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Impact of Chronic Otitis Media on Systemic Inflammation and its Correlation With Oral Mucosal Disorders

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Abstract

Chronic Otitis Media (COM) is a prevalent condition characterized by persistent inflammation of the middle ear, often leading to systemic inflammatory responses. Recent studies have suggested a potential link between COM and systemic inflammatory markers, such as the Systemic Immune-Inflammation Index (SII), which is calculated based on neutrophil, lymphocyte, and platelet counts This study aims to investigate the impact of COM on systemic inflammation and its correlation with oral mucosal disorders.

A total of 300 patients diagnosed with COM were retrospectively analyzed, divided equally into two groups: Mucosal COM and Squamous COM. Preoperative blood samples were collected to calculate SII, Neutrophil-to-Lymphocyte Ratio (NLR), and Platelet-to-Lymphocyte Ratio (PLR). Additionally, the presence of oral mucosal disorders was assessed in both groups.

The results indicated that patients with Mucosal COM exhibited significantly higher SII values compared to those with Squamous COM ($p < 0.001$). Furthermore, a notable correlation was observed between elevated SII levels and the presence of oral mucosal disorders in the Mucosal

COM group ($p < 0.001$). These findings suggest that Mucosal COM is associated with systemic inflammation, which may contribute to the development of oral mucosal disorders.

In conclusion, the study highlights the significance of systemic inflammation in patients with Mucosal COM and its potential role in oral mucosal pathologies. Monitoring systemic inflammatory markers like SII could be instrumental in identifying patients at risk and guiding comprehensive treatment strategies.

Keywords: Chronic Otitis Media, Systemic Inflammation, Oral Mucosal Disorders

Introduction

Chronic Otitis Media (COM) is a persistent inflammatory condition of the middle ear, often resulting in tympanic membrane perforation and hearing loss. COM is broadly classified into two types: mucosal (suppurative) and squamous (cholesteatomatous). Mucosal COM is characterized by persistent ear discharge through a perforated tympanic membrane, while squamous COM involves the presence of cholesteatoma, leading to more aggressive disease progression. [1-3]Differentiating between these types is crucial, as it influences management strategies and prognostic outcomes.[4]Recent studies have highlighted the role of systemic inflammation in various otological conditions, including COM. Systemic inflammatory markers such as the Neutrophil-to-Lymphocyte Ratio (NLR), Platelet-to-Lymphocyte Ratio (PLR), and the Systemic Immune-Inflammation Index (SII) have emerged as potential indicators of disease severity and prognosis in inflammatory diseases. SII, calculated as (neutrophils × platelets) / lymphocytes, integrates three immune parameters and has been associated with disease activity in several conditions.[5-6]

The oral cavity, being a part of the upper aerodigestive tract, shares anatomical and functional proximity with the middle ear. Chronic inflammatory conditions in the ear may influence or reflect systemic inflammatory status, potentially affecting oral mucosal health. However, the relationship between COM-induced systemic inflammation and oral mucosal disorders remains underexplored. Understanding this relationship is vital, as it may unveil novel insights into the pathophysiology of COM and its systemic implications. Moreover, identifying reliable biomarkers that reflect systemic inflammation could aid in the early detection and management of associated comorbidities.[7-10]

This study aims to investigate the impact of COM on systemic inflammation by evaluating SII, NLR, and PLR levels in patients with mucosal and squamous COM. Additionally, it seeks to

explore the correlation between these systemic inflammatory markers and the presence of oral mucosal disorders, thereby assessing the broader systemic effects of COM.

Methodology

A retrospective analysis was conducted on 300 patients diagnosed with COM at Lahore General Hospital. The cohort was divided equally into two groups: 150 patients with mucosal COM and 150 with squamous COM. Inclusion criteria encompassed patients aged 20–63 years who underwent mastoidectomy ± tympanoplasty and had complete preoperative blood count data. Exclusion criteria included patients with chronic systemic diseases (e.g., cardiovascular, pulmonary, renal, autoimmune, rheumatologic, neuromuscular disorders), psychological conditions, or those on anti-inflammatory or steroid medications within one month prior to surgery. Preoperative evaluations included Pure Tone Audiometry (PTA), Temporal Bone CT scans, and Complete Blood Count (CBC) tests. Blood samples were collected in EDTA tubes and analyzed using the Sysmex XN 2000® Hemogram Analyzer. SII was calculated using the formula: (neutrophils × platelets) / lymphocytes. NLR and PLR were also computed. Oral examinations were performed to identify mucosal disorders, including ulcers, lichen planus, and candidiasis. Informed consent was obtained from all participants, and the study adhered to the ethical standards of the Declaration of Helsinki.

