ORIGINAL ARTICLE

DOI:10.33897/fujd.v2i1.281

Role of raised C-Reactive Protein (CRP), Total Leukocyte Count (TLC) and Differential Leukocyte Count (DLC) in Odontogenic Space Infections

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Received: 29 August 2021 / Revised: 04 November 2021 / Accepted: 26 November 2021 / Published online: 12 January 2022

ABSTRACT

Objectives: Serum C- Reactive Protein (CRP), Total Leukocyte Count (TLC) and Differential Leukocyte Count (DLC) measurements have been effectively utilized as a diagnostic marker to study infection in many disciplines. However, the usefulness of these is scarce in maxillofacial infections. This study aimed to assess the frequency of raised CRP, TLC and DLC in patients with odontogenic space infections.

Materials and Methods: This descriptive cross-sectional study was conducted at the Department of Oral and Maxillofacial Surgery, de'Montmorency College of Dentistry, Punjab Dental Hospital, Lahore, over a span of six months i.e., from August 2019 to February 2020. A total of 181 patients (age range from 18 to 70 years) with facial space infection of odontogenic origin only were recruited. Patients suffering from chronic disease like diabetes mellitus and chronic renal failure, and pregnant women were excluded. Patient's venous blood samples were collected preoperatively and sent to the hospital laboratory for measurement of CRP, TLC and DLC levels. Descriptive statistics (mean ± standard deviation and frequencies) were performed using SPSS version 21.

Results: Amongst the 181 participants, the mean age of 44.43 ± 14.68 years were recorded of which 113 (62.43%) were male and 68 (37.57%) were females with male to female ratio 1.7:1. The mean values of CRP were 3.52 ± 1.23 mg/L, TLC were 13670 ± 1890 cells/mm3 and DLC were 8.54 ± 2.39 × 109 /L. Moreover, the frequency of CRP levels was raised in 100%, TLC in 71.82% and DLC in 85.08% patients with odontogenic space infections.

Conclusion: This study concluded that raised CRP levels are more indicative of the clinical severity of the infection compared to TLC and DLC. Thus, CRP was found to be an effective biomarker in patients with facial space infection of odontogenic origin.

Keywords: CRP, DLC, Infections, Laboratory, Odontogenic Space, TLC

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ORIGINAL ARTICLE

DOI:10.33897/fujd.v2i1.281

How to cite this Article:

Hameed S, Akhtar MU, Janjua OS, Mirza AI, Saleh MI, Javaid H. Role of raised C-Reactive Protein (CRP), Total Leukocyte Count (TLC) and Differential Leukocyte Count (DLC) in Odontogenic Space Infections. Found Univ J Dent. 2022;2(1):58-63

INTRODUCTION

Fascial spaces are latent spaces formed by the distention of tissues secondary to infection from the periodontal tissues, pulp and alveolar bone, where the infection penetrates the cortical plate and discharge into the surrounding spaces.[1] Orofacial infection are common in human beings since ancient times. The anatomical and functional complexity of the orofacial region and the presence of adjacent spaces advance the spread of infections in the region, making diagnosis sometimes difficult and increasing the potential for severe complications.[2] The spread of infections has been found to follow the path of least resistance through connective tissue and along fascial planes leading to diverse presentations depending on the type, site and area of spread.[3] Patients with fascial space infections of odontogenic origin are at major risk from life-threatening complications such as airway obstruction, meningitis, and septicemia, thus making vigilant scrutiny and monitoring of such patients a necessity.[4]

