Original Article

Measurement Concentration of Ficolin-1 and Calprotectin for Serum and Swab in Tonsillitis Infection

Shaimaa Mohammed Wtwt, Azhar Omran Althahab[1]

AL-Hindia Teaching Hospital, Karbala Health Directorate, Karbala, Iraq, [1]Department of Biology, College of Science, University of Babylon, Hilla, Iraq

Abstract

Background: Tonsillitis is a common and widespread disease in children. It is related to the immunity of persons, so a group of people with tonsillitis was studied and the immunity associated with tonsillitis was studied by studying some immunological parameters. **Objective:** The aim of this study was to measure the level of calprotectin and ficolin-1 in patients and compared with healthy control. **Materials and Methods:** During the period from March to October, a total of 150 patients were collected from Al-Hindia General Hospital (ear, nose and throat [ENT] unit) (n = 150 blood samples, n = 150 swab samples), and samples were also collected as 50 control samples. The whole blood sample was collected from each participant, noting that the sera and swab were used to determine ficolin-1 and calprotectin concentration by enzyme-linked immunosorbent assay kit (BT LAB) Bioassay Technology Laboratory (Cat. No. E4010hu) China. **Results:** There are variable concentrations of ficolin-1 among patient groups. A significant increase at $P < 0.05$ concentration of ficolin-1 in mucosal patients in comparison with control at the mean ± SD (4.13±1.29), whereas A significant increase at $P < 0.05$ concentration of ficolin-1 in systemic patients in comparison with control at the mean ± SD (4.13 ± 1.29). There are variable concentrations of calprotectin among patient groups. A significant increase at $P < 0.05$ concentration of calprotectin in mucosal patients in comparison with control at the mean ± SD (1.00 ± 0.00), whereas nonsignificant at $P < 0.05$ concentration of calprotectin in systemic patients in comparison with control at the mean ± SD (7.96 ± 5.85). **Conclusion:** Signification increasing in immunological parameters was shown in the healthy control compared with serum and swabs of ficolin-1. Significant increase in serum and swab compared with healthy control.

Keywords: Calprotectin, ficolin-1, tonsillitis

Introduction

Tonsillitis is an infection of the tonsils in the pharynx. Tonsillopharyngitis is the word most frequently used because inflammation typically affects both the lingual and adenoid tonsils. Tonsillitis is a common condition that can be caused by viruses or bacteria, particularly in children.[1] Numerous organisms, including bacteria, viruses, yeast, fungus, and parasites, can cause tonsil inflammation. Some of these infectious organisms are naturally present in the oropharynx, while others are external pathogens. Since the oropharynx is colonized by numerous organisms, some illnesses are polymicrobial, which can be seen in infections that combine anaerobic and aerobic bacteria.[2]

The complement system was crucial in the host's defense against contagious pathogens because it could encourage leukocyte recruitment, opsonization of immune complexes and pathogens, and cytolysis. Multiple pattern-recognition molecules (PRM)—ficolins, mannose-binding lectin (MBL), and collectin (CL-K1)—along with the MBL/ficolin-associated serine proteases—which play a crucial role in recognizing the glycoproteins on the surface of the pathogen—activated the lectin pathway, a crucial pathway of the complement system.[3-5] Humans have three different kinds of ficolin, which are innate immunity PRM. These are ficolin-1 (M-ficolin), ficolin-2 (L-ficolin), and ficolin-3 (H-ficolin).[6]

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Address for correspondence: Dr. Shaimaa Mohammed Wtwt, AL-Hindia Teaching Hospital, Karbala, Iraq. E-mail: Shaimaaali271993@gmail.com.

