

# Can neutrophil-lymphocyte ratio, platelet-lymphocyte ratio and mean platelet volume be used as inflammation markers in patient selection for tonsillectomy?

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## Abstract

**Objective:** The aim of this study was to investigate whether mean platelet volume (MPV), neutrophil-lymphocyte ratio (NLR) and platelet-lymphocyte ratio (PLR) can be used as inflammation markers in selection of pediatric patients, who were planned to undergo tonsillectomy for sleep apnea, or not.

**Methods:** The tonsillectomy group consisted of pediatric patients who had undergone tonsillectomy for sleep apnea between 2013–2015 years. The control group consisted of children who had presented to the Well-Child Outpatient Clinics. The patient charts were reviewed retrospectively. MPV, NLR and PLR values were recorded and analyzed.

**Results:** In the tonsillectomy group, there were 23 patients whereas the control group consisted of 31 healthy children. The median age was 5 in the tonsillectomy group and 6 in the control group. MPV, NLR and PLR values did not have statistically significant differences between the tonsillectomy and control groups ( $p=0.838$ ,  $p=0.314$  and  $p=0.896$ , respectively).

**Conclusion:** MPV, NLR and PLR values are not inflammation markers that can be used in selection of patients to undergo tonsillectomy for sleep apnea.

**Keywords:** Tonsillectomy, tonsillar hypertrophy, sleep apnea, mean platelet volume.

## Özet: Tonsillotomi hasta seçiminde nötrofil-lenfosit oranı, trombosit-lenfosit oranı ve MPV inflamasyon belirteci olarak kullanılabilir mi?

**Amaç:** Bu çalışmanın amacı uyku apnesi nedeni ile tonsillotomi yapılması planlanan pediatrik hastaların seçiminde ortalama trombosit hacmi (OTH), nötrofil-lenfosit oranı (NLO) ve trombosit-lenfosit oranının (TLO) inflamasyon belirteci olarak kullanılıp kullanılmayacağını araştırmaktır.

**Yöntem:** 2013–2015 yılları arasında uyku apnesi nedeni ile tonsillotomi yapılan pediatrik hastalar tonsillotomi grubunu oluşturdu. Sağlam çocuk polikliniğine başvuran pediatrik hastalar ise kontrol grubunu oluşturdu. Hastaların dosyaları retrospektif olarak incelendi. OTH, NLO ve TLO değerleri kaydedildi ve analiz edildi.

**Bulgular:** Tonsillotomi grubunda 23, kontrol grubunda 31 hasta mevcuttu. Tonsillotomi grubunda medyan yaş ortalaması 5, kontrol grubunda 6 idi. OTH, NLO ve TLO değeri tonsillotomi ve kontrol grubunda istatistiksel olarak anlamlı farklılık göstermiyordu ( $p=0.838$ ,  $p=0.314$  ve  $p=0.896$ ).

**Sonuç:** OTH, NLO ve TLO değerleri, uyku apnesi nedeni ile tonsillotomi yapılması planlanan hastaların seçiminde kullanılabilecek inflamasyon belirteçleri değildir.

**Anahtar sözcükler:** Tonsillotomi, tonsil hipertrofisi, uyku apnesi, ortalama trombosit hacmi.

The most common indication for tonsillar surgery is tonsillar hypertrophy, which leads to sleep apnea, in the pediatric age group.<sup>[1]</sup> In recent years, tonsillectomy has frequently been used in the treatment of tonsillar hypertro-

phy, due to its advantages such as creating less surgical trauma, less bleeding and pain together with faster recovery.<sup>[2–4]</sup> Polysomnography is not routinely used for diagnosis in pediatric patients. An indication of tonsillectomy is

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based on findings in medical history and physical examination. There has been no available marker reported for decision-making on the indication for tonsillotomy.

Recently, mean platelet volume (MPV), the neutrophil-lymphocyte ratio (NLR) and the platelet-lymphocyte ratio (PLR), which are prominent inflammation markers, have been studied on patient groups having sleep apnea. Besides the reports showing a correlation of these values with the disorder, there have also been publications that revealed no relationship.<sup>[5-7]</sup>

We reviewed the pediatric patients who had undergone tonsillotomy with the indication of sleep apnea and investigated whether MPV, PLR, and NLR values can be used as inflammation markers.