Although clinical signs are the first line to diagnose any ongoing disease process, however, these may sometimes appear late or may be insufficient to give a precise assessment of an infectious process particularly in the case of facial space infection of odontogenic origin. Different laboratory diagnostic markers have been used to predict the severity and course of infections, thereby avoiding the potential risk of patients slipping into further complications. Among those, white blood cells count (WBC) and erythrocyte sedimentation rate (ESR) values are valuable in determining the state of the patient at testing time, however, the predictability of these is limited.[5] The advantage of serum-derived surrogate predictor behaviour and the outcome cannot be underestimated, arising interest in identifying substances that could function as a prospective monitor of disease progression. Thus, various inflammatory markers such as C-Reactive Protein (CRP), Total Leukocyte Count (TLC) and Differential Leukocyte Count (DLC) came into existence for quantitative determination.[6] Quantitative determination of serum inflammatory biomarkers can aid in defining therapeutic efficacy of different treatment regimes of infection, for monitoring post-operative infections, for investigating levels of infections and appropriate use of antibiotics.[7,8] Besides, All three tests (triple test) are easily available blood tests, are not very expensive and the definite advantage is that they can be obtained within about 1-2 h. Thus, the surgeon on-call can decide about the management of patients suspected of acute appendicitis well in time before complications ensue.

This study aimed to determine the frequency of raised CRP, TLC and DLC in patients with odontogenic space infections. A literature search revealed no local study on this topic, so this study will be a very useful addition to the existing literature. Moreover, this study will be helpful for the general dentists, oral and maxillofacial surgeons, and general practitioners in the management of odontogenic fascial space infections, as it will highlight the better and reliable indicators out of CRP, TLC and DLC for the assessment of odontogenic space infections.

MATERIALS AND METHODS

This descriptive, cross-sectional study was conducted in the Department of Oral & Maxillofacial Surgery, Punjab Dental Hospital, de'Montmorency College of Dentistry, Lahore from August 2019 to February 2020. Ethical approval was sought from the institutional ethical committee and written informed consent from all the patients were obtained before the start of the

DOI:10.33897/fujd.v2i1.281

study. A total of 181 consecutive patients (age range from 18-70 years irrespective of gender) suffering from fascial space infection of odontogenic origin only were included. Medically compromised patients, pregnant females, chronic smokers, patients on steroid therapy and contraceptives were excluded from the study. All the patients were treated and observed by the same surgeon. The sample size was determined using the WHO calculator with a confidence interval of 95% and a 7% margin of error. Diagnosis of the space involved was made based on history and clinical examination (presence of carious or periodontally involved tooth correlated as foci of infection on clinical examination, and radiographic evidence of periapical changes). The patient's venous blood sample was collected pre-operatively by applying a tourniquet and puncturing antecubital vein using a vacutainer and was sent to the hospital laboratory for measurement of serum CRP, TLC and DLC levels. Definitive management consisted of incision and drainage of abscess and the extraction of the offending tooth as indicated. Empirical antimicrobial therapy and appropriate analgesic drugs were started for the control of infection and relief of pain. All the personal information and laboratory reports of the patients included in this study were kept strictly confidential.

The collected information was analyzed by using SPSS version 20.0. Mean and standard deviation were calculated for age, duration of symptoms, serum CRP, TLC and DLC levels. Frequency and percentages were calculated for gender, raised serum CRP, TLC and DLC.

RESULTS

Amongst the 181 participants, the mean age of 44.43± 14.68 years was recorded of which 113 (62.43%) were male and 68 (37.57%) were females with male to female ratio 1.7:1. The mean duration of symptoms in this study was 29.24±7.61 hours. The mean BMI was 30.02±2.05 kg/m^2. The mean values of CRP were 3.52 ± 1.23 mg/L, TLC was 13670±1890 cells/mm3 and DLC were 8.54±2.39 × 109 /L. Moreover, as shown in Table 1, the frequency of CRP levels was raised by 100%, TLC in 71.82% and DLC in 85.08% of patients with odontogenic space infections.

