Abant Tıp Dergisi

Abant Medical Journal

Abant Med J 2024;13(3): 111-115, doi:10.47493/abantmedj.1559691

Impact of Adenotonsillectomy on Pediatric Blood Profiles

Adenotonsillektominin Pediatrik Kan Profilleri Üzerindeki Etkisi

Ahmet KÖDER [1*], Saffet KILIÇASLAN [2]

[1] Department of Otorhinolaryngology, Faculty of Medicine, Trakya University, Edirne, Türkiye

[2] Düzce Atatürk State Hospital, Düzce, Türkiye

Geliş Tarihi (*Received*): 01.10.2024 **Kabul Tarihi (*Accepted*):** 21.11.2024 **Yayın Tarihi (*Published*):** 31.12.2024

Abstract

Objective: Adenotonsillar hypertrophy (ATH) is a common condition in children, often leading to obstructive sleep apnea and other complications. This study aimed to evaluate the impact of adenotonsillectomy on various blood parameters in children with ATH.

Materials and Methods: Medical records of 84 children diagnosed with ATH and/or chronic tonsillitis, who underwent adenotonsillectomy, were reviewed. Key parameters analyzed included white blood cell count (WBC), platelet count (PLT), hemoglobin (Hgb) levels, mean platelet volume (MPV), and platelet distribution width (PDW). Blood samples were collected preoperatively, and at postoperative day 1, week 1, and month 3, and results were compared.

Results: A significant decrease in MPV, PDW, and Hgb levels was observed immediately postoperatively. Interestingly, Hgb levels significantly increased three months post-surgery, returning to or surpassing preoperative levels. Although platelet counts remained unchanged, the temporary reduction in RBC count, Hgb, and Hct levels suggests a physiological response to surgical blood loss and trauma. These parameters normalized within three months, reflecting the body's effective compensatory mechanisms.

Conclusion: Adenotonsillectomy significantly impacts certain blood parameters in the short term, with most values normalizing by the three-month follow-up. These findings emphasize the importance of monitoring hematologic changes postoperatively and suggest that adenotonsillectomy, while causing temporary alterations in blood parameters, is ultimately a safe and effective procedure for managing ATH in children.

Keywords: Adenotonsillectomy, Hemoglobin, Adenotonsillar Hypertrophy, Platelet, Tonsillectomy.

&

Öz

Amaç: Adenotonsiller hipertrofi (ATH), çocuklarda sık görülen bir durumdur ve sıklıkla obstrüktif uyku apnesi ve diğer komplikasyonlara yol açar. Bu çalışmanın amacı, ATH'li çocuklarda adenotonsillektominin çeşitli kan parametreleri üzerindeki etkisini değerlendirmektir.

Gereç ve Yöntemler: ATH ve/veya kronik tonsillit tanısı konulan ve adenotonsillektomi geçiren 84 çocuğun tıbbi kayıtları incelendi. Analiz edilen temel parametreler arasında beyaz kan hücresi sayısı (WBC), trombosit sayısı (PLT), hemoglobin (Hgb) seviyeleri, ortalama trombosit hacmi (MPV) ve trombosit dağılım genişliği (PDW) yer aldı. Kan örnekleri ameliyattan önce ve ameliyattan sonraki 1. gün, 1. hafta ve 3. ayda toplandı ve sonuçlar karşılaştırıldı.

Bulgular: MPV, PDW ve Hgb seviyelerinde ameliyattan hemen sonra önemli bir azalma gözlendi. İlginç bir şekilde, Hgb seviyeleri ameliyattan üç ay sonra önemli ölçüde artarak ameliyat öncesi seviyelere geri döndü veya onları geçti. Trombosit sayıları değişmeden kalsa da RBC sayısı, Hgb ve Hct düzeylerindeki geçici azalma, cerrahi kan kaybına ve travmaya karşı fizyolojik bir tepki olduğunu düşündürmektedir. Bu parametreler, vücudun etkili telafi edici mekanizmalarını yansıtarak üç ay içinde normale dönmüştür.