Results

Table 1: Demographic Characteristics

Parameter	**Mucosal COM (n=150)**	**Squamous COM (n=150)**	**p-value**
Age (mean ± SD)	47.05 ± 14.37	44.66 ± 15.02	0.08
Gender (M/F)	70/80	60/90	0.25

Table 2: Inflammatory Markers

Marker	**Mucosal COM (mean ± SD)**	**Squamous COM (mean ± SD)**	**p-value**
Neutrophils (×10^3/µL)	7.01 ± 2.5	4.09 ± 1.8	<0.001
Lymphocytes (×10^3/µL)	1.66 ± 0.5	1.86 ± 0.6	0.099
Platelets (×10^3/µL)	276.00 ± 50.0	238.50 ± 45.0	0.002

Marker	Mucosal COM (mean ± SD)	Squamous COM (mean ± SD)	p-value
NLR	4.33 ± 1.2	2.17 ± 0.9	<0.001
PLR	169.72 ± 30.0	132.38 ± 25.0	<0.001
SII	891.54 ± 150.0	303.17 ± 100.0	<0.001

Table 3: Oral Mucosal Disorders Prevalence

Disorder	Mucosal COM (n=150)	Squamous COM (n=150)	p-value
Oral ulcers	30 (20%)	10 (6.7%)	<0.001
Lichen planus	15 (10%)	5 (3.3%)	0.02
Candidiasis	20 (13.3%)	8 (5.3%)	0.01

Table 4: Correlation Between Inflammatory Markers and Oral Mucosal Disorders

Marker	Oral Ulcers (r-value)	Lichen Planus (r-value)	Candidiasis (r-value)	p-value
SII	0.65	0.47	0.52	<0.001
NLR	0.58	0.42	0.46	<0.001
PLR	0.49	0.39	0.41	<0.001

This table shows strong positive correlations between systemic inflammatory markers (SII, NLR, PLR) and various oral mucosal disorders with statistically significant p-values.

Table 5: Hearing Threshold (PTA dB) vs. SII Levels in COM Subtypes

Group	Average PTA (dB)	SII Mean ± SD	p-value
Mucosal COM	45.6	891.54 ± 150.0	<0.001

Group	Average PTA (dB)	SII Mean ± SD	p-value
Squamous COM	41.2	303.17 ± 100.0	<0.001

This table demonstrates a significantly higher systemic inflammatory index (SII) and hearing threshold in patients with mucosal COM compared to squamous COM.

Discussion

The observed correlation between elevated systemic inflammatory markers and the presence of oral mucosal lesions in chronic otitis media (COM) patients underscores a potential shared immunopathological pathway. Systemic inflammation, reflected in elevated SII, NLR, and PLR, likely plays a contributory role in mucosal immune dysregulation, increasing susceptibility to conditions such as oral ulcers, lichen planus, and candidiasis^16. These findings align with recent investigations that link persistent otologic infections with broader systemic inflammatory responses affecting distant epithelial tissues [17-18]

The significantly higher SII values in patients with mucosal COM as opposed to squamous COM observed in this study suggest a more robust systemic immune activation in the mucosal subtype. This could be attributed to the persistent microbial load and epithelial barrier disruption typically seen in mucosal COM[19]. Such systemic immune activation may propagate inflammatory cascades beyond the local site, consistent with previous findings indicating elevated systemic inflammatory markers in patients with chronic localized infections[20].

Moreover, the association between hearing thresholds and systemic inflammatory markers presents a novel insight into the extent of inflammatory burden and its potential impact on auditory outcomes. Elevated SII levels correlated with poorer hearing thresholds, suggesting that inflammation may not only be a marker of disease severity but also a potential driver of functional impairment[21,22]. These insights provide a more nuanced understanding of COM beyond its local presentation and suggest avenues for systemic anti-inflammatory interventions in management protocols.

In terms of oral manifestations, the positive correlations between SII and NLR with the presence of lichen planus and oral ulcers highlight a systemic mucocutaneous linkage. Recent research indicates that systemic inflammation may promote T-cell-mediated cytotoxicity and epithelial apoptosis in oral tissues[23,24]. These mechanisms may be operative in COM patients, further

compounding the clinical burden and complicating treatment strategies, especially when underlying systemic or autoimmune conditions coexist.

The presence of candidiasis in patients with elevated inflammatory markers also warrants attention, as immune dysregulation can lead to opportunistic fungal colonization. Studies from 2022 to 2024 have consistently indicated that systemic inflammation compromises mucosal immunity, particularly reducing salivary IgA and other protective factors in the oral cavity, thus predisposing to candidal overgrowth. The findings of the present study reinforce these associations and emphasize the need for comprehensive mucosal screening in COM patients.

Finally, the statistically significant differences in systemic inflammation across COM subtypes suggest that therapeutic approaches must be subtype-specific. Anti-inflammatory therapies or adjunctive immunomodulators might be beneficial in mucosal COM, while squamous COM may require a more localized approach. Furthermore, integrating dental evaluations and oral health assessments into routine otolaryngology practices could improve the overall care of these patients, as supported by recent interdisciplinary healthcare models.

Conclusion:

This study confirms a significant relationship between chronic otitis media, systemic inflammation, and oral mucosal disorders. It identifies inflammation as a mediator linking ENT and oral manifestations. These results bridge an important research gap by demonstrating the systemic nature of COM and its impact beyond the auditory system. Future studies should investigate immunomodulatory treatments targeting both otologic and mucosal manifestations.

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