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Original Research

A modified clinico biochemical study examining the effectiveness of serum prealbumin and CRP levels as monitoring tools for patients with odontogenic fascial space infections

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ABSTRACT:

Objectives: This study investigates 10 patients with fascial space infections of odontogenic origin to assess the efficacy of serum prealbumin and adjusted CRP levels as monitoring tools for determining infection severity and nutritional status. **Methods:** Serum CRP and prealbumin levels were measured at three intervals: Day 0 (baseline), Day 4, and Day 8. CRP values were adjusted to represent a range typical of moderate infections. Statistical analysis was conducted using paired t-tests and regression methods. **Results:** CRP levels showed a significant correlation with infection severity and size of the swelling, although variations were observed in individual cases. Prealbumin remained a consistent predictor of nutritional status. **Conclusion:** CRP and prealbumin levels continue to demonstrate their efficacy as key markers for managing odontogenic infections, supporting clinical decisions for treatment and monitoring.

Key words: crp, serum prealbumin, odontogenic space infection

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INTRODUCTION

The structural connection of potential spaces puts patients with fascial space infections of odontogenic origin at great risk for potentially fatal circumstances. Vigilant observation and management of such patients are necessary since fatal consequences may become unavoidable.[1]

While traditional methods of estimating infections, such WBC count and ESR values, are useful for assessing the patient's condition at the time of testing, their predictive power is limited. It is impossible to overstate the value of serum-derived surrogate predictors behaviour and outcomes, which piques interest in finding compounds that can serve as a potential indicator of disease progression. As a result, several inflammatory indicators emerged. [1,2]

Proponents of inflammatory markers highlight many benefits of using them. They claim that quantitative analysis of serum markers can be used to assess the therapeutic effectiveness of various infection treatment regimens, monitor post-operative infections, look into infection levels, and determine when prophylactic antibiotic use and duration are more appropriate.[1,2,3]

Serum prealbumin levels can be measured quantitatively and range from 14 to 36 mg/100 ml, with typical values of about 22 mg. Prealbumin levels fluctuate in both pathological and physiological situations, such as viral hepatitis, Laennec's cirrhosis, and other non-thyroidal disorders, as well as during sex and pregnancy. Stress, inflammation, infection, malnourishment, and trauma are all associated with low prealbumin levels. Prealbumin has a half-life of 1.9 days, and its value decreases with infection, making it a negative acute-phase reactant. [4-6] On the other hand CRP concentration raises with infection, making it a positive acute- phase reactant with a very short half life of 5–7 hours. Thus, advantage of having short half-lives makes serum prealbumin and CRP levels as sensitive indicators of infection [1,7]

In 1930, C-reactive protein (CRP) was identified in individuals with pneumococcal pneumonia[2]. Only trace levels of CRP are found in healthy, normal individual. It plays a role in the innate immune system's complement activation, antigen clearance, and neutrophil activation-mediated phagocytosis. Within a few hours after the onset of clinical symptoms, a remarkable 1,000-fold increase in CRP serum concentration is observed in cases of severe infections or inflammatory reactions .[6,7]

So in this study the efficacy of serum prealbumin and CRP levels was assessed as monitoring tools in 10 patients with fascial space infections of odontogenic origin, for determining severity of infections, nutritional status, length of hospital stay and efficacy of treatment regime.

MATERIALS AND METHODS

Patients diagnosed with fascial space infections of odontogenic origin who visited the Department of Oral and Maxillofacial Surgery at the dental college and hospital in Rajasthan, were the subjects of the prospective study. All of the patients received inpatient care. Patients between the ages 20–50 years who had carious or periodontally affected teeth that correlated with infection foci on clinical examination and radiographic evidence of periapical alterations were eligible for inclusion. The study excluded patients with preexisting medical conditions, pregnant women, chronic alcoholics, patients receiving steroid medication, and those using contraceptives. Buccal, canine, sublingual, submandibular, submental, submassetric, pterygomandibular, superficial temporal, deep temporal, parotid, lateral pharyngeal, and retropharyngeal spaces were the face regions that were examined. All patients were treated and observed by the same surgeon. Routine laboratory investigations were done along with airway assessment.

Discharge samples from the infected location were gathered at the start of treatment and sent for culture sensitivity. To assess prealbumin and crp levels, blood samples were obtained from each patient at T1 (before to beginning therapy), T2 (the fourth day of treatment), and T3 (the eighth day of treatment).