Sonuç: Adenotonsillektomi, kısa vadede belirli kan parametrelerini önemli ölçüde etkiler ve çoğu değer üç aylık takipte normale döner. Bu bulgular, hematolojik değişikliklerin ameliyattan sonra izlenmesinin önemini vurgulamaktadır ve adenotonsillektominin, kan parametrelerinde geçici değişikliklere neden olsa da çocuklarda ATH'yi yönetmek için nihayetinde güvenli ve etkili bir prosedür olduğunu düşündürmektedir.

Anahtar Kelimeler: Adenotonsillektomi, Hemoglobin, Platelet, Adenotonsiller Hipertrofi, Tonsillektomi.

Atıf/Cite as: Köder A, Kılıçaslan S. Impact of Adenotonsillectomy on Pediatric Blood Profiles. Abant Med J. December 2024;13(3):111-115. doi:10.47493/abantmedj.1559691

[*] **Sorumlu Yazar (Corresponding Author):** Ahmet Köder, **e-mail**: ahmetkoder@yahoo.com

Introduction

The palatine tonsils are dense, compact clusters of lymphoid tissue found in the side wall of the oropharynx, bordered at the front by the palatoglossus muscle and at the back by the palatopharyngeus and superior constrictor muscles (1). The adenoids, another essential part of the immune system, are situated on the roof and back wall of the nasopharynx (2). Together, the tonsils and adenoids are components of Waldeyer's ring, a circle of lymphoid tissue in the pharynx that is vital for protecting the body from pathogens. The size of the tonsils changes with age, individual variations, and health conditions, usually growing quickly around the fifth or sixth year of life and reaching their largest size during puberty.

Assessing the tonsils and adenoids should begin with a thorough medical history, as this can reveal symptoms indicative of adenotonsillar hypertrophy (ATH). Symptoms of ATH encompass feeding difficulties in young children, mouth breathing, noisy breathing, loud snoring, frequent night awakenings, excessive daytime drowsiness, bedwetting, night terrors, behavioral shifts, and poor school performance. A physical exam might show adenoid facies, marked by a dull facial look, flattened nasolabial folds, an open mouth, and protruding upper teeth. In severe cases, heart failure might occur, and children may sleep in unusual positions, like the sniffing position or with an extended neck. Growth can be impacted, leading to failure to thrive.

Adenotonsillar hypertrophy is the leading cause of upper airway blockage in children, resulting in various short-term and long-term symptoms. Short-term issues include mouth breathing, nasal blockage, nasal-sounding speech, snoring, obstructive sleep apnea (OSA), chronic sinus infections, and repeated ear infections. Long-term complications of OSA involve growth delays, heart problems, and cognitive issues like low IQ, learning and behavior difficulties, hyperactivity, and poor focus (3). The primary indications for adenotonsillectomy in children are recurrent adenotonsillitis, repeated episodes of serous otitis media, peritonsillar abscess, and, most commonly, apnea associated with adenotonsillar hypertrophy (4). Despite improvements in surgical techniques, postoperative hemorrhage continues to be a frequent cause of mortality and morbidity in patients after tonsillectomy (5). Post-tonsillectomy hemorrhage is rare, yet it remains the leading cause of reoperation and mortality in children following tonsillectomy (6).

Given the significant health impact of ATH, understanding the systemic effects of adenotonsillectomy is essential. Platelet indices and white blood cell (WBC) count are key indicators of systemic inflammation and overall health (7). This study aims to investigate the changes in blood markers in patients with ATH who underwent adenotonsillectomy, providing insight into the broader physiological effects of this common surgical intervention.