## Materials and Methods

The charts of 23 pediatric cases, who had been admitted to the Outpatient Clinics of Department of Otorhinolaryngology between May 2013 and June 2015 with symptoms of sleep apnea such as sleeping with the mouth open, snoring, nocturnal enuresis, attention deficit, witnessed apnea and problems in learning, in whom grade 4 tonsillar hypertrophy had been identified, and tonsillotomy had been performed by cold knife-bipolar cautery, were reviewed retrospectively. In tonsillotomy cases, polysomnography was not performed during decision-making for indication. These patients constituted the tonsillotomy group. For the NLR, PLR and MPV values of the tonsillotomy group, the complete blood counts (hemogram) used for anesthetic evaluation during the preoperative period were used. The MPV, NLR, and PLR values of all patients were measured by using the same hematology analyzer.

For the control group, non-obese children, who were admitted to the Well-Child Outpatient Clinic, with no cardiac or acute infectious disease, in whom medical history revealed no infection in the last 2 months, no antibiotic use within the last month, no snoring, absence of sleeping with the mouth open, witnessed apnea or nocturnal enuresis, no attention deficit, who did not have a chronic inflammatory disorder and in whom tonsillar size was grade 1–2 in physical examination, were randomly selected. The charts of the subjects in the control group were reviewed retrospectively. The complete blood counts during their admissions were used for NLR, PLR, and MPV values. The MPV, NLR, and PLR values of all subjects in the control group were measured by using the same hematology analyzer. NLR value was calculated by dividing neutrophil count to lymphocyte count. PLR value was obtained by dividing platelet count to lymphocyte count.

The age, gender, MPV, NLR and PLR values were recorded, and the data were statistically analyzed.

## Statistical analysis

Compliance of quantitative variables with normal distribution was analyzed with the Kolmogorov-Smirnov test. Since MPV variable was consistent with normal distribution, t-test for independent groups was used for comparisons between groups and descriptive statistics were shown as a mean  $\pm$  standard deviation. Since the variables of age, NLR and PLR did not comply with the assumption of normal distribution; the analysis was performed by Mann-Whitney U test for intergroup comparisons, and the descriptive statistics were shown as median (25–75 percentiles). For comparison of groups regarding gender, the chi-square test was used. A value of  $p < 0.05$  was considered statistically significant.

## Results

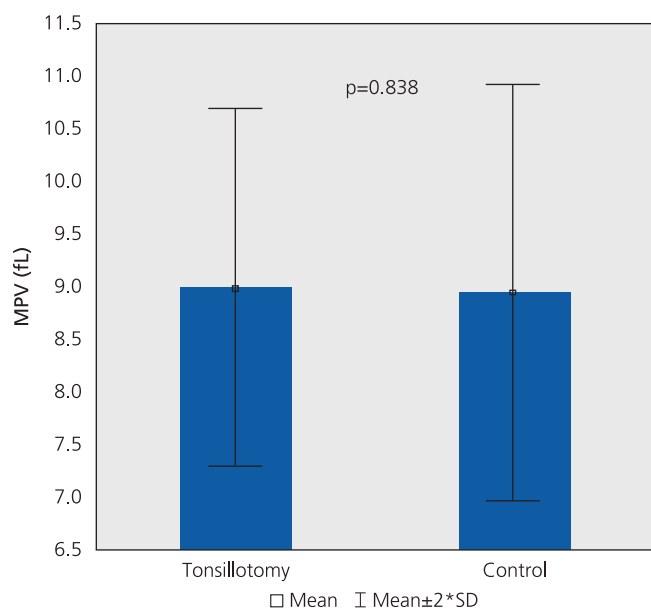
There were 23 patients in the tonsillectomy group and 31 subjects in the control group. The median age was 5 (range: 2–16) years in the tonsillotomy group, whereas 6 (range: 2–15) years in the control group. The female/male ratio was 11/12 in the tonsillectomy group and 16/15 in the control group. There were no statistically significant differences between the two groups regarding age and gender (Table 1). MPV value did not have any statistically significant difference between the tonsillotomy and control groups ( $p = 0.838$ ) (Fig. 1). NLR value did not have any statistically significant difference between the tonsillotomy and control groups ( $p = 0.314$ ) (Fig. 2). PLR value did not have any statistically significant difference between the tonsillotomy and control groups ( $p = 0.896$ ) (Fig. 3).