Appropriate analgesics were administered for pain management, and an empirical antibiotic regimen was initiated to treat infection. Patients receiving the empirical antibiotic regimen received intravenous amoxicillin, 500 mg tid of metronidazole, and 1.2 g bd of clavulanic acid. 75 mg bd of injectable diclofenac sodium was administered to manage pain. 50 mg of tramadol was injected if the pain continued.

The affected tooth was extracted if necessary. The dependent portion of swelling, vital tissues, and facial aesthetics were taken into account when making the incisions. Decompression was performed, locules were broken if found, and infected areas were examined. Daily irrigation with an antibiotic solution was carried out. The Penrose drain was positioned until the discharge ceased. No additional surgery was performed if the infection resolved, and empirical antibiotic treatment was maintained. However, if the infection worsened or didn't go away, more surgery was performed, and the antibiotic regimen was adjusted based on sensitivity and culture results.

Every fourth day, patients were evaluated using a variety of clinical criteria that were associated with the laboratory results for CRP and serum prealbumin. Signs and symptoms were the two categories of clinical data used to evaluate infection. Signs included the number of places involved (using clinical observation and CT scan), active discharge (one if present, zero if missing), mouth opening (measured central incisor distance), and change in swelling size (using thread and scale). The following symptoms were noted: hoarseness of voice (one if present, zero if absent), dysphagia (one if present, and zero if absent), and pain (visual analogue scale).

Malnutrition and illness are clearly indicated by a serum prealbumin level less than 16 mg/dl. Likewise, serum CRP levels more than 11 mg/dl indicate a confirmed infection. If test results for both inflammatory markers and clinical measures indicated that patients' conditions had improved, the treatment plan was deemed effective. The patients were monitored for a month.

Case 1

(A) **(B)**

Figure 1 (A):Preoperative picture of Rightt buccal space infection
Figure 1 (B):Post-treatment photograph of patient

Case 2

(A) **(B)**

Figure 2 (A): Preoperative picture of Leftt buccal space infection
Figure 2 (B): Post-treatment photograph of patient

Statistical Analysis

Statistical analysis was done with Statistical Package for Social Sciences (IBM SPSS Statistic for window, version 21.0. Armonk, NY: IBM Corp.) at 95% CI and 80% power to the study. Kolmogorov-Smirnov and Shapiro Wilk test was done to check for normal distribution of the data. Descriptive statistics was performed in terms of mean and standard deviation, Statistical analysis of the obtained results was done using Repeated Measures ANOVA factor analysis and $p<0.05$ was considered statistically significant.

RESULTS

The patients were within the age group of 20–50 years.

Table 1 shows the CRP levels at different time intervals. It was observed there was gradual decrease in the CRP levels over the period of time. CRP level on Day 0 was 34.6±8.84 was reduced to 7.9±3.47 respectively. This difference in the CRP levels was highly statistically significant. Table 2 showed the changes in prealbumin levels over the period of time, it showed the prealbumin level at Day 0 was 6.76± 0.75 which was gradually raised by Day 8 to 15.62±1.32 respectively. The difference in Prealbumin levels was observed to be highly statistically significant. ($p<0.001$)

The regression equation on Day 8 explained the inverse relationship between prealbumin and swelling, with prealbumin being a significant predictor of swelling size ($p < 0.01$). Changes in prealbumin values could explain 44.51% of the variation in swelling size. However, prealbumin was found to be a significant predictor of mouth opening ($p < 0.05$) with a R value of 29.52%, and mouth opening was directly proportional to prealbumin. Additionally, prealbumin levels were inversely correlated with the number of fascial gaps implicated. According to the regression

equation, the number of spaces decreased by 0.37 units for every unit rise in prealbumin, and prealbumin levels accounted for 53.59% of the variation in the number of gaps. With R values of 38.94%, the regression equation demonstrated a direct and linear relationship between CRP and swelling size, with CRP being a significant predictor of swelling size ($p < 0.01$). An inverse relationship between mouth opening and CRP was explained by the mouth opening data. With R values of 45.71 percent, the equation demonstrated that CRP was a significant predictor of mouth opening ($p < 0.01$).

The regression equation on day 8 explained the inverse relation between prealbumin and swelling, prealbumin being significant predictor of swelling size ($p < 0.01$) and 44.51 % variation in size of swelling could be explained by changes in prealbumin values. Mouth opening was directly proportional to prealbumin but data obtained was not found to be significant ($p > 0.05$) with R value of 6.1 %. Number of spaces involved was inversely proportional to prealbumin values. The regression equation explained direct and linear relation between CRP and size of swelling, but CRP was not a significant predictor of size of swelling ($p > 0.05$) having R values of 18.2 %.

