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Biochemical Parameter Analysis in Pediatric Patients with Chronic Tonsillitis

ALRUWAILI, FAISAL SUBAIH M[1], ALRUWAILI, KAMAL FARHAN N[1] ALSHAMMARI, AHMED FAHAD R[1], ALRUWAILI, HAMOUD OWAIDH W[1]

1: LABORATORY SPECIALIST

Abstract:

Chronic tonsillitis is a prevalent condition in pediatric pathology, influenced by various risk factors and pathogenic mechanisms. This study examines epidemiological data and biochemical markers related to inflammation, as well as mineral, lipid, and hepatic metabolism, in a cohort of 37 school-age children diagnosed with chronic tonsillitis. Our findings reveal a correlation between chronic tonsillitis and elevated levels of circulating inflammatory cells, transaminases, cholesterol, and triglycerides, alongside decreased levels of procalcitonin, C-reactive protein, calcium, vitamin D, and serum iron. These results underscore the interplay between the analyzed biochemical profile and the systemic factors implicated in the onset and persistence of chronic tonsillitis in children. Understanding these associations may facilitate prognostic optimization for pediatric chronic tonsillitis.

Keywords: Chronic tonsillitis, pediatric patients, biochemical analysis

Introduction:

Chronic tonsillitis, a component of Waldeyer's lymphatic ring inflammation primarily affecting the palatal tonsils, persists as a significant health concern among children despite advancements in medical management. The tonsils, integral lymphoid structures, play a crucial role in the immune response, exhibiting hyperplastic growth until around the age of 6, coinciding with the maturation of the defense system. (Abu Bakar et al., 2018)

However, environmental risk factors can trigger local and systemic pathogenic processes, perpetuating chronic inflammation in the tonsils, particularly the palatal ones. Consequently, systemic markers of inflammation and alterations in blood composition serve as indicators for assessing the risk and severity of tonsillectomy requirement. (Miyake & Karasuyama, 2017)

Although the correlation between circulating levels of lymphocytes, basophils, eosinophils, monocytes, or neutrophils and tissue-specific inflammation may vary, these systemic inflammatory elements offer insights into the overall proinflammatory status associated with chronic tonsillitis. (Tashkin & Wechsler, 2018)

Similarly, deviations from normal values in serum markers reflecting mineral metabolism, lipid profiles, or liver function highlight potential synergistic or alternative pathways contributing to the maintenance of chronic tonsillitis. (Ramirez et al., 2018)

This study investigates specific biochemical parameters indicative of inflammation in school-age patients, aiming to elucidate the relationship between inflammatory status and systemic markers representative of proinflammatory mechanisms. (Bain et al., 2017)

Materials and Methods:

This retrospective study comprised 37 school children aged 7 to 15 years diagnosed with a history of chronic tonsillitis, who underwent ongoing monitoring

Patients were seen at the Pediatrics department, during which they were advised to undergo a series of biochemical assessments, including complete blood count (CBC), procalcitonin, C-reactive protein, antistreptolysin O (ASO) titer, calcium, vitamin D, serum iron, aspartate aminotransferase (AST), alanine aminotransferase (ALT), cholesterol, and triglycerides.

The results of these recommended analyses were interpreted in the context of chronic tonsillitis diagnosis.

Statistical analysis of epidemiological data (age, gender, environment) and biochemical findings was conducted using the chi-square ($\chi 2$) comparison test within the SPSS10 (Statistical Package for Social Sciences) software, with a significance level set at $p<0.05$.

The study included patients diagnosed solely with chronic tonsillitis, excluding cases with concomitant acute or chronic inflammatory conditions, as well as those with immunocompromised status.

All data were collected prior to initiating any new specific or non-specific treatment, and only data from patients without nutritional supplements in the past three months were considered.

Written consent for data processing for scientific purposes was obtained from all legal representatives of the patients involved in the study.

Results:

In this study involving 37 school-age children, the mean age at diagnosis was 9.2±2.2 years, with the majority falling below 10 years (73%, 27 cases).

Females constituted the majority of the patients (70.3%, 26 cases), and most were from urban areas (59.4%, 22 cases).

Analysis of serum values for investigated biochemical parameters revealed notable findings:

- The majority of pediatric patients exhibited changes in complete blood count (CBC), including lymphocytosis (75.6%, 28 cases), basophilia (59.5%, 22 cases), eosinophilia (78.4%, 29 cases), monocytosis (59.5%, 22 cases), and neutrophilia (73%, 27 cases).
- Procalcitonin levels were low in 43.2% (16 cases), while C-reactive protein levels were low in 89.2% (33 cases).
- Antistreptolysin O (ASO) titers were elevated in 56.7% (21 cases). Decreased levels of calcium were observed in 81.1% (30 cases), along with reduced serum iron and vitamin D levels in 67.6% (25 cases).

- Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) levels were elevated in 64.9% (24 cases) of patients.
- High cholesterol levels were present in 75.7% (28 cases), and elevated triglycerides were observed in 70.3% (26 cases).

Statistical analysis indicated significant associations:

- Lymphocytosis (p=0.001), eosinophilia (p=0.002), and monocytosis (p=0.008) were significantly associated with the urban environment.
- Neutrophilia was prevalent among urban patients (p=0.026).
- Low procalcitonin levels were associated with urban residency (p=0.002), while C-reactive protein levels did not show significant associations (p>0.05).
- ASO elevation was associated with neutrophilia (p=0.046).
- Low vitamin D levels were statistically associated with decreased calcium levels (p=0.001).
- Iron deficiency was associated with neutrophilia (p=0.029).
- Elevated AST and ALT levels were significantly associated with basophilia (p=0.003).

Additionally, transaminase variations were synchronous across analyzed cases.

Discussion:

Chronic tonsillitis, with its peak incidence occurring between 5 and 8 years of age, remains a prevalent reason for pediatric medical visits and otolaryngological consultations. Effective management is crucial to prevent potential complications that could impact adult life. (Parisi et al., 2018)

In this study, a significant proportion of patients were females under the age of 10, predominantly from urban areas. The urban environment's prevalence can be attributed to factors like pollution and dense population, known risk factors exacerbating chronic tonsillitis in school-age children. (Ioniță et al., 2013)

Elevated levels of lymphocytes, basophils, eosinophils, monocytes, and neutrophils were observed in most patients, particularly those from urban settings. These circulating elements play pivotal roles in tonsillar inflammation, contributing to chronic inflammatory processes. For instance, lymphocytes secrete lymphokines that activate macrophages, while basophils participate in allergic immunomodulation mechanisms. Eosinophils, often indicative of allergic responses, were notably elevated in urban patients, reflecting heightened exposure to allergens and pollutants. (Stelter, 2014)

Neutrophils, typically associated with acute inflammation, also contribute to chronic inflammation through various mechanisms, including phagocytosis and the release of immunogenic products. Procalcitonin and C-reactive protein, as markers of inflammation and bacterial infection, exhibited low values, suggestive of the chronic repair phase in tonsillar lesions. (Grunig et al., 2014)

Antistreptolysin O (ASO) elevation, identified in over half of the patients, correlated with neutrophilia, indicating a potential role in chronic inflammation. Additionally, low serum levels of calcium, vitamin D, and iron were prevalent, suggesting their involvement in chronic tonsillitis

pathogenesis. Notably, a significant association between calcium and vitamin D levels was observed, reinforcing their immunomodulatory roles. (Mostafavi et al., 2015)

Elevated AST and ALT levels, indicative of liver dysfunction, were prevalent, likely attributed to disorganized lifestyles leading to overweight or obesity. Liver dysfunction in children, traditionally viewed as metabolic, is increasingly recognized for its immunological functions. (Kaushansky et al., 2016)

The high prevalence of elevated cholesterol and triglyceride levels aligns with literature describing adipokine release from adipose tissue, contributing to chronic inflammation and predisposing children to obesity-related complications. (Sakai & Kobayashi, 2015)

While the study identified increased inflammatory cell counts in blood, the discrepancy with tissue-level counts underscores the need for further investigation into the underlying pathogenic mechanisms and their clinical significance. (Caielli et al., 2012)

Overall, these findings highlight the multifaceted nature of chronic tonsillitis in children, necessitating comprehensive management strategies addressing both environmental and systemic factors. Further research is warranted to elucidate the intricate interactions driving this complex condition. (Castanheira & Kubes, 2019)

Conclusions:

This study underscores the systemic nature of chronic tonsillitis in children, with a notable increase in circulating inflammatory cells observed in the majority of patients. This finding suggests a synergistic action at the systemic level in perpetuating the inflammatory process associated with chronic tonsillitis.

Furthermore, the study elucidates the involvement of altered mineral and lipid metabolism in the self-maintenance of chronic tonsillitis. Low serum levels of essential minerals such as calcium, vitamin D, and iron, alongside elevated cholesterol and triglyceride levels, highlight the complex interplay between metabolic dysregulation and chronic inflammation in pediatric tonsillitis.

The urban environment emerges as a significant risk factor for chronic tonsillitis, likely due to increased exposure to pollutants and allergens. This underscores the importance of environmental factors in the pathogenesis of pediatric tonsillitis and highlights the need for targeted interventions in urban settings to mitigate the risk of chronic tonsillitis in children.

The comprehensive biochemical profile obtained in this study, along with the observed relationships between analyzed parameters, offers valuable insights for optimizing the criteria for monitoring, diagnosis, and treatment of chronic tonsillitis in children. By leveraging this information, healthcare providers can tailor interventions more effectively, potentially improving outcomes and quality of life for pediatric patients with chronic tonsillitis.

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