

Assessing the Efficacy of C-Reactive Protein in Monitoring Recovery in Diabetic and Non Diabetic Patients with Space Infections

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ARTICLE INFO



Keywords:

Glycosylated haemoglobin, CRP, WBC Count

ABSTRACT

Introduction: Maxillofacial space infections are one of the most common complaints in oral and maxillofacial surgery that can lead to high morbidity and mortality if not assessed and managed properly. Systemic diseases like diabetes can critically influence their progress and recovery. Serum C-reactive protein is a marker with a short lifespan that can assess the progress of the disease with greater sensitivity. **Aim:** The present study aimed to assess the efficacy of CRP for monitoring the progress of maxillofacial space infections in both diabetics and non diabetic patients.

Materials and methods: The present study was conducted in the Department of Oral & Maxillofacial surgery, Kamineni Institute of Dental Sciences, Narketpally, Telangana. A total of 40 patients (22 females and 18 males) with maxillofacial space infections were selected for the study. The patients were divided into 2 groups (group A as diabetics, group B as non diabetics) based on medical history and HbA1c test. The patients were treated according to standard protocol and the assessment of recovery was done with CRP, WBC count, and other factors like swelling and mouth opening.

Results: The mean value for HbA1c in group A was 7.095 and 6.110 in group B preoperatively. CRP was statistically significant

Conclusion: In the present study, it was concluded that CRP is as reliable a indicator of the progress of the disease as WBC count.

INTRODUCTION

Maxillofacial infections are a public health concern, primarily relating to dental disease and maxillofacial trauma.¹ At the beginning of the 20th century, dental infections were associated with a mortality rate of 10–40%, but this percentage declined after the use of antibiotics.

Glycosylated haemoglobin is measured primarily to identify the three month average plasma glucose concentration¹. Compared to blood sugar levels, HbA1c gives a more accurate picture of long term glucose control in a patient which can influence the patient response to the space infection. High HbA1c levels tend

indicate a greater chance of acute infections with poorer prognosis.²

C-reactive protein is a pentameric acute phase reactant discovered in 1930 in pneumococcal pneumonia patients. Synthesized by liver, and its production controlled primarily by IL-6. CRP is present only in small amounts in normal healthy individuals and is involved in process of innate immune system.³ CRP is the most commonly measured circulating marker for subclinical inflammation, with widely available, stable and standardized assays for its measurement.⁴ **MATERIALS AND METHODS:-** This study was approved by the Institutional Ethical Committee and was conducted at

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Patients between the age group of 18-70 years and patients with maxillofacial space infections of odontogenic origin were included. Patients below 18 years of age, patients with maxillofacial space infections of non odontogenic origin, pregnant and lactating patients, patients with psychological and neural disorders, patients who are chronic alcoholics, patients on steroid therapy, patients on oral contraceptives, patients who are immuno-compromised were excluded from the study

A detailed case history was recorded in a specially prepared proforma. Written and verbal consent was taken from the patient approved by the institutional ethical committee. All the patients enrolled in this study fulfilled the inclusion and exclusion criteria. Radiographs were taken for all patients to identify the foci of infections.

Following a thorough medical history, HbA1c test was done for all the 40 patients and they were divided into 2 groups based on the results obtained. Group A includes 20 patients with diabetes. Group B includes 20 patients who were non diabetics. Blood samples were taken from antecubital vein to estimate the HbA1c levels preoperatively on day 0. Serum CRP levels, WBC counts, mouth opening and swelling size measurements were taken three times on the following days:

PO – Before starting the treatment.

D1 – 1st day of treatment.

D5 – 5th day of treatment.

RESULTS

Out of forty patients, twenty two were females and eighteen were males. In group A with twenty patients, eleven were females and nine were males. In group B

with twenty patients, eleven were females and nine were males. The mean age group is 18 – 70 years with an average of 52 years in diabetics and 36 years in non diabetics. The highest number of space infections is in 61-70 years, less in 50-60 yrs, least between 18-20years. Buccal space infections has the highest prevalence in the present study accounting for (17) cases, followed by combined space infections (7) cases, followed by submandibular space infections (6) cases, followed by canine space infection (4) cases, followed by submasseteric space infection (2) cases, followed by pterygomandibular space infection (2) cases, followed by submental space alone in one case and ludwigs angina in one case. Mandible (75%) is the most commonly involved jaw in both groups. Left side is more commonly involved than right side. Overall 36 is the most commonly involved tooth in the present study.

