Role of C- reactive protein in hospital stay of patients with odontogenic infections

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Abstract

Background: C-reactive protein (CRP) may act as prognosticator of the duration of hospital stay among odontogenic infection patients.
Objective: To assess the association between the clinical/laboratory variables and a severe clinical course; prolonged hospital stay.
Material and methods: A prospective study involving all the patients treated for maxillofacial infections of odontogenic origin in the Oral and Maxillofacial Surgery Department of Government Dental College and Hospital, Srinagar between November 2018 and September 2019. A total of 68 were enrolled.
Results: The concentration of CRP was found to be a significant predictor of hospital stay (p<0005).
Conclusion: CRP can be used as a predictor for the likely duration of hospital stay and hence will enable us in efficient bed management.

Keywords: C-reactive protein, hospital stay, odontogenic infections

Introduction

The most significant proportion of maxillofacial hospital stay is attributed to odontogenic infections.[1] These infections usually present as a local swelling however, sometimes these can lead to a life-threatening condition.[2] Even though, the medicine has seen a leap of advances still the course of infection can be unpredictable which can at times even lead to death.[3,4] Odontogenic infections are commonly associated with a prolonged hospital stay which in turn adds to the substantial financial costs to the health service.[5]

The severity of these infections is aggravated by various systemic and local predisposing conditions such as diabetes mellitus, immunosuppression, and previous radiotherapy.[6] Peters *et al*. established that the presence of an immunosuppressive medical condition is the most dramatic modifier of duration of hospital stay.[7]

The white blood cell (WBC) count and the erythrocyte sedimentation rate (ESR) assist in defining the condition of the patient on admission but their predictability is limited.[2] A serum inflammatory marker that is present in minor amounts in healthy people and its concentration, rises acutely with infection, would be a sensitive predictor for the duration of hospital stay. With this background in context, the present research aims to investigate whether any clinical or laboratory variables on admission are associated with a severe clinical course and a prolonged hospital stay in patients with odontogenic infections.

Methodology

A prospective study was designed. It included all patients diagnosed with odontogenic infections who were treated in the Oral and Maxillofacial Surgery Department of Government Dental College and Hospital, Srinagar between November 2018 and September 2019. Patients with non-odontogenic infections, such as salivary gland infections, secondary infections involving a neoplasm, dermatological conditions, sinusitis and complicated trauma were excluded from the study. Details regarding age, gender, site of infection, temperature, WBC and neutrophil count and CRP concentration on admission, and on antibiotic treatment, operation, any pre-existing medical conditions associated with a potential for immunosuppression, diabetes mellitus status, and duration of stay were recorded. The infratemporal, submasseteric, pterygomandibular, parapharyngeal, and retrosternal spaces were regarded as deep spaces. The outcome variable was the duration of the hospital stay and CRP constituted our primary predictor variable.

Four regimens of antibiotics were prescribed: amoxicillin-clavulanic acid, amoxicillin-clavulanic acid with metronidazole, clarithromycin-metronidazole, and clindamycin. Descriptive statistics were computed for

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every study variable. Pearson's test was used to investigate the association between the predictor variables and the outcome variable (duration of stay), and the Kruskal-Wallis test to associate duration of stay with ordinal variables that included more than two values (affected spaces and antibiotics). Predictor variables that were significantly associated with duration were entered in to a regression model. A linear regression with a forward stepwise method was applied to study the correlation of these variables with duration of stay. P value of 0.05 or less was regarded as significant.

Results

Of the 210 patients treated for maxillofacial infections in our department between November 2018 and September 2019, 68 were diagnosed with infections of odontogenic origin and subsequently enrolled in this study. There were 38 men and 32 women, mean age 39 years. The mean (SD) duration of stay, which was 2.8 (2) days, was not associated with sex or age (p>0.005).

Table1 shows the sites of infection. The number of spaces involved was not associated with a prolonged hospital stay. However, the difference between the duration of stay of patients with infections that involved one or two spaces (n=62, mean (SD) 2.7 (1.43) days and that of those with infections in more than two (n=6, mean (SD) 5 (3.04) days), was significant (p<0.005). The difference between the duration of stay of patients with deep space infections (n=15, mean (SD) 4.55(3.17) days) and that of those with infections that were not in deep spaces (n=53, mean (SD) 2.38 (1.5) days), was also significant (p < 0.005).

