mean age of 7.12 (±2.373). White blood cell, platelet count, MPV, platelet crit and platelet distribution width levels were measured before and 3 months after adenoidectomy. Children's symptoms for upper airway obstruction (UAO) (presence of snoring, mouth breathing or difficulty in breathing during sleep, obstructive breathing or apnea during sleep) were questioned in the preoperative and postoperative period by a standardized questionnaire.

Results: There was no significant difference between preoperative and postoperative mean values of MPV, hemoglobin, platelet count ($p > 0.05$). White blood cell levels were significantly higher in the preoperative period values compared with postoperative period values ($p < 0.05$). Preoperative UAO scores were significantly higher than the postoperative UAO scores. After stratification of the degree of obstruction (as mild, moderate and severe) there was no significant difference in between groups in terms of MPV values.

Conclusion: There was no significant relation between MPV levels and obstructive adenoid hypertrophy.

1. Introduction

Adenoidectomy is one of the most frequently performed surgeries in children. Major indications for this procedure are upper airway obstruction causing snoring and chronic infection involving the upper respiratory tract. Adenoidectomy is currently the most efficient treatment of adenoid hypertrophy.

Adenoid hypertrophy is an important disease in childhood period because it is the most common cause of upper airway obstruction, obstructive sleep apnea and hypoxia in children. Obstructive sleep apnea syndrome (OSAS) is defined as the cessation of ventilation during sleep and is usually associated with hypoxia and/or hypercapnia [1]. OSA exists in 1–3% of children and can occur at any age [2]. Untreated OSA causes cardiovascular complications, impaired growth, and learning and behavior problems. One recent study showed that chronic alveolar hypoventilation due to chronic upper airway obstruction causes right ventricle (RV) dysfunction induced by hypoxemic pulmonary vasoconstriction [3]. Adenotonsillectomy or adenoidectomy without tonsillectomy should be the first line therapy for children with OSA and adenotonsillary or adenoid hypertrophy [4].

Mean platelet volume (MPV) indicates platelet activation. Platelet activation is associated with cardiovascular complications. Larger platelets show more activity and have greater prothrombotic potential [5]. MPV levels increase in hypertension, hypercholesterolemia, diabetes mellitus, acute myocardial infarction and acute ischemic stroke [6]. One recent study showed that MPV levels are higher in patients with severe obstructive sleep apnea than healthy patients [7]. A study by Sagit et al. showed that MPV is increased in patients who have septal deviation and marked upper airway obstruction with snoring [8].

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Table 1
Upper airway obstruction (UAO) questtionnaire modified from ref 10. Three questions regarding the symptoms were used and were calculated as shown in the formula. Symptom scores greater than 3.5 was interpreted as severe; symptom scores between 3.5 and −1 was interpreted as moderate; symptom scores lower than −1 was interpreted as mild.

	UAO score align="left"= align="left"1.42D align="left"+ align="left"1.41A align="left"+ align="left"0.71 align="left"S align="left"− align="left"3.83		
	Mild	Moderate	Severe
UAO symptom scores	≤−1	(−1)−3.5	≥3.5

D: difficulty breathing during sleep; A: apnea observed during sleep; S: snoring. Answers: 0: never, 1: occasionally, 2: frequently, 3: always.

In our study we aimed to find out whether there would be a difference between preoperative and postoperative MPV values of children that have undergone adenoidectomy.

2. Materials and methods

Sixty one children that underwent adenoidectomy at our institution between October 2011 and April 2013 with the indication of adenoid hypertrophy were included in our study. The degree of obstruction of the nasal airway was confirmed with lateral cephalograms. Although nasopharyngeal examination using endoscopes is the gold standard in evaluating adenoid hypertrophy, objective evaluation is not possible unless computer programs or electronic images are used [9]. In order to avoid variances in selecting our study subjects we used the method described by Elwany for categorizing the level of obstruction. “Enlarged adenoid” was defined as an adenoid/nasopharynx ratio >0.7 [10]. Adenoid/nasopharynx ratio has been shown to have a good correlation with endoscopic examination findings [9]. Study group had no other airway disease except adenoid hypertrophy. Patients’ ages ranged from 4 to 11 (mean 7.12 ± 2.373). Patients with chronic diseases or a history of adenotonsillectomy were excluded from the study.