The data for mouth opening explained an inverse relation between CRP and like swelling size CRP was also not a significant predictor of mouth opening ($p > 0.05$) having R values of 18.8 %. Number of spaces involved was directly proportional to CRP values. The regression equation implied that for every one unit increase in CRP, there was an increase of 0.10 units in number of spaces and 48.72 % of the variation in number of spaces was explained by CRP values.

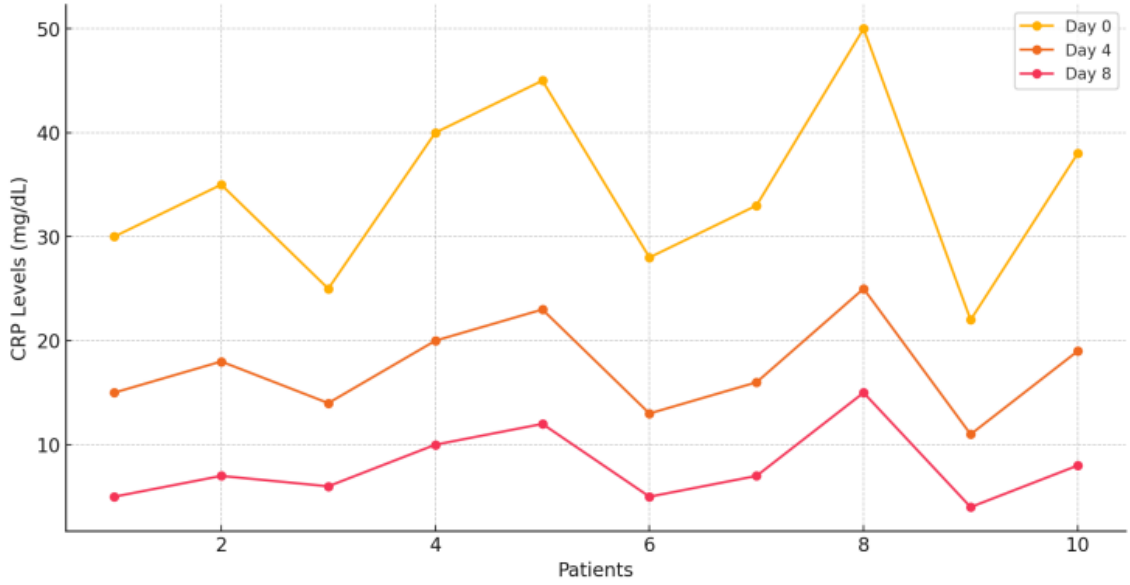
The investigation also demonstrated that when the patient's health improved with successful therapy, the levels of the markers decreased dramatically and approached normal. However, for the patient whose condition did not improve and who passed away on the sixth day, there was little change in the marker levels. The markers' values continued to be substantially out of range. The patient had submandibular, pterygomandibular, lateral pharyngeal, retropharyngeal, sublingual, and submental space infection at the time of admission. Thus, the study demonstrated that prealbumin and CRP are important indicators of infection severity and treatment regimen efficacy.

Table 1: Comparison of CRP levels between different time intervals

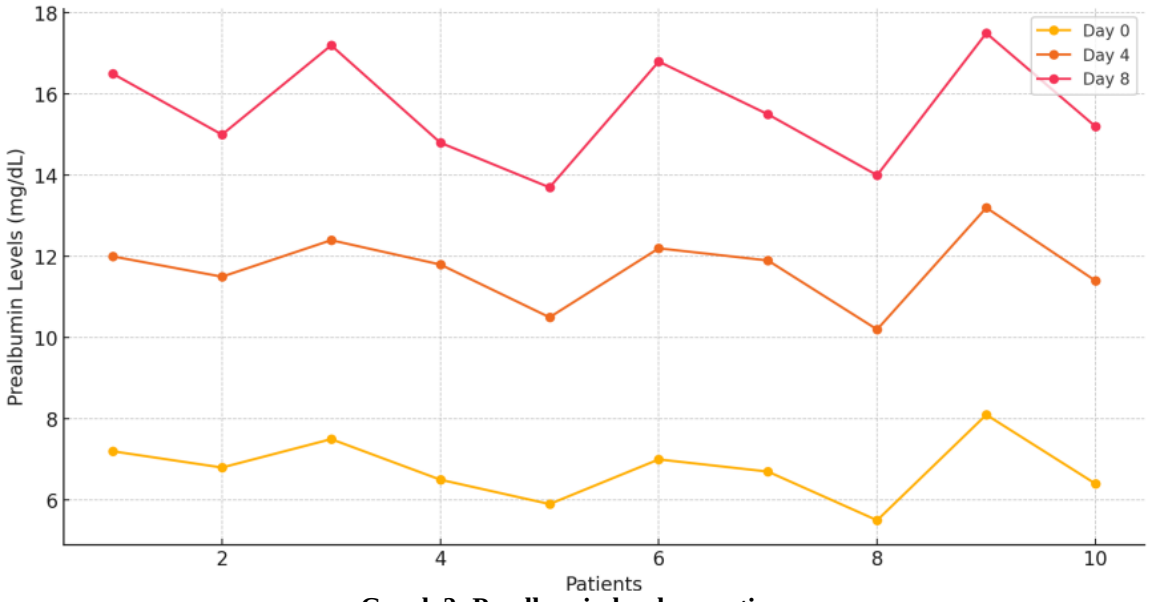
	Mean	Std. Deviation	F value	P value
CRP DAY 0	34.6000	8.84685	129.640	<0.001*
CRP DAY 4	17.4000	4.45222		
CRP DAY 8	7.9000	3.47851		

