

Article

Comparative Analysis of Systemic Immune Inflammatory Index in Acute Tonsillitis and Peritonsillar Abscess

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Abstract: This study aimed to investigate the utility of the Systemic Immune Inflammatory Index (SIII) as a diagnostic biomarker for distinguishing between acute tonsillitis and peritonsillar abscess. Conducted retrospectively at Trakya University, the study analyzed 122 cases of acute tonsillitis and 124 cases of peritonsillar abscess, using data from patients treated at the university's Otorhinolaryngology Department between 2013 and 2023. Ethical approval was obtained from the institution's Ethics Committee. Blood samples were evaluated to assess three key parameters: neutrophil-lymphocyte ratio (NLR), platelet-lymphocyte ratio (PLR), and SIII. Results demonstrated a significant difference in SIII values, with patients suffering from peritonsillar abscess showing significantly higher SIII levels compared to those with acute tonsillitis. Similarly, PLR values were significantly different between the groups, reinforcing the clinical relevance of these markers. In contrast, NLR did not show a statistically significant difference. These findings highlight the potential of SIII as a valuable biomarker for distinguishing between acute tonsillitis and peritonsillar abscess, offering promising applications in otolaryngology to enhance diagnostic accuracy and inform treatment decisions.

Keywords: Systemic Immune Inflammatory Index; Acute Tonsillitis; Peritonsillar Abscess; Diagnostic Biomarker; Otorhinolaryngology

1. Introduction

In the realm of otolaryngology, distinguishing between different conditions that affect the tonsils is crucial for accurate diagnosis and appropriate treatment. Two common conditions in this domain are acute tonsillitis and peritonsillar abscess. Inflammation of the tonsillar tissues in the oropharynx is commonly referred to as acute tonsillitis [1]. Formun Üstü Acute tonsillitis and peritonsillar abscess may initially present with similar symptoms, including sore throat, fever, and difficulty swallowing. However, their underlying nature and the potential complications they pose differ significantly. Acute tonsillitis is an inflammation of the tonsils caused by viral or bacterial infections [2]. It is a common condition, particularly among children and young adults, typically responding well to antibiotics and supportive care [2]. Peritonsillar abscess is a more severe and localized infection that occurs adjacent to the tonsil, often resulting from untreated or inadequately treated tonsillitis. The abscess can cause severe pain, difficulty in opening the mouth, and sometimes difficulty breathing. Drainage and more aggressive medical intervention are often required [3]. The Systemic Immune Inflammatory Index (SIII) is a relatively novel marker

used in medicine to assess systemic inflammation [4]. It is calculated based on the relative counts of three types of blood cells: neutrophils, lymphocytes, and platelets. These ratios have demonstrated their utility as prognostic factors across a spectrum of health conditions, including diverse malignant solid tumors and inflammatory disorders [5, 6]. Formun Üstü Elevated SIII values are often associated with increased systemic inflammation and have been linked to various health conditions. Yang et al. and Zhong et al. in their respective meta-analyses, documented that the SIII emerged as a noteworthy predictor for both progression-free survival and overall survival among cancer patients [7, 8]. The aim of this study is to determine whether peritonsillar abscess and acute tonsillitis cases can be differentiated through routine blood tests.

2. Methods

This study, conducted at Trakya University Otorhinolaryngology Department, involved 122 cases with acute tonsillitis and 124 cases with peritonsillar abscess. The study included individuals who had not received any prior treatment. The study was reviewed retrospectively. Data from patients between 2013 and 2023 were used, and ethical approval was received from Trakya University Non-Interventional Scientific Research Ethics Committee protocol code: 2023/333 decision number: 14/07. The SIII values were determined prior to commencing the treatment. Blood samples were collected from each patient, and the levels of hemoglobin, erythrocytes, leukocytes, neutrophils, lymphocytes, and platelets were measured. The platelet lymphocyte ratio (PLR), neutrophil lymphocyte ratio (NLR), and SIII values were then computed using the formula. We calculated the Systemic Immune-Inflammation Index (SIII) using the formula: $\text{platelet count} \times \text{neutrophil count} / \text{lymphocyte count}$, as reported in previous studies [9, 10]. Statistical analysis, including the T test, was used to compare these parameters between the two groups. Values with $p < 0.05$ were considered statistically significant. IBM SPSS Statistics 20.0 for Windows (Armonk, NY, USA) was utilized for the statistical calculations.