Table 1: Head and Neck Spaces involved in patients with odontogenic infections

Space	No. of Patients	Mean (SD) duration of stay (days)
Overall involvement		
Buccal	45	-
Submandibular	35	-
Infraorbital	18	-
Submental	7	-
Sub masseteric	6	-
Parapharyngeal	5	-
Retrosternal	2	-
Pterygomandibular	1	-
Temporal	1	-
No.of Spaces involved		
1	30	2.54 (1.2)
2	32	2.60 (1.5)
3	5	3.66 (2.61)
4	1	13

Table 2: Antibiotic regimens used to treat patients with odontogenic maxillofacial infections

Antibiotic	No. of patients	Mean (SD) duration of stay (days)	Range
Amoxicillin/Clavulanic acid	33	2.3 (2.1)	1-13
Clavulanic acid and metronidazole	30	3.1 (1.8)	1-9
Clarithromycin and metronidazole	3	3	-
Clindamycin	2	3	-

Table 2 shows the antibiotic regimen prescribed to the patients during the hospital stay. The patients who did not recover after treatment with amoxicillin/clavulanic acid were shifted to metronidazole. The difference in hospital stay between patients on amoxicillin/clavulanic acid and those on amoxicillin/clavulanic acid with metronidazole was significant (p< 0.005). None of the 68 studied were immunocompromised before treatment.

On admission, the mean (SD) WBC count was 11.01 ×103 (6.04) cells/mm3 (range3.9 ×103 to 32.8 ×103) and the mean (SD) core temperature was 3 7.5 (amoxicillin/clavulanic acid SD (1.1) amoxicillin/clavulanic acid and metronidazole SD (1.7)∘C. The mean (SD) neutrophil cell count was 9.75 ×103 (5.68) cells/mm^3 (range2.12 ×103 to 28.35 ×103), and the mean (SD) CRP was 85.68 (92.7) mg/L (range3–409). There was a significant positive correlation between duration of stay and WBC count, between duration and neutrophil cell count and between duration and CRP (p <0.005).

To study the association between duration of stay and the predictor variables identified, we used a multivariate regression model with a forward stepwise method. Only CRP was a significant predictor of hospital stay (p <0.005) (Table3).

Table 3: Predictor variables of duration of hospital stay in odontogenic infection patients

Predictor Variables	p value
C – reactive protein	0.00
White blood cell count	0.24
Neutrophil cell count	0.13

Discussion

C-reactive protein (CRP) is an acute-phase protein that is present in small amounts in healthy people, and its serum concentration rises substantially as a reaction to severe infections. In the present study, a positive linear relation between CRP and the duration of stay in patients with odontogenic infections was observed. [8, 9] A high serum concentration of CRP on admission has been strongly associated with the severity and the complicated course of odontogenic infections.[2] Our results, confirmed that the site of infection did not correlate with hospital stay Similar results were observed by the Flynn *et al*. who

reported no significant association between a longer hospital stay and involvement of a specific facial space.[10] The present study showed that the patients prescribed with metronidazole in addition to amoxicillin/clavulanic acid spent longer in hospital than those who only had the latter, and this difference was significant (p<0.005). These patients had more severe anaerobic bacterial infections, and therefore took longer to recover. In our study, the CRP was positively associated with the duration of hospital stay. Our findings are further supported by the work of Sharma *et al*.[11] They concluded that the CRP concentration has a strong correlation with the severity of infection, and the duration of hospital stay.[11]

The inability to identify the impact of pre-existing immune compromised on the severity of the infection and subsequently on the duration of stay was not possible because of our relatively small sample. This group has specific characteristics that could influence the duration of stay, and therefore should be studied independently.

The serum CRP concentration on admission can be used as an effective predictive marker of the duration of hospital stay in patients with infections of odontogenic origin and ultimately enable a more cost-effective patient care.

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