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Ficolin-1 is primarily released by monocytes and neutrophils and is encoded by the FCN1 gene on chromosome 9q34. The FCN2 gene, which is found at chromosome 9q34 and encodes ficolin-2, is primarily produced by hepatocytes and secreted into the blood system. Numerous academics have examined the relationship between FCN gene polymorphism and numerous autoimmune, inflammatory, and infectious illnesses in recent years.[7,8]

Calprotectin makes up 60% of the cytosolic protein in neutrophils and, to a lesser degree, in monocytes and macrophages, which are present in various body fluids such as plasma, urine, cerebrospinal fluid, feces, saliva, and synovial fluid. The metabolic processes of cell differentiation, immune control, tumorigenesis, apoptosis, and inflammation are all impacted by calprotectin. The protein calprotectin, which is thought to be a favorable acute-phase protein, is important during inflammation. It supports chemotaxis and, as a damage-associated molecular pattern protein, is linked with the innate immune response. It induces the expression of cell receptors involved in migration, adhesion, and neutrophil phagocytosis.[9]

Materials and Methods

The tonsillitis swab samples and blood were typically taken from 200 individuals, including 50 healthy controls and 150 patients with clinically confirmed tonsillitis (70 females and 80 males) age range (1–75 years). Between March 2022 and October 2022, these patients visited the ear, nose and throat (ENT) department at Al-Hindia General Hospital, where a tonsillitis swab was collected using a sterilized cotton swab from the infected region.

The whole blood sample was collected from each participant, noting that the sera and swab were used to determine ficolin-1 and calprotectin concentration by enzyme-linked immunosorbent assay (ELISA) kit (BT LAB) Bioassay Technology Laboratory (Cat. No. E4010hu) China.

Results

Immunological study

Ficolin-1 concentration

Ficolin-1 was estimated by using ELISA, which was used for quantification of human ficolin-1. The results of this test were calculated by using the standard curve fit equation. Mean ± SD of ficolin-1 concentration in the serum of patient was 2.99 ± 0.79 pg/mL, while control was 4.13 ± 1.29 pg/mL with a high significantly increased at *P* value <0.05. Also in mucosal ficolin1 concentration was higher 2.98 ± 0.52 pg/mL compare with control 5.77 ± 0.61 pg/mL and give increase in *P* value < 0.05 as shown in Table 1.

Table 1: Concentration of ficolin-1 pg/mL in tonsillitis patients and control

Ficolin-1 (pg/mL)	No.	Mean ± SD	*P*-value
Patients (serum)	150	2.99 ± 0.79	0.000**
Control	50	4.13 ± 1.29	
Patients (swab)	150	2.88 ± 0.52	0.000**
Control	50	5.77 ± 0.61	

**$P <$ 0.01 (highly significant)

There are variable concentrations of ficolin-1 among patient groups. A significant increase at $P < 0.05$ concentration of ficolin-1 in mucosal patients in comparison with control at the mean ± SD (5.77 ± 2.1), whereas a significant increase at $P < 0.05$ concentration of ficolin-1 in systemic patients in comparison with control at the mean ± SD (4.13 ± 1.29) [Table 1].

Table 2 shows the concentration of ficolin-1 (systemic and mucosal) increased in control groups compared with patients that are significant in all groups.

2-Calprotectin concentration

Calprotectin was estimated by using ELISA, which was used for the quantification of human calprotectin. The results of this test were calculated by using a standard curve fit equation. Mean ± SD of calprotectin concentration in the serum of the patient was 12.13 ± 59.11 pg/mL, while control was 7.96 ± 5.85 pg/mL with nonsignificantly in *P* value < 0.05. Also in mucosal Calprotectin concentration was higher 6.55±1.3 pg/mL compare with control 2.36±0.02 pg/mL and give significantly increase in *P* value <0.05 as shown in Table 3.

There are variable concentrations of calprotectin among patient groups. A significant increase at $P < 0.05$ concentration of calprotectin in mucosal patients in comparison with control at the mean ± SD (1.00 ± 0.00), whereas nonsignificant at $P < 0.05$ concentration of calprotectin in systemic patients in comparison with control at the mean ± SD (7.96 ± 5.85) [Table 3].

Table 4 compared each group of patients with matched age groups of control. The results appeared the concentration of calprotectin (systemic) in control were higher than in patients in group 1 and group 2, while in group 3 and group 4, the concentrations of calprotectin in patient were higher the in control, the concentration of calprotectin in (mucosal) the patient was higher than control in all groups but nonsignificant in all groups for systemic and mucosal.