3. Results

A total of 124 cases were included in the peritonsillar abscess group, consisting of 43 women and 81 men. The average age of women was 35.6 years and 37.2 years for men. The tonsillitis group comprised 122 cases, with 57 men and 65 women. The average age of men was 27.3 years and for women 29.3 years. There was no significant difference between the two groups in terms of age and gender. Normality analysis of acute tonsillitis and peritonsillar abscess data Sig. 0.000 is significant, For the normality test, skewness and kurtosis values were examined. The skewness value for the acute tonsillitis data was 1.371, and the kurtosis value was 2.098. For the peritonsillar abscess data, the skewness value was 1.606, and the kurtosis value was 2.45. In the reliability analysis, Cronbach's alpha value was found to be 0.78. Hemogram parameter distributions of the groups are seen in Table 1. Patients with peritonsillar abscess had notably higher SIII values compared to those with acute tonsillitis (Figure 1). This difference holds substantial clinical significance, as it suggests that SIII can serve as a valuable biomarker in distinguishing between these conditions.

It is important to note that, in addition to SIII, the study also examined the NLR and the PLR. The NLR did not reveal a statistically significant difference between the two groups. In contrast, PLR was also found to be statistically significant, further emphasizing the potential utility of these markers in clinical practice (Figure 2). SIII, NLR, and PLR values are summarized in Table 1.

Table 1. Neutrophil, Platelet, Lymphocyte, SIII, NLR, and PLR values of participants.

	Tonsillitis			Peritonsillar Abscess		
	Mean	Median	Range	Mean	Median	Range
Neutrophil	9.4	9.3	23.4	10.0	9.2	22.3
Platelet	232.7	227.0	389.0	291.2	272.5	424.0
Lymphocyte	2.5	1.7	11.7	2.1	1.9	20.2
SIII	1346.9	1197.4	8454.0	1654.5	1422.6	5361.6
NLR	5.9	5.3	37.4	5.9	4.9	23.0
PLR	132.5	126.5	437.6	161.2	142.5	485.3

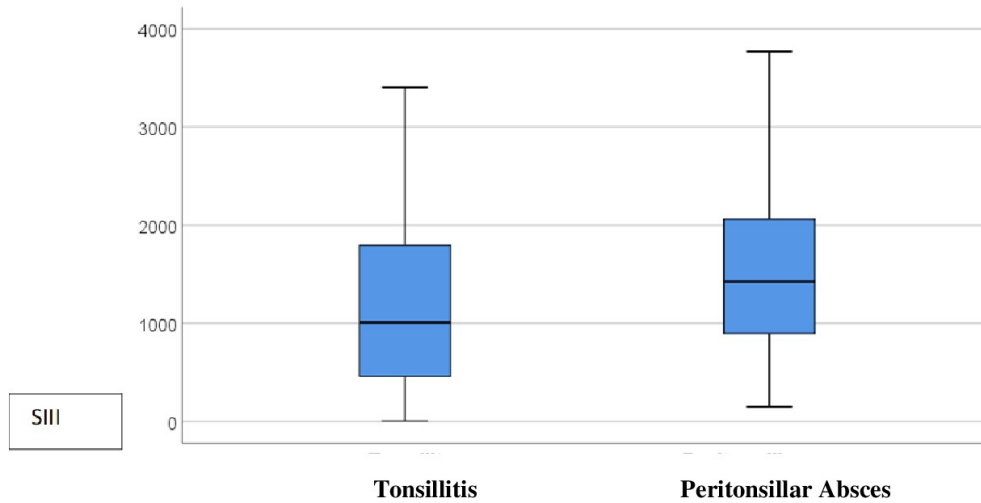


Figure 1. SIII values were significantly higher in peritonsillar abscess patients compared to those in the tonsillitis group ($p < 0.001$).

