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Neutrophil Counts and Rates in Otorhinolaryngology

Erkan Yildiz

Abstract

Complete blood count is a fairly inexpensive test that is widely used in the clinic. Neutrophils are also one of the most important parameters in complete blood count. They play a critical role in upper respiratory tract infection, as well as in many chronic otolaryngology diseases. It also has widespread uses in otorhinolaryngology practice. There are many publications on neutrophil counts and neutrophil lymphocyte ratios in patients. Neutrophil counts and rates play an important role in the follow-up and prognosis of many important otolaryngology diseases such as bell palsy, sudden hearing loss, allergic rhinitis, chronic otitis media, nasal polyposis, and chronic rhinosinusitis. In this chapter, the importance of neutrophils in these diseases will be discussed with the literature.

Keywords: neutrophil, neutrophil lymphocyte ratios, otolaryngology

1. Introduction

Neutrophils are known as basic defense cells in humans. However, recent research has shown that they do much more than defense. Neutrophil migration and its roles in inflammation gradually attracted the attention of researchers. The use of advanced technology has been effective in demonstrating the behavior of neutrophils in tissues. Neutrophils follow multiple ways to advance to the site of injury and infection [1].

Neutrophils are the most abundant leukocytes in the blood. They trigger the first damage in the host during the infection phase. They provide these roles thanks to phagocytosis, degranulation and reactive oxygen types. Overactivation of neutrophils sometimes leads to excessive tissue damage. Neutrophils causing chronic inflammation can cause loss of function in organs. When the number of neutrophils decreases, the response to inflammation decreases and this turns into immune deficiency. Neutrophils are produced in the bone marrow; this number may increase up to 1000 times in case of need.

Recently, neutrophil counts, and neutrophil lymphocyte ratios have been used in the diagnosis and follow-up of clinical errors. Numerous researches have been done on this subject and its widespread use has started in otolaryngology [2, 3].

2. Neutrophils in rhinology

In many nose-related diseases, nasal congestion is the main symptom. The most important of these diseases are allergic rhinitis, septum deviation, rhinosinusitis,

