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Research

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The Effect of Adenotonsillectomy on Mean Platelet Volume and Neutrophil-to-Lymphocyte Ratio

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ABSTRACT

Objectives: To explore the effect of adenotonsillectomy on mean platelet volume (MPV) levels and neutrophil to lymphocyte ratio (NLR) values in children with obstructive sleep apnea syndrome (OSAS).
Subjects and Methods: In total, 127 children (69 males, 58 females; average age 10.20±8.96 years; range, 5-18 years) who underwent adenotonsillectomy with a diagnosis of OSAS were included in the study. Pre-operative MPV levels and NLR values were compared with measurements in the post-operative third month. A *p*-value <0.05 was considered to reflect statistical significance.
Results: Mean pre-operative MPV values were 8.12±1.28 femtoliters (fL) and mean post-operative MPV values were 7.96±1.01 fL, respectively. Post-operative MPV values were significantly lower than pre-operative measurements (p=0,028, p<0.05). Mean pre-operative NLR levels were 1.46±0.82 and post-operative NLR values were 1.42±1.01, respectively. Post-operative NLR values were significantly lower than pre-operative NLR values (p=0.032, p<0.05).
Conclusion: We observed statistically significant lower MPV levels and NLR values after adenotonsillectomy in children with OSAS. Future randomized studies should explore the relationship between the MPV levels, NLR values and parameters in polysomnography in larger numbers of patients with OSAS.

KEYWORDS: Mean platelet volume (MPV); Neutrophil to lymphocyte ratio (NLR); Adenotonsillectomy; Obstructive sleep apnea syndrome (OSAS).

ABBREVIATIONS: MPV: Mean Platelet Volume; NLR: Neutrophil To Lymphocyte Ratio; OSAS: Obstructive Sleep Apnea Syndrome; QoL: Quality of Life; IEC: Institutional Ethics Committee; AH: Adenoid Hypertrophy; EDTA: Ethylene-diamine-tetracetic acid; NCSS: Number Cruncher Statistical System.

INTRODUCTION

Obstructive sleep apnea (OSA) caused by repetitive upper airway obstruction, is a syndrome characterized by recurrent episodes of sleep apnea and hypopnea. The incidence of OSA in children is reported lower than adult.[1] Obstructive sleep apnea syndrome (OSAS) may inspire poor concentration, excessive daytime somnolence, morning headaches, metabolic, cardiopulmonary and cardiovascular diseases, and a lower quality of life (QoL).[2] Polysomnography is utilized to diagnose and evaluate the severity of OSAS, and it is accepted as the gold standard diagnostic method for OSAS. The most common cause of OSAS in children is adenotonsillar hypertrophy.[1,2]

Mean platelet volume (MPV) is used as a parameter of platelet functions. Larger platelets are more reactive than platelets of normal platelets. Also, MPV is considered as a predictive value of aterosclerosis.[3] In literature, increasing MPV levels have been associated

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with the prognosis of some diseases including such as hypertension, unstable angina pectoris and OSA.[4,5] The study of Sagit et al[6] have shown that MPV levels are elevated in patients with marked septal deviation. They explained that the elevation in MPV levels of the patients with marked nasal septal deviation could be prevented by septoplasty.

Neutrophil to lymphocyte ratio (NLR) is recommended as a parameter of systemic inflammation.[7] NLR can be easily determined by a simple complete blood count analysis and is a valuable parameter in diseases such as sudden hearing loss, some cancers, autoimmune and cardiovascular diseases.[8,9] Neutrophils and lymphocytes are essential for cytokine production in inflammatory disorders on acute and chronic process, respectively.[10]

In the present study, we explored the effect of adenotonsillectomy on MPV levels and NLR values in children with OSAS.