In both the groups HbA1c levels were checked preoperatively. In group A, HbA1c test mean was given as 7.095. In group-B the mean HbA1c was given as 6.11. The CRP levels, WBC count, mouth opening, swelling size was recorded preoperatively and postoperatively on day 1 and day 5 respectively. The mean CRP values in group A preoperatively was 3.12 and on postoperative day 1 it was 1.92 and on postoperative day 5 it was 0.93, whereas in group B it was 2.28 preoperatively and 1.62 on 1st 0.69 on the 5th post operative day (FIG 1). The mean WBC counts in group-A was 15405 preoperatively and 14290 on 1st postoperative day 11915 on 5th postoperative day, whereas in group B it was 10,410 preoperatively and 9050 on 1st postoperative day and 8140 on 5th postoperative day. (FIG 2)

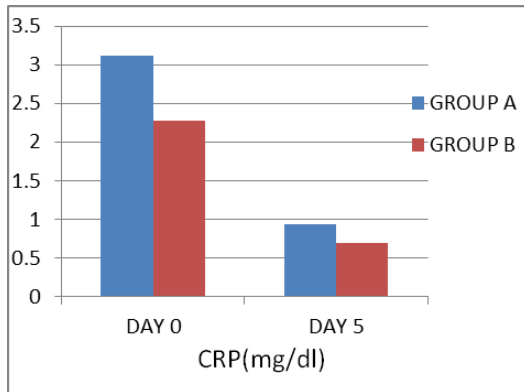


Figure 1

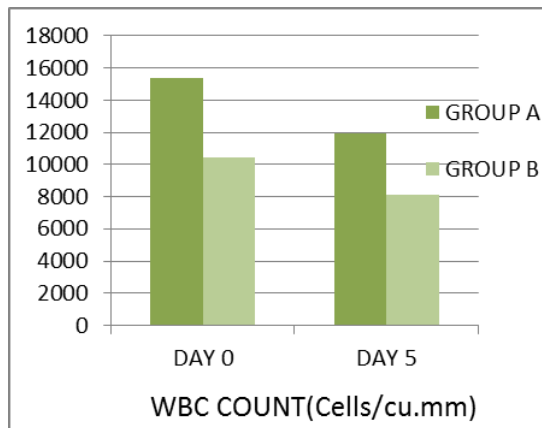


Figure 2

In assessment of trismus, there was gradual decrease in swelling size noted on day 1 and day 5, when compared with preoperative day, whereas there was gradual increase noted in the mouth opening on day 1 and day 5, when compared with preoperative day in both the groups.

In group A growth of microorganisms were seen in 16 patients (80%) out of twenty patients, absence of growth was seen in 4 patients (20%). In group B Growth of microorganisms were seen in ten (50%) out of twenty patients. *Klebsiella pneumoniae* was the most commonly isolated organism in this group A. *Streptococcus* species was the most commonly isolated organism in group B.

Based on the organisms cultured appropriate antibiotics were given for infection control.

DISCUSSION

The treatment of orofacial infections is part of an everyday practice in oral and maxillofacial surgery. Odontogenic abscess-forming infection usually spreads into the potential anatomical spaces present in the oral and maxillofacial region.⁵

The poor host response is multifactorial and diabetes has long been considered as one of the factors reducing host response. One of the serious complications of diabetes includes predisposition to infections. Diabetic individuals are not only at high risk for infectious disease but it is also believed that they often respond poorly to infections once they occur.⁶

C- Reactive Protein is present only in small amounts in normal healthy individuals, but its serum concentration may increase upto 1000-folds with infection, trauma, surgery, and other acute inflammatory events.^{7,8} With a short half-life of 5-7 hours and not significantly influenced by age and gender, CRP exhibit a rapid rise and fall of its serum level with the inflammatory process.³

In our study, we have tracked the progress of the infection under treatment with antibiotics and incision and drainage, in two groups, diabetic and non diabetic, as assessed by their HbA1c. The assessment of recovery was based on WBC count, CRP and other factors like swelling and mouth opening. The fasting blood sugar values were also assessed daily, in all the patients, in due course of the management.

The mean CRP values in group A preoperatively was 3.12 and on postoperative day 5 it was 0.93, whereas in group B it was 2.28 preoperatively and 0.69 on the 5th post operative day. The mean WBC counts in group-A

was 15405 preoperatively and 11915 on postoperative day 5, whereas in group-B it was 10,410 preoperatively and 8140 on postoperative day 5. The mean difference in CRP levels from day 0 to day 5 in Group A was 2.19 whereas in group B it was 1.59 and mean difference in WBC counts were 3490 in Group A and 2270 in group B.