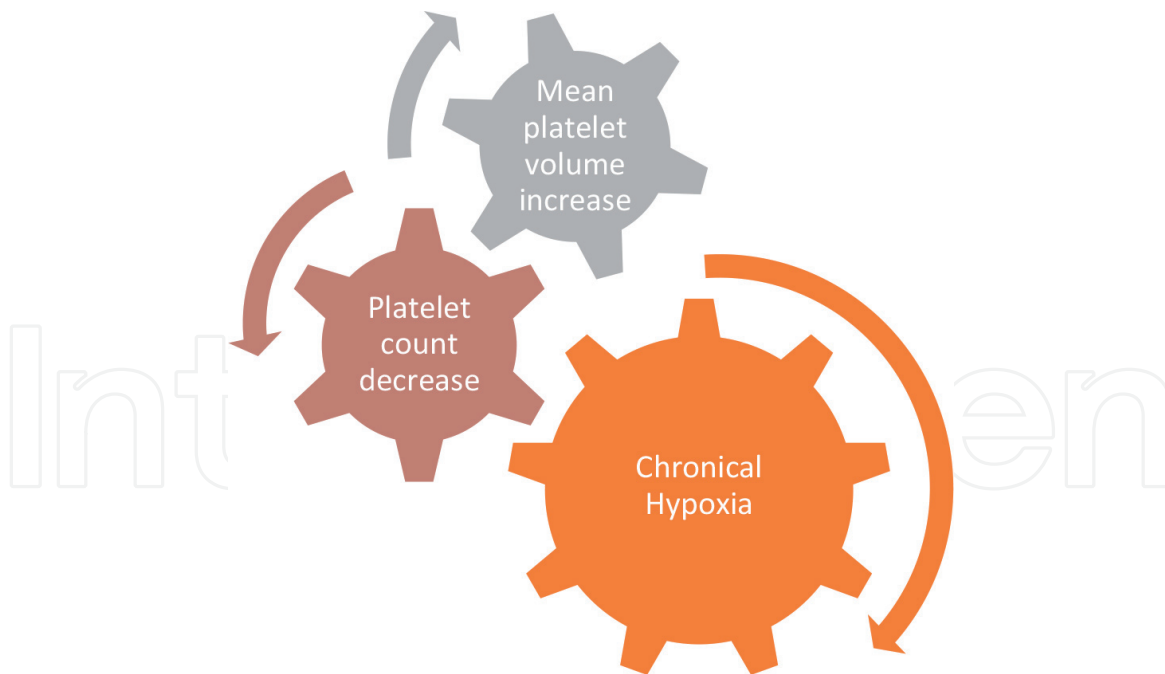


Figure 1.
Change of hematological parameters in hypoxia caused by nasal congestion [1].

nasal polyp, and antrochoanal polyp. These diseases have chronic hypoxia and are caused by airway resistances. Hypoxia increases the mean platelet volume (**Figure 1**). Erythropoiesis develops again due to hypoxia. Therefore, change begins in hematological markers. In the study of patients with nasal septum deviation, the number of platelets decreased while the mean platelet volume increased [1]. Similarly, similar results were obtained in sleep apnea syndrome. No relation was found between laboratory values and apnea in pediatric sleep apnea children [2]. No significant difference was observed in pre- and postoperative studies in children with adenoid hypertrophy [3]. NLR has also been shown to be prognostic in patients with allergic rhinitis. Neutrophils, eosinophils, and basophils can be monitored in nasal cytology.

3. Neutrophils in otology

Neutrophils, which are effective in many areas of otolaryngology, are also important in otology. In otology, inflammatory cells increase and inflammatory changes are observed in diseases such as acute otitis media, serous otitis media, chronic suppurative otitis media, cholesteatoma, facial paralysis, sudden idiopathic sensorineural hearing loss, tinnitus, and vertigo. There are many studies on hematological markers in sudden idiopathic sensorineural hearing loss. NLR, PLR, neutrophil and lymphocyte count are known to be prognostic [4]. No relationship was found between the degree of hearing loss in the audiogram and hematological parameters [5]. Another study showed that there were laboratory parameters such as lymphocyte, lymphocyte%, platelet, mean platelet volume, platelet distribution width (MPV), neutrophil-lymphocyte ratio, platelet-lymphocyte ratio, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration [6] NLR Adult Bell While it can be used prognostically in paralysis, PLR has been reported to be meaningless [7]. In pediatric Bell palsy, it was observed that both NLR and PLR were significant [8]. In otitis media with effusion, hematological parameters were important markers determining viscosity [9]. In a study conducted with inactive patients with active chronic otitis

media, no difference was observed in both patient groups [10]. In chronic otitis media, both NLR and PLR and MPV values are found to be high, as well as normal studies [11]. In the cholesteatoma, there is an invasive transition of the outer ear epithelium to the middle ear. During this transition, inflammatory cytokines are produced. No difference in NLR levels from control groups was found in cholesteatoma [12]. In a study of tinnitus patients, a connection was found between tinnitus and MPV values [13].

4. Neutrophils in infections in the oral region

In recurrent aphthous stomatitis, no relation was found between hematological parameters and infection. There was no difference between these patients and the control group in terms of WBC, Hb, neutrophil, lymphocyte, platelet, MPV, NLR, PLR, ESR, and CRP levels [14]. Although tonsillectomy and adenoidectomy are common surgical procedures, the effects of these operations on the immune system have not been fully established. Studies in patients with chronic tonsillitis and adenoid hypertrophy show that chronic tonsillitis and adenoid hypertrophy disrupt neutrophil chemotaxis functions and these values become normal after adenotonsillectomy. In addition, oxidant values appear to improve after this procedure [15]. It has been shown that it can be used in chronic tonsillitis patients as an effective assistant method in determining neutrophil-lymphocyte ratio, tonsillectomy, and postoperative follow-up [16]. It was stated that the mean platelet volume and neutrophil lymphocyte ratio can be used as markers in peritonsillar abscess [17].