## Discussion

Tonsillectomy and tonsillotomy are commonly used surgical methods in the treatment of tonsillar hypertrophy which

**Table 1.** Demographic characteristics, median MPV, NLR and PLR values in terms of groups, and p values.

	Tonsillotomy group (n=23)	Control group (n=31)	p value
Age (years)	5 (2–16)	6 (2–15)	
Gender (Female/Male)	11/12	16/15	
Mean platelet volume (MPV) (fL)	8.99 $\pm$ 0.84	8.93 $\pm$ 0.98	0.838
Neutrophil-lymphocyte ratio (NLR)	1.28	1.05	0.314
Platelet-lymphocyte ratio (PLR)	109.4	96.8	0.896



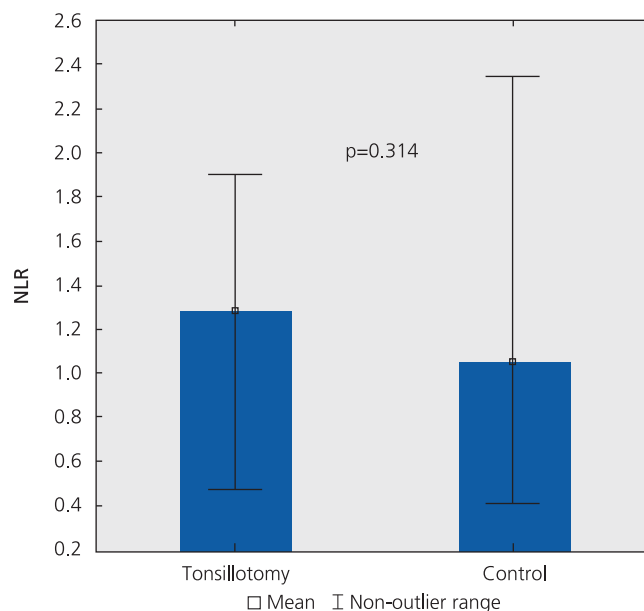
**Fig. 1.** Statistical difference of mean platelet volume (MPV) value between the groups.

causes obstructive sleep apnea in children. According to the report of American Academy of Otolaryngology-Head and Neck Surgery Foundation, tonsillectomy has the primary role in the treatment of sleep apnea related to tonsillar hypertrophy.<sup>[8]</sup> However, tonsillotomy has started to be used as an alternative method in the treatment of tonsillar hypertrophy in recent years, since it leads to less postoperative pain and bleeding.<sup>[9]</sup> The high efficacy of tonsillotomy in the treatment of pediatric sleep apnea has been proven by polysomnography.<sup>[10]</sup>

Windfuhr and Werner have defined two types of operations for reducing the tonsillar size in their study; tonsillotomy and partial intracapsular tonsillectomy.<sup>[9]</sup> Tonsillotomy can be performed by using a laser, coblator, cold knife, radiofrequency, microdebrider, monopolar needle cautery or bipolar cautery.<sup>[11-14]</sup> In our study, cold knife and bipolar cautery were used for tonsillotomy.