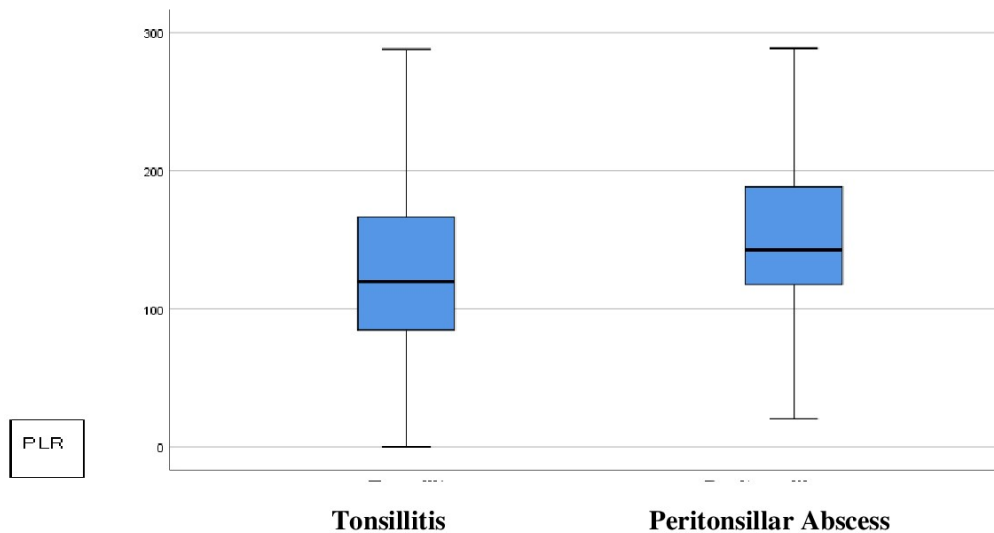


Figure 2. PLR values were significantly higher in peritonsillar abscess patients compared to those in the tonsillitis group ($p < 0.001$).

4. Discussion

Acute tonsillitis, characterized by the inflammation of the tonsils, is commonly caused by viral or bacterial infections [2]. The clinical presentation often involves sore throat, fever, difficulty swallowing, and tender cervical lymphadenopathy. Management strategies for acute tonsillitis primarily depend on the underlying etiology. When left untreated or improperly managed, acute tonsillitis may progress to a peritonsillar abscess, a collection of pus adjacent to the tonsil. The condition presents with severe throat pain, trismus, “hot potato” voice, and deviation of the uvula. Prompt intervention is vital, often necessitating drainage of the abscess and antibiotic therapy to prevent complications and promote recovery [3]. Distinguishing between acute tonsillitis and peritonsillar abscess is critical for accurate diagnosis and appropriate treatment. Accurate differentiation between these conditions is essential to avoid complications and ensure effective management.

The NLR and PLR have been identified as valuable novel inflammatory biomarkers for infection including in head and neck infections [11–15]. In our study, PLR was found to be significantly high in the peritonsillar abscess group. Likewise, a recently devised predictive indicator, SIII has emerged [16]. Nevertheless, its specific utility in the context of infectious diseases remains not fully elucidated. Our study highlights a significant disparity in the SIII between patients with acute tonsillitis and those with peritonsillar abscess. In our study, the SIII was found to be statistically significant when compared between the peritonsillar abscess group and the tonsillitis group. The SIII serves as a valuable marker of systemic inflammation and immune response. The elevated SIII in peritonsillar abscess compared to acute tonsillitis suggests a more pronounced inflammatory state and potential severity of the condition. The utilization of SIII could thus aid clinicians in differentiating between these two conditions, potentially allowing for timely and accurate diagnoses.

The implications of utilizing SIII as a diagnostic tool in distinguishing between acute tonsillitis and peritonsillar abscess are noteworthy. Its ability to reflect the underlying inflammatory response offers a non-invasive, cost-effective method for clinicians to make informed decisions regarding patient management. Incorporating SIII assessment into the diagnostic protocol could potentially expedite the appropriate treatment, thereby reducing the risk of complications and improving patient outcomes.