5. Neutrophils in head and neck infections

NLR values can be used as a prognostic indicator in deep neck infections occurring after acute bacterial tonsillitis [18]. It can also be used seriously in the evaluation of chronic tonsillitis [19]. NLR values were not found statistically significant in children with obstructive sleep apnea undergoing adenoidectomy [2].

6. Neutrophils in head and neck cancers

Neutrophils play an important role in cancer formation and progression [20]. In head and neck cancers with high degree of systemic inflammation, an increase in the number of neutrophils is detected. Many studies have also been done on the prognosis of head and neck cancers. The study showed that increased neutrophil lymphocyte ratios (NLR) worsened head and neck cancer prognosis. Similar results have emerged in another study [21, 22]. In another study, a significant correlation was found between high cut-off value before treatment and poor prognosis [23]. In another study, it was determined that the rate of NLR in the nasopharyngeal carcinoma was a poor prognosis factor [24]. In patients who received pre-treatment adjuvant or primary chemotherapy in squamous cell head and neck cancers, the NLR ratio has been indicated as an important marker in demonstrating treatment success [25]. In another study related to the rates of laryngeal cancer, it was shown that the NLR rate did not change in benign lesions, premalignant or malignant laryngeal lesions of the larynx, but was prognostic in lymph node metastases. In Ref. [26], it was shown that it can help early confirmation of treatment failure in patients with metastatic HNSCC [27]. In patients with head and neck cancer of unknown P16-negative primer, NLR-6.0 was significantly associated with poor prognosis [28]. In a study in patients with oral squamous

Neutrophil/lymphocyte ratio in head and neck carcinoma.		
Study	Region	Ratio
Takenaka et al. [21]	Head and neck (all)	Elevated
Takenaka et al. [24]	Nasopharynx	Elevated
Bojaxhiu et al. [25]	Head and neck (chemotherapy before/after)	Elevated
Eskiizmir et al. [26]	Laryngeal neoplasm	Elevated only in lymph node metastasis
Mascarella et al. [22]	Head and neck (all)	Elevated
Zhang et al. [29]	Oral squamous cell carcinoma	Elevated
Xu et al. [28]	Unknown primary head and neck carcinoma(p16-)	Elevated (worse prognosis)

Table 1.
Neutrophil/lymphocyte ratio in head and neck carcinoma.

cell cancers, increased NLR values have been shown to be a sign of poor prognosis [29]. It has higher NLR, MLR, PLR, and RDW values in children with histopathologically diagnosed lymphoma than in children with reactive LAP. Anywhere NLR, MLR, PLR, and RDW tests can be used to determine which LAP patients should be selected for biopsy (**Table 1**) [30].