Three months before surgery and 3 months after surgery; hemoglobin, WBC, platelet count, MPV, Pct, PDW levels were measured. We investigated if there is a significant difference between preoperative and postoperative levels of these parameters.

The caregivers of all of the subjects underwent a standardised questionnaire composing of three questions for three major symptoms of UAO (ie snoring, difficulty in breathing during night sleep and apneas). Symptom score was calculated for each subject as suggested by Brouilette et al. [11]. Symptom scores greater than 3.5 was interpreted as severe; symptom scores between 3.5 and −1 was interpreted as moderate; symptom scores lower than −1 was interpreted as mild (As shown in Table 1).

Table 2
Laboratory Parameters of Study Groups. (WBC; white blood cell, MPV; mean platelet volume, Pct; Platelet crit, PDW; platelet distrubition width, ns; nonsignificant). Data is shown as mean ± standard deviation.

	Preoperative	Postoperative	p
WBC	7.9 ± 2.1	8.7 ± 2.07	$p < 0.05$
Hemoglobin	12.5 ± 0.8	12.7 ± 1.4	ns
Platelet count	354.4 ± 94.2	344 ± 84.3	ns
MPV	7.5 ± 1.07	7.7 ± 0.8	ns
Pct	0.262 ± 0.60	0.264 ± 0.55	ns
PDW	35.3 ± 14.7	34.6 ± 14.2	ns

Tripotassium EDTA based anticoagulated blood samples were drawn from the antecubital vein in the morning after 20 min rest following a fasting period of 12 h. Mean platelet volume and other hematologic parameters were measured by using Beckman Coulter LH 780 Hematology Analyzer.

Adenoidectomy was performed with cold surgical techniques by adenoid curette. No postoperative complications were observed.

This study complied with the Declaration of Helsinki and was approved by the Ethics Committee and the institutional review board of Umraniye Education and Research Hospital. Informed consent was taken from all caregivers. NCSS program was used for statistical analysis. For evaluation of data, descriptive statistical methods, as well as paired sample t test was used for comparison. Results were evaluated at 95% confidence interval, with significance at $p < 0.05$ level. Power analysis was conducted to determine the necessary patient population for obtaining reliable MPV values.

3. Results

Our study population composed of 61 pediatric patients that underwent adenoidectomy operation. Patients had a mean age of 7.12 (±2.373).

Mean values of MPV and hemoglobin, platelet count were not significantly different between preoperative and postoperative periods ($p > 0.05$). But white blood cell levels were significantly

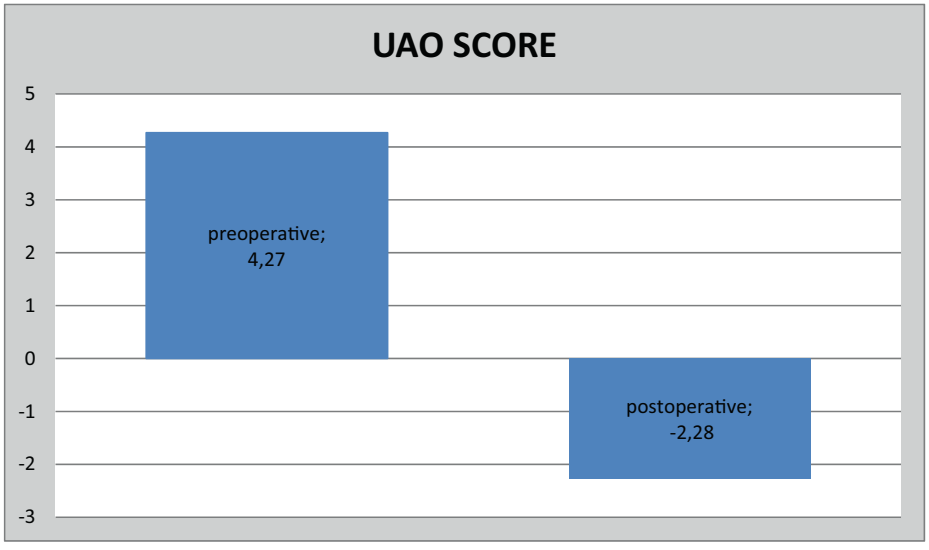

Fig. 1. Preoperative and postoperative UAO symptom severity. UAO: upper airway obstruction.