Discussion

A number of cells produce ficolins (ficolin-1 by neutrophils, monocytes, and in bone marrow; ficolin-2 by hepatocytes; ficolin-3 by hepatocytes, alveolar type II pneumocytes, and ciliated bronchial cells). They are in the blood and

Table 2: Prevalence of ficolin-1 among age group

Parameter	Age	Patient (systemic)	Control (systemic)	*P* value	Patient (mucosal)	Control (mucosal)	*P* value
Ficolin-1	1–14	3.61 ± 1.2	4.09 ± 1.3	0.000**	2.75 ± 0.6	5.77 ± 2.1	0.000**
	15–29	2.92 ± 0.7	4.09 ± 1.3	0.000**	3.05 ± 0.8	5.77 ± 2.1	0.000**
	30–44	2.63 ± 0.3	4.09 ± 1.3	0.000**	2.99 ± 0.5	5.77 ± 2.1	0.000**
	<45	2.64 ± 0.2	4.09 ± 1.3	0.000**	2.74 ± 0.2	5.77 ± 2.1	0.000**

**$P <$ 0.01 (highly significant)

Table 3: Concentration of calprotectin pg/mL in tonsillitis patients and control

Calprotectin (pg/mL)	No.	Mean ± SD	*P*-value
Patients (serum)	150	12.13 ± 2.3	0.620
Control	50	7.96 ± 1.05	
Patients (swab)	150	6.55 ± 1.3	0.000**
Control	50	2.36 ± 0.02	

**$P <$ 0.01 (highly significant)

support the overall immune reaction. Additionally, ficolin-1, which is linked to pulmonary macrophages, and ficolin-3 play a local role in the respiratory system.[10]

Ficolin-1, also known as M-ficolin, binds to certain respiratory pathogens, such as *Staphylococcus aureus*, *Streptococcus pneumoniae, Micobacterium tuberculosis*, *Pseudomonas aeruginosa*, and *Aspergillus fumigatus*.[11]

The current research, which disagrees with,[3] found that serum ficolin-1 levels were lower in patients with systemic lupus erythematosus than in healthy controls and that these levels were negatively correlated with disease activity.

Calprotectin (CP), a calcium- and zinc-binding heterodimer of 36.5 kDa size that is primarily produced in neutrophils and has significant extracellular activity, is made up of two heavy (MRP14) and one light (MRP8) S100 family proteins that are involved in extracellular signaling.[12] Antibacterial, apoptosis-inducing, and chemotactic activities are just a few of the many roles that CP plays.[13] CP can be used as an inflammatory marker in pediatric illnesses, and fecal calprotectin is a noninvasive, objective test that reflects various pathological processes that occur in patients' intestines.[14] While serum calprotectin (SCP) may be a sensitive nonspecific inflammatory measure in a number of pediatric conditions.[15]

Similar to[16] the current research found that asthmatic patients' SCP levels were significantly higher than those of healthy controls and tended to be higher than those of people with chronic obstructive pulmonary disease patients. Patients with noncystic fibrosis bronchiectasis, a disease marked by recurrent respiratory infections reflected in primarily neutrophilic airway inflammation, had SCP levels that were even higher. SCP levels in our asthmatic community were unaffected by gender, age, smoking status, atopic status, or asthma onset. There was a significant positive correlation and positive correlating tendency between SCP levels and sputum neutrophil percentages, respectively, in both asthmatic subgroups with either neutrophilic or eosinophilic airway inflammation, supporting earlier findings. Similar findings were made by,[17] who discovered that patients with Behcet's syndrome had substantially higher serum levels of calprotectin than patients with viral infections and healthy controls. Additionally, compared to the standard biomarkers, the initial SCP levels showed improved diagnostic precision for the bacterial etiology of sepsis. Despite the fact that both protein levels significantly dropped over the course of the research, the WBC count returned to normal more quickly. Adults with various bacterial infections, such as typhoid fever, tuberculosis, acute melioidosis, sepsis complicating surgery, and secondary bacterial infection after trauma, had already been discovered to have elevated calprotectin concentrations in the blood,[18,19] whereas not agreement with[20] found that there was no difference in serum level of calprotectin in asthmatic children and healthy controls.