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References

- [1] Unlu I, Kesici GG, Oneç B, Yaman H, Guclu E. The effect of duration of nasal obstruction on mean platelet volume in patients with marked nasal septal deviation. *European Archives of Oto-Rhino-Laryngology*. 2016;**273**:401-405. DOI: 10.1007/s00405-015-3580-2
- [2] Derin S, Erdogan S, Sahan M, Topal H, Sozen H. Neutrophil-lymphocyte ratio in patients with adenoidectomy. *Journal of Clinical and Diagnostic Research*. 2016;**10**(3):MC03-MC05. DOI: 10.7860/JCDR/2016/16549.7360
- [3] Onder S, Caypinar B, Sahin-Yilmaz A, Toros SZ, Oysu C. Relation of mean platelet volume with obstructive adenoid hypertrophy in children. *International Journal of Pediatric Otorhinolaryngology*. 2014;**78**:1449-1451. DOI: 10.1016/j.ijporl.2014.06.001
- [4] Cao Z, Li Z, Xiang H, Huang S, Gao J, Zhan X, et al. Prognostic role of haematological indices in sudden sensorineural hearing loss: Review and meta-analysis. *Clinica Chimica Acta*. 2018;**483**:104-111. DOI: 10.1016/j.cca.2018.04.025
- [5] Salvago P, Rizzo S, Bianco A, Martines F. Sudden sensorineural hearing loss: Is there a relationship between routine haematological parameters and audiogram shapes? *International Journal of Audiology*. 2017;**56**:148-153. DOI: 10.1080/14992027.2016.1236418
- [6] Durmus K, Terzi H, Karatas TD, Dogan M, Uysal IO, Sencan M, et al. Assessment of hematological factors involved in development and prognosis of idiopathic sudden sensorineural hearing loss. *The Journal of Craniofacial Surgery*. 2016;**27**:e85-e91. DOI: 10.1097/SCS.0000000000002241
- [7] Oya R, Takenaka Y, Imai T, Sato T, Oshima K, Ohta Y, et al. Neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio as prognostic hematologic markers of Bell's palsy: A meta-analysis. *Otology & Neurotology*. 2019;**40**:681-687. DOI: 10.1097/MAO.0000000000002166
- [8] Kim DH, Oh JH, Kim J, Cho CH, Lee JH. Predictive values of neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio, and other prognostic factors in pediatric patients with Bell's palsy. *Ear, Nose, & Throat Journal*. 2020. DOI: 10.1177/0145561320922097
- [9] Elbistanli MS, Koçak HE, Acipayam H, Yiğider AP, Keskin M, Kayhan FT. The predictive value of neutrophil-lymphocyte and platelet-lymphocyte ratio for the effusion viscosity in otitis media with chronic effusion. *The Journal of Craniofacial Surgery*. 2017;**28**:e244-e247. DOI: 10.1097/SCS.0000000000003452
- [10] Tansuker HD, Eroğlu S, Yenigün A, Taşkin Ü, Oktay MF. Can serum neutrophil-to-lymphocyte ratio Be a predictive biomarker to help differentiate active chronic otitis media from inactive chronic otitis media? *The Journal of Craniofacial Surgery*. 2017;**28**:e260-e263. DOI: 10.1097/SCS.0000000000003484
- [11] Yigit E, Onerci Celebi O, Araz Server E, Longur ES. Neutrophil-to-lymphocyte ratio and mean platelet volume in chronic otitis media with or without cholesteatoma. *Istanbul Medical Journal*. 2018;**19**:162-166. DOI: 10.5152/imj.2018.77854
- [12] Kılıçkaya MM, Aynali G, Tuz M, Bağcı Ö. Is There A Systemic inflammatory effect of cholesteatoma? *International Archives of Otorhinolaryngology* 2017;**21**:42-45. doi:10.1055/s-0036-1584363