Table 3
Mean platelet values after stratification of subjects according to upper airway obstruction scores (UAO).

UAO scores	Mild	Moderate	Severe	*p*
MPV values	7.40 ± 0.62	7.40 ± 0.86	7.35 ± 0.88	ns

higher in the preoperative period compared with the postoperative period ($p < 0.05$) (Table 2).

Mean preoperative UAO scores (4.27 ± 2.96) were significantly higher than mean postoperative UAO scores (−2.28 ± 2.51) ($p < 0.01$) (Fig. 1). Normal values of MPV in children have been shown to be between 7.4 and 10.4 [12]. The mean preoperative MPV values of our study population were in the normal range described for children at this range.

Subjects were then stratified into three groups according to their UAO scores. There was no significant difference between the groups in terms of the severity of obstruction (Table 3).

4. Discussion

Adenoid hypertrophy is a common cause of recurrent and chronic nasal obstruction. Chronic nasal obstruction increases upper respiratory tract resistance. Elevated upper respiratory tract resistance leads to chronic hypoxia and hypercapnia due to alveolar hypoventilation. Chronic hypoxia and hypercapnia result in the activation of the sympathetic nervous system and cause endothelial dysfunction; as a result there may be an increase in tendency for hypercoagulopathy [13]. Hypercoagulopathy may lead to cardiovascular complications [14–16].

Mean platelet volume is one of the most important parameters showing platelet activity. Large platelets contain more dense granules, are enzymatically and metabolically more active and have greater prothrombotic potential [8]. The number of granules and adhesion receptor number by volume tend to increase in parallel and hence the risk of complications increases due to hypercoagulopathy [17].

Nasal obstruction is one of the major complaints of patients presenting to otolaryngology outpatient clinics. Adenoid hypertrophy and septal deviation are the most frequent causes of nasal obstruction. A couple of studies in adults have been published on the relationship of septoplasty operation, pulmonary artery pressure and MPV values. A study by Fidan et al. showed that after septoplasty operations pulmonary artery pressure significantly decreases [18]. Sagit et al. found that septoplasty has a curative effect for hypercoagulopathy with reducing MPV values [8]. Varol et al. demonstrated that six months of CPAP therapy caused significant reductions in median MPV values in patients with severe OSA [5]. Cevik et al. found that MPV values were significantly lower in patients with nasal polyps than controls [19]. In a study by Yilmaz et al. in children, it has been shown that adenotonsillary hypertrophy causes higher pulmonary artery pressure values and adenotonsillectomy is an effective therapeutic measure in such patients [13].

To our knowledge, this study is the first report showing the effect of adenoidectomy operation on the value of MPV. In our study, preoperative and postoperative MPV values showed no significant difference with adenoidectomy operation. Likewise, in a report by Tuncel et al., it is claimed that there is no significant difference in MPV values between asthmatic children and control groups [20].

Studies on WBC values after adenoidectomy are limited. Two recent studies failed to show any significant difference between preoperative and postoperative WBC values [8,21]. In our study, we have shown that there is a significant difference between pre and postoperative WBC values. It is likely that WBC values decreased with chronic inflammation related to obstruction of adenoid hypertrophy.

Adenoidectomy alone has been shown to be a satisfactory treatment for nasal obstruction and obstructive sleep apnea [22]. Likewise, we have once again shown that UAO symptoms decrease significantly after adenoidectomy. On the other hand, our study has not shown any effect of adenoidectomy on MPV levels. One possible reason for this is that the study group included pediatric patients; chronic hypoxia exposure time is shorter in the pediatric population than in adult patients.

Studies on the relation between upper airway obstruction and MPV values are scarce. MPV values in children may not be related to upper airway obstruction. More studies are needed to illuminate this issue.

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