Materials and Methods

This study was conducted at the Van Education and Research Hospital Otorhinolaryngology Department and reviewed retrospectively. Data from patients treated between 2016 and 2018 were utilized. Ethical approval was obtained from the Van Education and Research Hospital Clinical Research Ethics Committee, with decision number 2016/4. The study included 84 children (44 male, 40 female) who underwent adenotonsillectomy using the cold knife dissection method for tonsillectomy and the curettage method for adenoidectomy. Exclusion criteria included systemic disease or intraoperative bleeding exceeding 200 cc. All participants were residents of Van with at least an average socioeconomic status. The outcome parameters assessed included mean values of WBC, hemoglobin (Hgb), hematocrit (Hct), platelet distribution width (PDW), and mean platelet volume (MPV), measured preoperatively, on postoperative day 1, at one week postoperatively, and at three months postoperatively. Data was reviewed retrospectively, and postoperative values were compared to preoperative values. Statistical analysis was performed using SPSS® 20.0 software (SPSS Inc., Chicago, IL, USA). Variables such as WBC, Hgb, Hct, PDW, and MPV were analyzed using repeated measures ANOVA. The McNemar test was used to compare postoperative values with preoperative values. A p-value of <0.05 was considered statistically significant.

Results

The study population consisted of 44 male children (52.3%) and 40 female children (47.6%), with a mean age of 7.07 ± 0.27 years (range: 3 to 10 years). The mean values of WBC, Hgb, Hct, PLT, PDW, and MPV were

recorded at four different times: before the operation, on the first day after the operation, one week after the operation, and three months after the operation. (Table 1). Compared to preoperative values, Hgb, MPV, and PDW significantly decreased ($p < 0.05$) on postoperative day 1 and week 1. WBC values significantly increased on postoperative day 1 ($p < 0.05$). There was no significant difference in preoperative versus postoperative PLT counts. No post-tonsillectomy bleeding was observed in any patient. By three months post-surgery, blood levels had returned to or surpassed preoperative values, with significant increases in Hgb, Hct, MPV, and PDW ($p < 0.05$).

Table 1.
WBC, Hgb, Htc, PLT, PDW, MPW values of participants

	WBC	Hgb	Htc	PLT	PDW	MPV
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Median (min-max)	Mean±SD
Preop	7.7±2.9	12.27±0.86	36.81±2.32	299000±70000	16.3 (15.5–18.7)	8.32 ±1.12
Postop 1.day	8.4±3.1	12.08±0.85	36.24±3.54	295000±72000	15.4 (13.9–16.8)	8.07 ±1.08
Postop 1.week	7.8±2.8	12.37±0.83	37.13±2.82	298000±75000	15.6 (14.0-17.5)	8.10±1.05
Postop 3.month	7.5±2.5	12.71±0.85	38.13±3.60	300000±71000	16.0 (15.2-18.6)	8.21±1.20