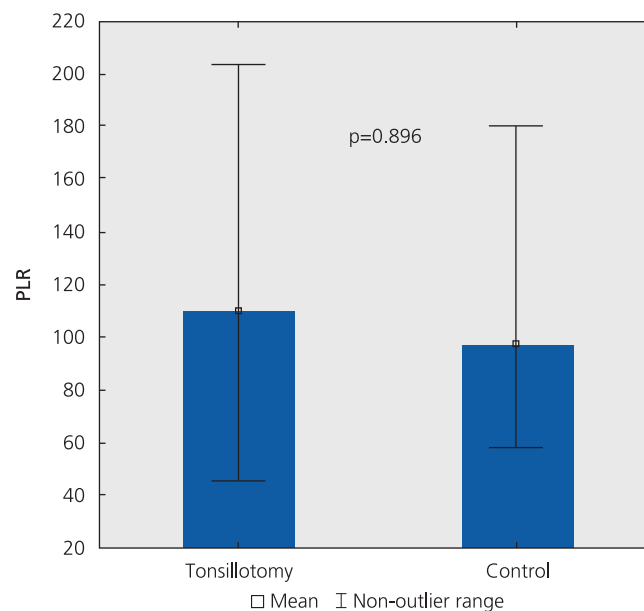
Regarding tonsillar hypertrophy, the mechanism causing obstructive sleep apnea has not been clearly identified in children.<sup>[15]</sup> Although the pathogenesis of sleep apnea is not clear yet, increase in the levels of inflammatory markers is well-known.<sup>[16]</sup> There are many inflammatory pathways and markers which play a role in the pathophysiology of sleep apnea in children.<sup>[17]</sup> CRP, interleukins, TNF- $\alpha$ , TNF- $\beta$ , adiponectin, and leptin are some of these markers.<sup>[18-20]</sup>

The sleep-related respiratory disorder is known to be associated with low-level systemic inflammation, and it is



**Fig. 2.** Statistical difference of neutrophil-lymphocyte ratio (NLR) value between the groups.

characterized by recurrent collapse of the upper airway.<sup>[21]</sup> Recently, NLR, PLR and MPV values, which have come to the forefront as inflammation markers, have been studied in patient groups with sleep apnea and varying results have been obtained.<sup>[5-7]</sup>



**Fig. 3.** Statistical difference of platelet-lymphocyte ratio (PLR) value between the groups.

Increased MPV has been shown to be associated with cardiovascular complications and sleep apnea.<sup>[7]</sup> Increased MPV has also been shown to be associated with upper airway obstruction which is accompanied by snoring.<sup>[22]</sup> Onder et al. have shown that no correlation was present between obstructive adenoid hypertrophy and MPV.<sup>[7]</sup> According to our study results, MPV does not have a diagnostic value as a marker in patient selection for tonsillotomy.

Neutrophil-lymphocyte ratio is a marker of systemic inflammation and increased NLR was shown to be correlated with unfavorable prognosis of the cardiac disease.<sup>[23,24]</sup> In patients with severe apnea, besides the presence of reports showing a relation between NLR and apnea-hypopnea index (AHI), there are also reports which have determined no relation between NLR and sleep apnea.<sup>[25,26]</sup> NLR has been reported to be usable as a marker to show chronic intermittent hypoxia.<sup>[27]</sup> According to our study results, NLR does not have a diagnostic value as a marker for patient selection for tonsillotomy.

Platelet lymphocyte ratio increases in peripheral arterial disorders, some malignancies and myocardial infarct with poor prognosis.<sup>[28-31]</sup> Koseoglu et al. have shown that PLR value was reduced in sleep apnea.<sup>[27]</sup> In another study, showing that PLR value was increased in patients with severe apnea, it has been suggested that PLR can be used as a marker for diagnosis of cardiovascular disorders in patients with obstructive sleep apnea syndrome (OSAS).<sup>[32]</sup> According to our study results, PLR does not have a diagnostic value as a marker for patient selection for tonsillotomy.

Numerous studies in which NLR, PLR, and MPV values have been investigated in patients with sleep apnea and having different results are present in the medical literature. In this study, we were not able to determine any relationship of pediatric sleep apnea with NLR, PLR, and MPV values. This result may be explained either by the relation of sleep-related respiratory disorder with low-level systemic inflammation or rarity of cardiovascular complications due to sleep apnea in this age group.

## Conclusion

As a conclusion, we consider that NLR, PLR, and MPV are not markers which can be used in patient selection for tonsillotomy with the indication of sleep apnea and do not have any diagnostic value for this patient group.

**Conflict of Interest:** No conflicts declared.

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