Calprotectin is used in the diagnosis of respiratory infections, and studies[21] show that it performs better than procalcitonin (PCT) and heparin-binding protein at differentiating bacterial and Mycoplasma respiratory infections from viral illnesses. Our findings are supported by findings from other research that procalcitonin has a limited clinical utility in the diagnosis of bacterial pneumonia.

The increase in calprotectin observed in sepsis[9,18] and other inflammatory conditions with neutrophil activation, such as appendicitis, sinusitis, and infections of prosthetic joints, is consistent with the response of calprotectin to bacterial respiratory infections.[22-25]

Conclusion

1. Signification increasing of immunological parameters was shown in healthy control compared with serum and swabs of ficolin-1.
2. Significant increase in serum and swab compared with healthy control.

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Conflicts of interest
There are no conflicts of interest.

Table 4: Prevalence of calprotectin among age group

Parameter	Age	Patient (systemic)	Control (systemic)	*P* value	Patient (mucosal)	Control (mucosal)	*P* value
Calprotectin	1–14	7.16±1.5	6.14±1.1	0.000**	6.18±1.4	2.16±0.3	0.000**
	15–29	7.67±1.1	6.18±1.4	0.000**	5.16±1.9	3.32±0.8	0.000*
	30–44	11.67±3.3	8.22±0.8	0.000**	9.15±1.1	3.21±0.2	0.000**
	<45	11.46±2.4	9.15±1.1	0.000**	7.77±1.2	2.99±0.1	0.000**