Table 2: Comparison of Prealbumin levels between different time intervals

	Mean	Std. Deviation	F value	P vlaue
PREALBUMIN DAY 0	6.7600	.75454	138.55	<0.001**
PREALBUMIN DAY 4	11.7100	.87870		
PREALBUMIN DAY 8	15.6200	1.32313		



Graph 1: CRP levels over time



Graph 2: Prealbumin levels over time

DISCUSSION

A complex series of metabolic and systemic reactions brought on by infections or other damage sources constitute the acute phase response. Changes in the hepatic production and serum levels of certain proteins, in addition to other physiological, metabolic, and biochemical changes are characteristics of the acute phase response. Therefore, hepatic synthesis is stimulated to produce more positive acute phase proteins such as CRP, complement 3, serum amyloid A, alpha-1, and glycoprotein, while hepatic production of visceral transport proteins (negative acute phase proteins) such as albumin, transferrin, thyroxine binding prealbumin (TBPA), and retinol binding proteins (RBP) is depressed.[1,9]

According to several investigations, visceral transport proteins—primarily those with a low turnover rate, such as TBPA and RBP—are helpful for monitoring nutritional recovery during nutrient replacement and for assessing protein and protein energy under feeding. But when an infection is present, their hepatic production is suppressed and their passage to the extravascular space is increased, which lowers their serum levels and makes them indicators of acute phase conditions.[9]

Similar to this, CRP plays a role in a number of non-specific immune defense mechanisms while being found in trace amounts in healthy people. A notable increase in serum concentration is frequently observed in cases of severe infections or inflammatory reactions. This raises the prospect that CRP rises quickly enough and specifically enough to be a reliable tool for early septicaemia diagnosis.

In the present study, we found that prealbumin and CRP had a high degree of correlation with severity of infection having p value <0.01 from day 0 to 4. These results were in consensus with the findings of study conducted by Pinilla et al. [10], where statistically significant correlation was observed 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.

Patients in this study who were admitted for treatment had prealbumin values that were much below what was deemed to be clinically normal. In addition to the systemic consequences of infection, low prealbumin concentrations appeared to be caused by anorexia and malnutrition linked to trismus, pain, discomfort from swelling, hoarseness of voice, dysphagia, and discharge. Prealbumin was considerably lower than typical clinical values when there were more than two fascial spaces involved, which is another marker of infection in odontogenic illnesses. The findings are consistent with the Cunningham et al.[5] study on deep space infection patients. Prealbumin was a significant predictor of hospital stay ($p < 0.01$), according to this study. According to the regression equation, hospital stay and prealbumin had an inverse connection; that is, the greater the prealbumin level, the shorter the hospital stay. These findings are consistent with the research conducted by Cunningham et al.[5] Additionally, they discovered a statistically significant correlation ($p < 0.38$) between the length of hospital stay and prealbumin concentration. Their study's use of logistic regression analysis revealed a negative correlation between prealbumin concentrations and hospital stay duration.

CONCLUSION

According to the results of this prospective investigation, prealbumin and CRP can be useful indicators for assessing the degree of infection and the effectiveness of a treatment plan in patients with odontogenic fascial space infections. Therefore, we draw the conclusion that prealbumin and CRP ought to be used as monitoring investigations for patients with odontogenic fascial space infections.

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