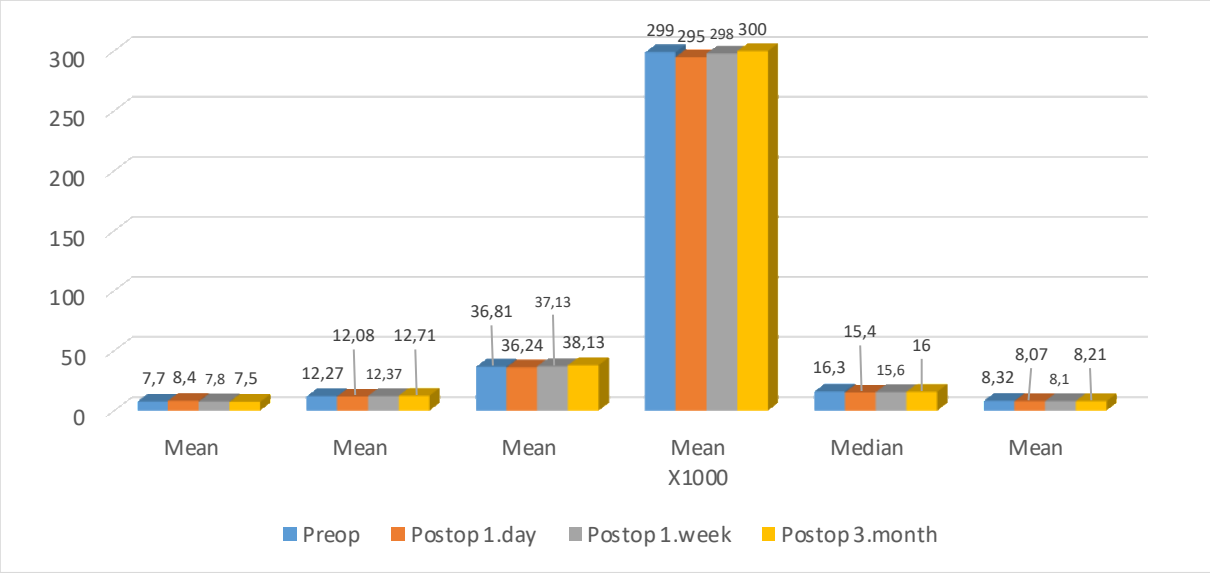

Figure 1. WBC, Hgb, Htc, PLT, PDW, MPW values of participants.

Discussion

Tonsillar hypertrophy is now the most common reason for tonsillectomy in children. Tonsillar hypertrophy is often accompanied by adenoid hypertrophy.

Adenotonsillar hypertrophy (ATH) is closely linked to sleep-disordered breathing (SDB) in children (8). Hypertrophic tonsils causing acute upper airway obstruction are typically associated with acute infections rather than chronic ones (9). Chronic tonsillar hypertrophy can be asymptomatic but may cause significant enlargement, which is responsible for up to 80% of obstructive sleep apnea (OSA) cases in children. Severe cases of OSA can result in cor pulmonale, pulmonary hypertension, pneumonia, chronic hypercapnia or hypoxia, and ultimately, right ventricular heart failure (10). Adenotonsillectomy is a common treatment for

ATH and is highly effective for treating upper airway obstruction and recurrent tonsillitis, regardless of the technique used. Consequently, tonsillectomy, with or without adenoidectomy, is among the most frequently performed surgeries in pediatric ENT practice (4). Perioperative blood loss is an unavoidable aspect of surgery, and minimizing intraoperative blood loss is ideal. Perioperative and postoperative blood loss in adenotonsillectomy is influenced by the surgical technique, the patient's coagulation status, perioperative infections, and systemic metabolic conditions (11).

In children, blood loss and postoperative effects are more pronounced compared to adults. Children's physiological mechanisms are less adaptable to rapid blood loss, making them more susceptible to significant changes in blood parameters and complications (12). The early postoperative period involves the body's compensation for blood loss.

The study's results provide valuable insights into these physiological responses. The study's results suggest that adenotonsillectomy is effective for ATH, with an immediate decrease in MPV, PDW, and Hgb levels reflecting a physiological response to surgical trauma and blood loss. The transient reduction in RBC count, Hgb, and Hct levels aligns with similar studies documenting decreases in these parameters following surgical interventions in children (11-13).

Importantly, these blood parameters normalized within three months post-surgery, indicating effective compensatory mechanisms and recovery. During this period, increases in hematopoietic and other growth factors contribute to overall body growth and accelerated hematopoiesis. A study by Gumussoy reported significant increases in growth factors and hormones (14). The observed increases in RBC, Hb, Hct, MPV, and PDW at one and three months postoperatively can be attributed to these growth factors. This supports previous research showing that, despite initial decreases, blood values typically return to baseline levels as healing progresses (12).

The stable platelet count suggests that while surgery affects some blood parameters, the overall platelet count remains unaffected, minimizing significant bleeding risks. The study emphasizes that perioperative and postoperative blood loss is influenced by surgical technique, coagulation status, and systemic conditions. Minimizing intraoperative blood loss is crucial to optimizing outcomes and reducing complications, aligning with best practices in pediatric ENT surgery (4).

The findings highlight the particular vulnerability of children to blood loss and postoperative effects. Children's less adaptable physiological mechanisms compared to adults underscore the need for careful monitoring and management during the perioperative period to ensure optimal recovery and mitigate risks.

Despite providing valuable insights, the study's retrospective design and use of a single surgical technique may limit generalizability. Future research could benefit from prospective studies comparing different surgical techniques and their impact on blood parameters and overall recovery.

Conclusion

Adenotonsillectomy remains a highly effective procedure for managing ATH and associated complications. The findings emphasize the importance of monitoring blood parameters and addressing postoperative issues promptly. Further research is needed to refine surgical techniques, minimize blood loss, and enhance recovery strategies for pediatric patients undergoing adenotonsillectomy.