The SIII, initially proposed as a prognostic indicator in certain cancers, has garnered attention in various inflammatory conditions due to its ability to reflect the balance between systemic inflammation and the immune response [5, 6]. Formun Üstü Neutrophils are associated with acute inflammation, while lymphocytes reflect the adaptive immune response. Platelets, apart from their role in coagulation, have been linked to inflammation. Therefore, a higher SIII suggests a more robust inflammatory response relative to the immune system's capability to control it. SIII's specificity lies in its ability to reflect the delicate balance between pro-inflammatory factors, such as neutrophils and platelets, and anti-inflammatory or regulatory factors like lymphocytes. Neutrophils, primary components of the innate immune system, increase during acute inflammation, while lymphocytes, critical in adaptive immunity, regulate the inflammatory response. Platelets, known for their role in clotting, also contribute to the body's inflammatory processes. Elevated SIII values signify an imbalance in these counts, indicating a potentially exaggerated systemic inflammatory response. In their study, Kusumoto et al. compared odontogenic infections and categorized patients into four groups based on severity, finding that SIII value was statistically significant [17]. In the context of acute tonsillitis and peritonsillar abscess, higher SIII values observed in peritonsillar abscess patients suggest a more intense and potentially severe inflammatory state than in acute tonsillitis cases. The significant difference in SIII values between patients with acute tonsillitis and those with peritonsillar abscess is of utmost clinical importance. The elevated SIII values in the peritonsillar abscess group indicate a higher level of systemic inflammation, which is likely associated with the more severe and localized nature of this condition.

SIII emerges as a novel and promising biomarker in the medical landscape, showing a strong potential to differentiate between these tonsillar conditions. This newly introduced marker extends its utility beyond distinguishing acute tonsillitis from peritonsillar abscess. Its versatility in reflecting systemic inflammation positions it as a valuable addition to the diagnostic armamentarium in otolaryngology. Moreover, the use of SIII can aid clinicians in making timely and accurate diagnostic and treatment decisions, contributing to improved patient outcomes.

The role of SIII in distinguishing between tonsillitis and peritonsillar abscess is part of its broader potential in enhancing diagnostics in the medical field. Its adaptability to various clinical contexts is supported by its performance in predicting patient outcomes across a spectrum of conditions, ranging from cancer to cardiovascular diseases.

Incorporating SIII into clinical practice brings us closer to harnessing the full diagnostic potential of this marker. However, it is crucial to emphasize that while SIII shows promise, it should not replace comprehensive clinical assessment. Clinical symptoms, physical examination, and other laboratory findings must always be considered in conjunction with SIII values to ensure a holistic approach to diagnosis. In particular, the utility of SIII may be most beneficial for first-line care or emergency care physicians who are less experienced in distinguishing between these conditions, or as a follow-up tool to guide decisions on expediting care.

This research represents a significant step toward enhancing the accuracy of diagnoses in otolaryngology and improving patient outcomes. While further research is warranted to validate these findings and explore the full scope of SIII's diagnostic capabilities, the evidence suggests that SIII, alongside other clinical factors, can be a valuable tool in guiding appropriate treatment decisions for patients with tonsillar infections. SIII stands as a promis-

ing new marker, providing a fresh perspective on the differentiation of tonsillitis and peritonsillar abscess, with far-reaching implications for diagnostics and patient care.

The retrospective and single-center nature of our study presents limitations. Additionally, to understand how SIII values change over the long term, and to predict outcomes in acute tonsillitis and peritonsillar abscess, further studies with long-term results are needed.

Author Contributions

Conceptualization, A.K., Y.C.O., S.K., A.Y.; methodology, A.K., A.Y., Y.C.O., S.K.; software, Y.C.O.; validation, A.K., Y.C.O. and S.K.; formal analysis, A.Y.; investigation, A.Y.; resources, A.K.; data curation, Y.C.O.; writing—original draft preparation, A.K., Y.C.O., S.K., A.Y.; writing—review and editing, A.K., S.K. and A.Y.; visualization, A.K.; supervision, A.K., A.Y., Y.C.O., S.K.; project administration, A.Y.; funding acquisition, A.K. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval for this study was obtained from the Trakya University Non-Interventional Scientific Research Ethics Committee on September 23, 2023. Decision No: 14/07.

Informed Consent Statement

This study is a retrospective study, and there is no informed consent form as the blood parameters of the patients in the system are examined.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Data sharing is subject to institutional and ethical guidelines.

Conflicts of Interests

The authors declare no conflict of interest. There is no funding provider in the study.

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