- [13] Ulusoy B, Bozdemir K, Akyol M, Mişe HI, Kutluhan A, Korkmaz MH. Investigation of neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio and mean platelet volume in patients with tinnitus. *The Journal of Laryngology & Otology*. 2018;**132**(2):129-132. DOI: 10.1017/S0022215117002481
- [14] Karaer IC. Mean platelet volume, neutrophil-to-lymphocyte ratio, and platelet-to-lymphocyte ratio as inflammatory markers in patients with recurrent aphthous stomatitis. *Eurasian Journal of Medicine*. 2020;**52**:38-40. DOI: 10.5152/eurasianjmed.2019.18486
- [15] Sennaroglu L, Onerci M, Hascelik G. The effect of tonsillectomy and adenoidectomy on neutrophil chemotaxis. *Laryngoscope*. 1993;**103**(12):1349-1351. DOI: 10.1288/00005537-199312000-00005
- [16] Yenigun A. The efficacy of tonsillectomy in chronic tonsillitis patients as demonstrated by the neutrophil-to-lymphocyte ratio. *The Journal of Laryngology and Otology*. 2015;**129**:386-391. DOI: 10.1017/S0022215115000559
- [17] Şentürk M, Azgın İ, Övet G, Alataş N, Ağırgöl B, Yılmaz E. O papel do volume plaquetário médio e a relação neutrófilos/linfócitos em abscesso periamigdaliano. *Brazilian Journal of Otorhinolaryngology*. 2016;**82**:662-667. DOI: 10.1016/j.bjorl.2015.11.018
- [18] Bakshi SS. Letter to the editor regarding “predictive value of the neutrophil-to-lymphocyte ratio in patients with deep neck space infection secondary to acute bacterial tonsillitis”. *International Journal of Pediatric Otorhinolaryngology*. 2017;**92**:193. DOI: 10.1016/j.ijporl.2015.10.028
- [19] Yenigun A, Sezen S, Calim OF, Ozturan O. Evaluation of the eosinophil-to-lymphocyte ratio in pediatric patients with allergic rhinitis. *American Journal of Rhinology & Allergy*. n.d.;**30**:e21-e25. DOI: 10.2500/ajra.2016.30.4296
- [20] Available from: <https://neurosurgery.directory/2019/07/07/neutrophil-to-lymphocyte-ratio-for-glioma/>
- [21] Takenaka Y, Oya R, Kitamiura T, Ashida N, Shimizu K, Takemura K, et al. Prognostic role of neutrophil-to-lymphocyte ratio in head and neck cancer: A meta-analysis. *Head & Neck*. 2018;**40**:647-655. DOI: 10.1002/hed.24986
- [22] Mascarella MA, Mannard E, Silva SD, Zeitouni A. Neutrophil-to-lymphocyte ratio in head and neck cancer prognosis: A systematic review and meta-analysis. *Head & Neck*. 2018;**40**:1091-1100. DOI: 10.1002/hed.25075
- [23] Cho JK, Kim MW, Choi IS, Moon UY, Kim MJ, Sohn I, et al. Optimal cutoff of pretreatment neutrophil-to-lymphocyte ratio in head and neck cancer patients: A meta-analysis and validation study. *BMC Cancer*. 2018;**18**. DOI: 10.1186/s12885-018-4876-6
- [24] Takenaka Y, Kitamura T, Oya R, Ashida N, Shimizu K, Takemura K, et al. Prognostic role of neutrophil-to-lymphocyte ratio in nasopharyngeal carcinoma: A meta-analysis. *PLOS One*. 2017;**12**. DOI: 10.1371/journal.pone.0181478
- [25] Bojaxhiu B, Templeton AJ, Elicin O, Shelan M, Zaugg K, Walser M, et al. Relation of baseline neutrophil-to-lymphocyte ratio to survival and toxicity in head and neck cancer patients treated with (chemo-) radiation. *Radiation Oncology*. 2018;**13**. DOI: 10.1186/s13014-018-1159-y
- [26] Eskiizmir G, Uz U, Onur E, Ozyurt B, Karaca Cikrikci G, Sahin N,

et al. The evaluation of pretreatment neutrophil–lymphocyte ratio and derived neutrophil–lymphocyte ratio in patients with laryngeal neoplasms. *Brazilian Journal of Otorhinolaryngology*. 2019;**85**:578-587. DOI: 10.1016/j.bjorl.2018.04.013

[27] Ueda T, Chikuie N, Takumida M, Furuie H, Kono T, Taruya T, et al. Baseline neutrophil-to-lymphocyte ratio (NLR) is associated with clinical outcome in recurrent or metastatic head and neck cancer patients treated with nivolumab. *Acta Oto-Laryngologica*. 2020;**140**:181-187. DOI: 10.1080/00016489.2019.1699250

[28] Xu C, Yuan J, Du W, Wu J, Fang Q, Zhang X, et al. Significance of the neutrophil-to-lymphocyte ratio in p16-negative squamous cell carcinoma of unknown primary in head and neck. *Frontiers in Oncology*. 2020;**10**. DOI: 10.3389/fonc.2020.00039

[29] Zhang B, Du W, Gan K, Fang Q, Zhang X. Significance of the neutrophil-to-lymphocyte ratio in young patients with oral squamous cell carcinoma. *Cancer Management and Research*. 2019;**11**:7597-7603. DOI: 10.2147/CMAR.S211847

[30] Tezol O, Bozlu G, Sagcan F, Tuncel Daloglu F, Citak C. Value of neutrophil-to-lymphocyte ratio, monocyte-to-lymphocyte ratio, platelet-to-lymphocyte ratio and red blood cell distribution width in distinguishing between reactive lymphadenopathy and lymphoma in children. *Bratislava Medical Journal*. 2020;**121**:287-292. DOI: 10.4149/bll_2020_045