Table 1: Frequency of raised C-Reactive Protein (CRP), Total Leukocyte Count (TLC) and Differential Leukocyte Count (DLC) in patients with odontogenic space infections

Laboratory test	Frequency (%)	
	Yes	No
Raised CRP	100 (100.0%)	00 (0.0%)
Raised TLC	130 (71.82%)	51 (28.18%)
Raised DLC	154 (85.08%)	27 (14.92%)

DISCUSSION

Advocates of inflammatory markers narrate numerous advantages for their usage. According to them, quantitative determination of serum markers can be used for determining the therapeutic efficacy of different treatment regimens of infections, for monitoring post-operative infections, for investigating various levels of infections, use of prophylactic antibiotics and duration of antibiotic usage become more appropriate.[9] Thus keeping various advantages of serum inflammatory markers in mind, many authors advised the use of CRP in the assessment of infections.[10-12]

In this study, the frequency of raised CRP levels was found in 100%, TLC in 71.82% and DLC in 85.08% of patients with odontogenic space infections. The results are similar to the study performed by Bali and colleagues in 2017 which showed raised CRP levels were found in 100%, TLC in 64.0% and DLC in 98.0% of patients with odontogenic space infections.[12]

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CRP was identified in 1930 by Tillet and Francis and is regarded as the acute-phase protein.[13] Normal values of CRP range from 1 to 10 mg/L. Serum CRP is nearly absent in healthy individuals but increases to 1000-fold or more when tissue damage occurs during infection, tissue injuries and inflammation.[14] It has been studied as a screening device for inflammation, a non-specific marker for disease activity and as a diagnostic adjunct. Physiologically, CRP enhances cell-mediated immunity by promoting phagocytosis, accelerating chemotaxis, and activating platelets. CRP is a reliable early indicator of inflammation or injury.[15] Smilowitz and colleagues recently documented that serial postoperative CRP levels could predict septic complications before their clinical manifestation.[16] In severe infections or inflammatory reactions a marked increase in the serum concentration is often seen. This suggests the possibility that the rise of CRP is sufficiently rapid and specific to serve as a definitive aid in the early diagnosis of septicemia.[17] Thus, based on these properties of the markers attempt has been made to use them in patients with fascial space infections.[18]

In the study conducted by Pinilla et al. a statistically significant correlation between prealbumin and CRP at 2nd day ($r = 0.45$, $p < 0.01$) and 5th day ($r = 0.53$, $p < 0.01$) in infection patients were observed.[19] Moreover, another study on undernourished children with an associated clinical infection found that mean serum levels of prealbumin was significantly decreased ($p < 0.001$) and levels of CRP was significantly increased ($p < 0.01$) when compared to healthy controls.[20]

The spread of infections to fascial spaces, which is an indicator of the severity of infection, is dependent on several factors such as the virulence of the microorganisms involved, duration of infection, state of patient's health, site of the infection, the point at which pus escapes from bone and discharges into the soft tissues and the natural barriers to the spread of infection.[3] The mean duration of symptoms in this study was 29.24±7.61 hours which is contrary to a study conducted by Sanchez et al. who studied 151 patients with severe odontogenic infections and reported that most of their patients presented with a clinical course of fewer than 7 days (81.8%) and few patients (18.2%) presented with a clinical course of more than 7 days.[21]

The raised frequency of CRP compared with TLC and DLC in this study are supported by various studies which showed that CRP is a better indicator of an infectious process because the CRP level rises faster than WBC in odontogenic infections.[9, 22-24]

CONCLUSION

This study concluded that among the three biomarkers studied, the frequency of raised CRP levels was found in 100% of patients followed by TLC and DLC. Thus, CRP was found to be an effective biomarker in patients with odontogenic space infections. So, we recommend that CRP, DLC and TLC should be used routinely for the assessment of odontogenic space infections to manage appropriately as this would result in reducing the morbidity of these patients. However, the value of CRP must always be interpreted in the clinical context and should not be used alone as an indicator to rule out a specific diagnosis.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

The ethical approval is provided by the Institutional Ethical Review Committee at Punjab Dental Hospital, de'Montmorency College of Dentistry, Lahore

FUNDING DISCLOSURE

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Approval of the final version of the manuscript to be

DOI:10.33897/fujd.v2i1.281

published: S. Hameed, M.U. Akhtar, O.S. Janjua, A.I. Mirza, I. Saleh, H. Javaid

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