



## Predictive value of the neutrophil-to-lymphocyte ratio in patients with deep neck space infection secondary to acute bacterial tonsillitis



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### ARTICLE INFO

#### Article history:

Received 5 January 2015

Received in revised form 10 June 2015

Accepted 13 June 2015

Available online 22 June 2015

#### Keywords:

Neutrophil-to-lymphocyte ratio

Inflammation

Acute bacterial tonsillitis

Deep neck infection

### ABSTRACT

**Objective:** The aim of this study was to determine whether the neutrophil-to-lymphocyte ratio (NLR) can be used as a predictor for deep neck space infections (DNSIs) that occur as a complication of acute bacterial tonsillitis in the pediatric population.

**Materials and methods:** We evaluated the NLR values of 180 pediatric patients diagnosed with acute bacterial tonsillitis with or without DNSI who presented to the Otolaryngology Department of Marmara University Hospital between 2010 and 2013. In cases in which DNSI was suspected, the patients underwent complete otolaryngological examination and radiological imaging including CT and MRI. NLR was calculated in all the subjects and was compared between the patients with acute bacterial tonsillitis without DNSI and those with DNSI.

**Results:** With regard to the tonsillitis-related complications, 17 patients had peritonsillar abscess (9.4%); five, parapharyngeal abscess (2.8%); and two, retropharyngeal abscess (1.1%). The mean NLR was significantly higher in the patients of acute bacterial tonsillitis with DNSI ( $P < 0.05$ ). The optimum cut-off value of NLR was determined to be 5.4.

**Conclusion:** This study is the first to investigate the relationship between NLR and DNSI as a complication of acute bacterial tonsillitis. The results demonstrated that the NLR value could be a potential laboratory parameter for diagnosing DNSIs.

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### 1. Introduction

Acute tonsillitis is commonly encountered in outpatient ENT clinics, especially in children and young adults. It is usually caused by viral agents and is accompanied by secondary bacterial infections. Acute tonsillitis often occurs secondary to viral infections and is usually a polymicrobial infection that is caused by interaction between the normal oropharyngeal flora and the extrinsic flora [1–4]. The diagnosis of acute tonsillitis is based on the patient's medical history, physical examination and laboratory studies including complete blood count, erythrocyte sedimentation rate, C-reactive protein (CRP) level, the rapid antigen detection test (RADT), serological tests and cultures for bacterial and viral agents. Conditions such as fever that is unresponsive to antibiotic

therapy, unilateral bulging above and lateral to one of the tonsils, bulging on the posterior pharyngeal wall, trismus and torticollis are indicative of deep neck space infections (DNSIs). Peritonsillar, retropharyngeal and parapharyngeal abscesses are complications of DNSI that occur as a result of adjacent spread from local sites. The main strategy for management of acute bacterial tonsillitis is antibiotic therapy, adequate hydration and oral intake, and treatment of pain and fever. If the treatment is delayed or is inadequate, acute bacterial tonsillitis may lead to life-threatening complications associated with DNSI including peritonsillar (49%), retropharyngeal (22%), submandibular (14%), buccal (11%), parapharyngeal space (2%), and canine space (2%) infections [5–9]. Delayed diagnosis of such complications can lead to increased rates of hospitalization and morbidity.

Neutrophils play central roles in the host response to infections and in the development of acute and chronic inflammation [10,11]. Recently, a number of studies have reported that the neutrophil-to-lymphocyte ratio (NLR) has potential as a marker of inflammation, both in cardiac and non-cardiac disorders [12–18]. Besides being a valuable biomarker for cardiac diseases, NLR is also a potential marker for inflammatory conditions caused by

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autoimmune conditions or infection. Early diagnosis and treatment are critical for patients with DNSI, but it may sometimes be challenging to diagnose DNSI early during the course of acute bacterial tonsillitis. Imaging techniques including CT or MRI may help in achieving an accurate diagnosis of the complications, but if NLR could be used as a marker of inflammation, the severity of the tonsillitis and presence of complications, it would ensure early diagnosis and treatment. However, no data are available on the role of NLR in predicting DNSI in cases of acute bacterial tonsillitis. Thus, we aimed to investigate whether NLR may be an independent predictive risk factor for DNSI in a pediatric population with acute bacterial tonsillitis.

## 2. Materials and methods

This study was approved by the Ethical Committee of Marmara University Faculty of Medicine (ID number: 09.2014.0267, Issue date: 18.12.2014).