MATERIALS AND METHODS

A retrospective review of data collected from January 2013 to January 2015 was performed at our hospital, by the Departments of Otolaryngology, Head and Neck Surgery. In total, 127 children who underwent adenotonsillectomy with a diagnosis of OSAS were included in the study. The OSAS was clinically defined by the occurrence of loud habitual snoring, witnessed apnea, and excessive daytime sleepiness at least one year due to parents observations. Patients with previous history of adenoidectomy, tonsillectomy, genetic syndromes, congenital malformations, cleft palate, nasal septal deviation, sinonasal infection, chronic diseases, hematological diseases were excluded from the study. Blood serum variables such as complete blood counts, glucose, cholesterol, triglyceride, and inflammatory markers including C-reactive protein (CRP) and erytrocyte sedimentation rate were evaluated to exclude hematological diseases, pre-operatively. No cardiovascular complaints and symptoms were determined in all of the patients. Also, electrocardiography was normal in all of the patients. All parents of the patients were informed about the study and a written consent was obtained from each parent of the patients. The study protocol was approved by the Institutional Ethics Committee (IEC). The study was conducted in accordance with the principles of Helsinki Declaration. All the patients had endoscopic examination of the oral cavity, nose and post-nasal space, pre-operatively. Adenoid tissue was classified as follows; grade 1, adenoid tissue completes less than 25% of choana; grade 2, adenoid tissue completes 25-50% of choana; grade 3, adenoid tissue completes 50-75% of choana and grade 4, adenoid tissue completes 75-100% of choana. Tonsil size was classified using Brodsky[11] grading scale as +1, tonsil hypertrophy causing less than 25% upper airway obstruction, +2 it causing 25-50% upper airway obstruction, +3 it causing 50-75% upper airway obstruction and +4, it causing more than 75% upper airway obstruction. All patients had grade 3 and 4 adenoid hypertrophy (AH) and tonsil hypertrophy. All operations risks and complications were explained to children's parents. Adenoidectomy was performed by using St. Clair-Thomsen® curatte under general anesthesia in supine position and haemostasis was secured by packing. Tonsillectomy was performed *via* cold-steel dissection approach. All the operations were performed by one of the surgeons in our department. All chidren were clinically no symptoms of infection at the time of adenotonsillectomy. Routine pre-operative blood samples were taken from the antecubital vein into tubes with ethylene-diamine-tetracetic acid (EDTA) by a nurse. Neutrophil, lymphocyte and MPV were measured by hematology analyzer machine. Normal values for MPV were accepted as 6.0-11.0 fL. NLR was calculated from the differential count by dividing the neutrophil measurement by the lymphocyte measurement. All of the patients were invited for control examinations at post-operative first week and third month. Blood samples were taken again in the post-operative third month, and the measurements were compared with pre-operative measurements.

Statistical Analysis

Number Cruncher Statistical System (NCSS) 2007 software (Kaysville, UT, USA) was used for all statistical analysis. Descriptive statistics (means and standard deviation, medians with interquartile range) were derived. The significance of intergroup differences was analyzed using Student's *t*-test, and the significance of the medians was analyzed with the Mann-Whitney U-test. A paired *t*-test was performed to test differences between preoperative and postoperative values of MPV and NLR. A *p*-value <0.05 was considered to reflect statistical significance.

RESULTS

We included 127 patients: 58(45.7%) females and 69(54.3%) males. Their average age was 10.20±8.96 years (range: 5-18 years). Mean pre-operative MPV values were 8.12±1.28 fL and mean post-operative MPV values were 7.96±1.01 fL, respectively. Post-operative MPV values were significantly lower than pre-operative measurements (p=0,028, p<0.05) (Figure 1). Mean pre-operative NLR levels were 1.46±0.82 and post-operative NLR values were 1.42±1.01, respectively. Post-operative NLR values were significantly lower than pre-operative NLR values (p=0.032, p<0.05, Figure 2) (Table 1).

DISCUSSION

Increased platelet activation may be related to an increase of cardiopulmonary risk in patients with OSAS. Also, MPV levels show indirectly the functions of platelets. MPV levels correlate with the cardiopulmonary risks and morbidity in several diseases. Patients with elevated MPV levels seem to have bad prognosis in some cardiovascular and neurological diseases such as unstable angina pectoris, myocardial infarction and stroke.[3-5] In literature, previous studies explored the effect of OSAS on MPV levels. The study of Soyalıç et al[12] have reported that MPV was higher in children with adenotonsillar hypertrophy and that

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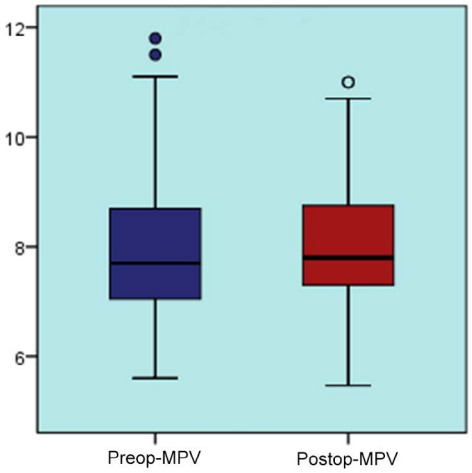

Figure 1: Mean Platelet Volume levels in pre- and post-operative terms.