Both the CRP and WBC levels show a similar pattern of recovery where, in group A the decrease is greater than in group B but the levels on 5th postoperative day remain above normal. Similarly both parameters, in group B, show normal values by the 5th postoperative day. We therefore concluded that CRP is as reliable a indicator of the progress of the disease as WBC count. Additionally, as the lifespan of CRP is shorter at approximately 5-7 hours, it is also a more sensitive indicator of the disease status. In a study done by Chan et al (2002) 9, the presence of bacterial infection were compared between infected and uninfected groups. They showed that CRP is a better indicator of bacterial infection than WBC count and body temperature.

We also noted that, even after the treatment, that is on postoperative day 5, the mean CRP and WBC levels are marginally above the normal range where as in group B they had returned to well within the normal range indicating the slower recovery in the diabetic group (group A). This is similar to a study done by Chang et al (2013)10, in which the diabetes mellitus group showed higher WBC level and CRP level at the time of treatment and on discharge compared to the non diabetic group.

In a study done by Stewart et al (2002)11, 72 patients were studied in which treatment for periodontitis is carried out. Significant reductions in levels of HbA1c in treatment and control groups, 17.1% and 6.7%, respectively. In a study done by Iwamoto et al (2001)12, treatments for gingivitis and chronic periodontitis were

carried out. A significant improvement of HbA1c levels, significant reduction in circulating TNF- α levels, significantly decreased fasting insulin levels were observed in patients not receiving insulin. The above two studies support our findings on infection control leading to better glycemic control.

There was gradual increase noted in the mouth opening on day 1 and day 5, when compared with day 0 preoperatively in both the groups with P value 0.00. The increase in the mouth opening after regular intervals was statistically significant with the P value < 0.001. The data for mouth opening explained an inverse relation between CRP and mouth opening, as with the degrading CRP level the mouth opening increases. Regression also proved CRP being a significant predictor of mouth opening (P < 0.01). These findings are similar to the studies conducted by Pepys MB and Hirschfield GM (2006),13 which found an excellent correlation of circulating CRP concentrations with the severity, extent and progression of the disease process. There was gradual decrease noted in the swelling size on day 1 and day 5, when compared with day 0 preoperatively with P value 0.00 in both the Groups. The reduction of the values at the regular intervals was statistically significant with the P value of <0.001. The similar study was done by Ashish Sharma et al (2012),14 it showed the linear relation between CRP and size of the swelling. Thus it was concluded that CRP is the significant predictor of size of the swelling (p<0.01). The mouth opening and swelling size thus showed a consistent improvement in both groups. However, though indicative of recovery from infection, and often correlating to other indicators, these two parameters are also highly dependant on the location of the infection and thus cannot be considered absolute indicators of improvement by themselves.

The most commonly isolated organisms in the present study were *Klebsiella pneumonia* in group A and *Streptococcus* species in group B and absence of growth was seen more (50%) in group B. These findings are similar to study done by Lingyan Zheng et al (2012),¹⁵ where in *Klebsiella pneumoniae* are more commonly isolated in diabetics and *Streptococcus* species in non diabetics. Possible contributing factors of the preponderance of *K. pneumonia* include increased oropharyngeal colonization by gram-negative bacilli, and defects of host defenses, especially phagocytic function impairment in hyperglycaemia.¹⁶ According to Dipesh Rao et al (2010),⁵ there was a high occurrence of no growth in culture reports. A total of 45% of cases yielded no growth but on direct smear examination, gram stain showed the presence of organisms in 40% of those cases. The presence of organisms on gram stain and failure to grow on aerobic cultures is a common finding. This may be attributable to anaerobic infections, collection of sample after antibiotic dose, and occasionally loss of organisms during handling, transportation, and processing of the samples. According to Rishi bali et al (2014),¹⁷ out of 60 specimens 46 contained bacterial pathogens while 14 showed no growth. The reason for lack of growth can be because these abscesses are caused by bacteria that are organized in biofilms, which may not grow on traditional water-based culture media, and fastidious microorganisms (particularly anaerobes) are highly sensitive and may not survive the transport period. No growth may also be attributed to empirical antibiotic therapy, as most of the patients will be on empirical therapy before the culture and sensitivity tests.

CONCLUSION

On the basis of our study we conclude that the CRP is as reliable a indicator of the progress of the disease, the

recovery rate is slower in diabetic group compared to the nondiabetic group.

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