In total, 180 pediatric patients who were admitted to the Otolaryngology Department of Marmara University Hospital from 2010 to 2013 and who were diagnosed with acute bacterial tonsillitis with or without DNSI were retrospectively reviewed. Informed consent was obtained from all the patients. Patients in whom DNSI was suspected underwent complete otolaryngological and radiological imaging studies with CT or MRI. The diagnosis was based on the patient's detailed history; physical examination; laboratory tests including white blood cell (WBC) count, peripheral blood smear, CRP, RADT, and throat and abscess culture; and also imaging studies in cases of suspected DNSI.

A lobulated mass having clear central hypodensity, clear ring enhancement, scalloping of mass wall were accepted as suggestive imaging findings of abscess and then diagnosis were confirmed with aspiration of pus.

The exclusion criteria were determined as follows: (a) the patients with a positive for viral antigen detection test in nasopharyngeal aspirate for adenovirus, enterovirus (coxsackie-A, rhinovirus), influenza and RSV and other suspected viral disease; (b) the patients manifested with typical clinical picture of infectious mononucleosis, detection of atypical lymphocytosis in peripheral blood smear and positive EBV Viral Capsid Antigen IgM.

According to whether DNSI was present, the patients were divided into two groups: acute bacterial tonsillitis without complications ( $n = 156$ ) (group 1) and acute bacterial tonsillitis with DNSI ( $n = 24$ ) (group 2). The two groups were evaluated based on the NLR values. Laboratory tests were performed on blood

samples obtained on admission to the hospital. The leukocyte and neutrophil counts were determined using an automated hematology analyzer (Coulter<sup>®</sup> LH 780 Hematology Analyzer; Beckman Coulter Inc., Brea, CA, USA). The reference range for the leukocyte count was 4000–10,000/ $\mu\text{L}$ . The NLR was determined in all the subjects and compared between group 1 and group 2.

### 2.1. Statistical analysis

Statistical analyses were carried out using the Statistical Package for the Social Sciences (SPSS) 15.0 for Windows (SPSS Inc., Chicago, IL, USA). The distribution of variables was assessed using the normality test. Differences between the two groups were analyzed using the Student *t*-test (variables with parametric distribution) and the Mann–Whitney *U*-test (variables with non-parametric distribution). Receiver operating characteristic (ROC) curve analysis was used to assess the sensitivity and specificity of NLR for predicting the presence of complications.  $P < 0.05$  was considered to indicate statistical significance.

## 3. Results

### 3.1. Patient characteristics and DNSI incidence

In total, the data of 180 patients were analyzed. The median age of the patients was 4 years (range, 6 months to 17 years). Of the 180 patients, 95 were male (53%) and 85 were female (47%). There was no significant gender-based difference in the incidence of acute bacterial tonsillitis. Seventeen of the patients had peritonsillar abscess (9.4%); five, parapharyngeal abscess (2.8%); and two, retropharyngeal abscess (1.1%). No other DNSI was found. The most common complication was peritonsillar abscess, followed by parapharyngeal abscess and retropharyngeal abscess. [Table 1](#)

### 3.2. Secondary bacterial infections

Of the 180 patients with acute bacterial tonsillitis, 100 were positive for group A beta-hemolytic *Streptococcus* (GABHS) (55.5%) and 80 (45.5%) were positive for other bacterial agents including group B, C, and G streptococci, *Arcanobacterium hemolyticum*, *Bacterioides* spp. and *Fusobacterium* spp. DNSI was polymicrobial in most cases: 19 patients (79%) were positive for a combination of aerobic and anaerobic organisms including group A beta-hemolytic *Streptococcus pyogenes* (GABHS), *Staphylococcus aureus*, Groups C and G *Streptococcus*, *Bacterioides* spp., *Fusobacterium*

**Table 1**  
Demographics and characteristics of patients.

	Acute bacterial tonsillitis without DNSI (Group I) <i>n</i> (156)	Acute bacterial tonsillitis with DNSI (Group II) <i>n</i> (24)	Total 180
Age	3.9 years (median)	4.65 years (median)	4 years
Gender	Male, 80(51.3%) Female, (48.7%)	Male, 13(54%) Female, 11(46%)	93 87
Complication	0	Peritonsillar abscess 17 (9.4%) Parapharyngeal abscess 5 (2.8%) Retropharyngeal abscess 2 (1.1%)	17 5 2
Oral intake difficulty	19 (12.2%)	24(100%)	
Hospitalization	13 patient	24 patient	37
Hospitalization period	1 day	Peritonsillar abscess 3.3 days (range, 1–7) Parapharyngeal abscess 12 days (range, 8–18) Retropharyngeal abscess and 9.5 days (range, 9–10)	
Treatment	Antibiotics alone	Surgical drainage and antibiotic therapy	

DNSI: deep neck space infection,  $n$  = number of patients.

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