Ethics Committee Approval: The study was approved by the Van Education and Research Hospital Clinical Research Ethics Committee, (approval number: 2016/4).

Informed Consent: Written consent was obtained from the participants.

Conflict of Interest: Authors declared no conflict of interest.

Financial Disclosure: Authors declared no financial support.

Author Contributions: Idea/Concept: A.K, S.K.; Design: A.K, S.K.; Supervision: A.K, S.K.; Funding: A.K, S.K.; Materials: S.K ; Data Collection/Processing: S.K.; Analysis/Interpretation: A.K, S.K.; Literature Review: A.K, ;

Drafting/Writing: A.K, S.K.; Critical Review: A.K, S.K. The authors have accepted responsibility for the entire content of this manuscript and approved its submission.

References

1. Kenna MA, Amin A. Anatomy and physiology of the oral cavity. In: Snow JB, Wackym PA, editors. Ballenger's Otorhinolaryngology Head and Neck Surgery. 17th ed. Shelton (CT): BC Decker Inc.; 2009. p. 769–74.
2. Susan S, Harold E, Jermiah CH, David J, Andrew W. Pharynx. In: Susan S, editor. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 39th ed. Philadelphia (PA): Elsevier; 2005. p. 619–31.
3. Scadding G. Non-surgical treatment of adenoidal hypertrophy: the role of treating IgE-mediated inflammation. Pediatr Allergy Immunol. 2010;21(8):1095–106.
4. Kontorinis G, Schwab B. Significance of advanced hemostasis investigation in recurrent, severe post-tonsillectomy bleeding. J Laryngol Otol. 2011;125(9):952–7.
5. Liu L, Rodman C, Worobetz NE, Johnson J, Elmaraghy C, Chiang T. Topical biomaterials to prevent post-tonsillectomy hemorrhage. J Otolaryngol Head Neck Surg. 2019 Sep 6;48(1):45.
6. Lee AC, Haché M. Pediatric anesthesia management for post-tonsillectomy bleed: current status and future directions. Int J Gen Med. 2022 Jan 4;15:63–9.
7. Akelma AZ, Mete E, Cizmeci MN, Karaarslan U, Sert S. The role of mean platelet volume as an inflammatory marker in children with chronic spontaneous urticaria. Allergol Immunopathol (Madr). 2015;43(1):10–3.
8. Feng X, Li G, Qu Z, Liu L, Näsström K, Shi XQ. Comparative analysis of upper airway volume with lateral cephalograms and cone-beam computed tomography. Am J Orthod Dentofac Orthop. 2015;147(2):197–204.
9. Brodsky L. Adenotonsillar disease in children. In: Bluestone CD, Stool SE, Kenna MA, editors. Pediatric Otolaryngology. 2nd ed. Philadelphia (PA): W.B. Saunders Company; 1996. p. 15–39.
10. Richardson MA. Sore throat, tonsillitis, and adenoiditis. Med Clin North Am. 1999;83(1):75–83.
11. Alatas N, San I, Cengiz M, Iynen I, Yetkin A, Korkmaz B, et al. Mean red blood cell volume loss in tonsillectomy, adenoidectomy, and adenotonsillectomy. Int J Pediatr Otorhinolaryngol. 2006;70(5):835–41.
12. Prasad KC, Prasad SC. Assessment of operative blood loss and the factors affecting it in tonsillectomy and adenotonsillectomy. Indian J Otolaryngol Head Neck Surg. 2011;63(4):343–8.
13. Simsek G, Karacayli C, Ozel A, Arslan B, Muluk NB, Kilic R. Blood parameters as indicators of upper airway obstruction in children with adenoid or adenotonsillar hypertrophy. J Craniofac Surg. 2015;26(3):e213–6.
14. Gümüssoy M, Atmaca S, Bilgici B, Unal R. Changes in IGF-I, IGFBP-3 and ghrelin levels after adenotonsillectomy in children with sleep-disordered breathing. Int J Pediatr Otorhinolaryngol. 2009;73(11):1653–6.