**P* value < 0.05 (significant)

***P* value < 0.01 (highly significant)

References

1. Georgalas CC, Tolley NS, Narula PA. Tonsillitis. BMJ Clin Evid 2014;2:0503.
2. Stelter K. Tonsillitis and sore throat in children. GMS Curr Top Otorhinolaryngol Head Neck Surg 2014;Doc07:13.
3. Hein E, Nielsen LA, Nielsen CT, Munthe-Fog L, Jacobsen S, *et al*. Ficolins and the lectin pathway of complement in patients with systemic lupus erythematosus. Mol Immunol 2015;63:209-14.
4. Alfatlawi WRO, Al-Kaif LAIK, Mahdi AE, Al-Khafaji YAK, Al-Saadi M A-K, Al-Charrakh AH, *et al* Immunological Study of Cytomegalovirus in the Serum of Iraqi Patients with Celiac Disease. Med J Babylon 2025;22:578-82.
5. Al-Musawy SHH, Al-Saimary IE, Flaifil MS. Level of cytokines profile in polycystic ovary syndrome. Med J Babylon 2023;37: 124-8.
6. Garred P, Honoré C, Ma YJ, Rorvi, Cowland J, Borregaard N, *et al*. The genetics of ficolins. J Innate Immun 2010;2:3-16.
7. Andrade FA, Beltrame MH, Bini VB, Gonçalves LB, *et al*. Association of a new FCN3 haplotype with high ficolin-3 levels in leprosy. PLoS Negl Trop Dis 2017;11:e0005409.
8. Elkoumi MA, Emam AA, Allah MN, Sherif AH, Zakaria MT, Sedky YM, *et al*. Association of ficolin-2 gene polymorphisms and susceptibility to systemic lupus erythematosus in Egyptian children and adolescents: A multicenter study. Lupus 2019;28:995-1002.
9. Bartakova E, Stefan M, Stranikova A, Pospíšilová L, Arientová S, Beran O, *et al*. Calprotectin and calgranulin C serum levels in bacterial sepsis. Diagn Microbiol Infect Dis 2019;93:219-26.
10. Matsushita M, Barnum S, Schein T. Ficolins. The Complement Factsbook. 2nd ed. London: Academic Press, Elsevier; 2018. p. 45-56.
11. Bidula S, Sexton DW, Schelenz S. Ficolins and the recognition of pathogenic microorganisms: An overview of the innate immune response and contribution of single nucleotide polymorphisms. J Immunol Res 2019;5:3205072.
12. Tibble JA, Bjarnason I. Non-invasive investigation of inflammatory bowel disease. World J Gastroenterol 2001;7:460-5.
13. Chen CC, Huang JL, Chang CJ, Kong MS. Fecal calprotectin as a correlative marker in clinical severity of infectious diarrhea and usefulness in evaluating bacterial or viral pathogens in children. J Pediatr Gastroenterol Nutr 2012;55:541-7.
14. Turner D, Leach ST, Mack D, Uusoue K, McLernon R, *et al*. Faecal calprotectin, lactoferrin, M2-pyruvate kinase and S100A12 in severe ulcerative colitis: A prospective multicentre comparison of predicting outcomes and monitoring response. Gut 2010;59:1207-12.
15. Sidler MA, Leach ST, Day AS. Fecal S100A12 and fecal calprotectin as noninvasive markers for inflammatory bowel disease in children. Inflamm Bowel Dis 2008;14:359-66.
16. Decaesteker T, Seys S, Hox V, Dilissen E, Marijsse G, Manhaeghe L, *et al*. Serum and sputum calprotectin, a reflection of neutrophilic airway inflammation in asthmatics after high-altitude exposure. Clin Exp Allergy 2017;47:1675-7.
17. Bartáková E, Štefan M, Stráníková A, Pospíšilová L, Arientová S, Beran O, *et al*. Calprotectin and calgranulin C serum levels in bacterial sepsis. Diagn Microbiol Infect Dis 2018;93:219-26.
18. Jonsson N, Nilsen T, Gille-Johnson P, Bell M, Martling CR, *et al*. Calprotectin as an early biomarker of bacterial infections in critically ill patients: An exploratory cohort assessment. Crit Care Resusc 2017;19:205-13.
19. Natesan M, Corea E, Krishnananthasivam S, Sathkumara HD, Dankmeyer JL, *et al*. Calprotectin as a biomarker for melioidosis disease progression and management. J Clin Microbiol 2017;55:1205-10.
20. Cobanoglu N, Galip N, Dalkan C, Bahceciler NN. Leptin, ghrelin and calprotectin: Inflammatory markers in childhood asthma. Multidiscip Respir Med 2013;8:62.
21. Wussler D, Kozhuharov N, Badertscher P, Mueller C, Breidthardt T, Sabti Z, *et al*. Clinical utility of procalcitonin in the diagnosis of pneumonia. Clin Chem 2019;65:1426-36.
22. Wouthuyzen-Bakker M, Ploegmakers JJW, Ottink K, Kampinga GA, Wagenmakers-Huizenga L, Jutte PC, *et al*. Synovial calprotectin: An inexpensive biomarker to exclude a chronic prosthetic joint infection. J Arthroplasty 2018;33:1149-53.
23. Nordal HH, Brokstad AK, Solheim M, Halse AK, Kvien TK, Hammer HB, *et al*. Calprotectin (S100A8/A9) has the strongest association with ultrasound-detected synovitis and predicts response to biologic treatment: Results from a longitudinal study of patients with established rheumatoid arthritis. Arthritis Res Ther 2017; 19:3.
24. Al-Maliki L, Guma MA, Alhiti MAJ, Ali SM, Ashraf S, MA Abdel-Raheem. Investigation of Some Biochemical Parameters Changes Due to Coronavirus Infections. HUCJMS 2025;3:Article 1. DOI: https://doi.org/10.62445/2958-4515.1055.
25. Ramadhan HH, Mohammed RN. Biomarkers and the Identification of Kidney Damage in Patients with Diabetes Mellitus. HUCJMS 2024;2:Article 8. DOI: https://doi.org/10.62445/2958-4515.1037.