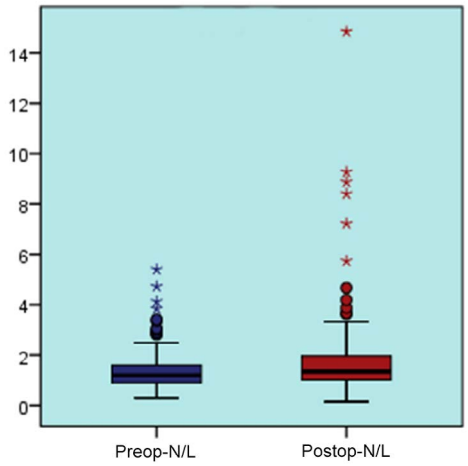

Figure 2: Neutrophil to lymphocyte ratio levels in pre- and post-operative terms.

	MPV levels(fL)	NLR values
pre-operative	8.12±1.28	1.46±0.82
post-operative	7.96±1.01	1.42±1.01
*p	p:0.028	p:0.032

MPV: Mean platelet volume; NLR: Neutrophil-to-lymphocyte ratio.
*p: Paired Samples t-test
*p<0.05

Table 1: Comparison of pre- and post-operative MPV and NLR values of patients.

adenotonsillectomy lowers MPV levels in such patients. In contrast, the study of Cengiz et al[13] have evaluated the associations between MPV levels and chronic tonsillitis-AH in children. They classified children into three groups. Group 1 consisted of patients who underwent adenoidectomy, whereas group 2 consisted of patients who underwent adenotonsillectomy and, group 3 consisted of healthy patients as control groups. MPV values (fL) in groups 1, 2 and 3 were 6.6±,0.8, 6.6±0.7 and 7.3±0.9, respectively, in their study. Also, they reported that MPV values in groups 1 and 2 were significiantly lower than control group and there was no significiant difference between group 1 and 2. These studies lead to new discussions. Overall, data on the effect of adenotonsillectomy on MPV levels remains sparse. In the present study, post-operative MPV levels reduced in children with OSAS. Therefore, we can not assert that adenotonsillectomy may reduce cardiovascular morbidity considering the lack of assessment of long-term outcomes. Confounding variables that were addressed include the study design, the study size and the characteristics of patients. To our knowledge, there is no reported study that focused on the effect of duration of OSAS on MPV levels in patients with OSAS. However, determination of the effect of duration of OSAS on MPV levels is objectively difficult. NLR is considered as an potential marker in identification of the disease severity in inflammatory disorders, including such as cardiovascular diseases, and auto-immune diseases.[7-9] The adenoid tissues, like all lymphoid tissue, enlarge when infected. Although, lymphoid tissue does act to fight infection, sometimes bacteria and viruses can lodge within it and survive. Chronic infection, either viral or bacterial, can keep the pad of adenoid tissues enlarged for years, even into adulthood.[14] In literature, there have been few studies of exploring the relationship between NLR levels and OSAS. The study of Köseoğlu et al[7] have reported that mean NLR values of the OSAS group were 1.88±0.85 and NLR values of control group were 2.01±0.85 and they found no significiant difference between OSAS group and normal group in terms of NLR values. Also, they asserted that NLR may be used as a marker that indicates chronic intermittent hypoxia in patients with OSAS. To our knowledge, the present study provides the first report of exploring the relationships between NLR and OSAS in children. In the present study, mean pre-operative NLR levels were 1.46±0.82 and post-operative NLR values were 1.42±1.01, respectively. We found that NLR values decreased by adenotonsillectomy.

Limitations of this study included a retrospective study design, the sample size, the lack of randomization and the lack of assessment of the polysomnography that is difficult procedure to be employed in children. If the study design was randomized study with performing polysomnography, the study may be more valuable. Future randomized studies should explore the relationship between the MPV levels, NLR values and parameters in polysomnography in larger numbers of patients with OSAS.

CONCLUSION

In conclusion, we observed statistically significant lower MPV levels and NLR values after adenotonsillectomy in children with OSAS. Overall, we cannot assert that adenotonsillectomy may reduce cardiovascular morbidity considering the lack of assessment of long-term outcomes.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

FINANCIAL DISCLOSURE

The authors declare that this case has received no financial support.

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