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C-reactive protein concentration as a prognostic factor for inflammation in the management of odontogenic infections

R. Mirochnik *,[1], S. Araida [1], V. Yaffe, I. Abu El-Naaj

Oral and Maxillofacial surgery department, "Baruch Padhe" Medical Center, Poria, Israel

Abstract

Our aim was to find out if it is possible to correlate the duration of stay in hospital, the severity of infection, involvement of particular anatomical spaces, white cell count, efficacy of surgical treatment, and fever with C-reactive protein (CRP) concentrations on admission. One hundred patients met our inclusion criteria. After their notes had been examined they were subdivided according to whether the infection of the main facial space involved was less severe, moderately severe, or very severe. The relations between degree of severity and CRP concentration on admission (<100 mg/L compared with 100+), age (years), sex, and duration of hospital stay (days) were examined using Poisson regression (because the distribution of characteristics, and particularly the duration of stay, were skewed). The overall model was significant ($p = 0.003$). Pearson and deviance chi square tests did not indicate overdispersion ($p = 0.97$ in both cases), which suggested that the assumptions about the Poisson distribution were valid. Log-rank chi square tests indicated that only severity had a significant effect ($p = 0.0001$), and C-reactive protein concentration was not significantly associated with group on admission, age, or sex. The moderately and very severe groups had longer median (range) durations of stay than the less severe group (5 (2-8) compared with 3 (1-8) days, respectively). CRP concentration was not a prognostic factor for the extent of odontogenic infections or presumed duration of stay, but severity scoring was a significant factor in the prediction of duration of stay in hospital.

Keywords: C-reactive protein (CRP); odontogenic infections; dental abscesses; drainage

Introduction

Acute dental infections are a common cause of emergency visits to the maxillofacial outpatient department. Most patients experience warning signs and symptoms before seeking emergency care, unaware that these infections are potentially life-threatening because of the anatomical connections between one anatomical space and another.[1]

During the preantibiotic era, severe odontogenic infection were associated with high mortality, which ranged from 10% to 40%,[2] yet nowadays treatment with modern antibiotics has significantly reduced mortality. However, during the past 15 years there has been a progressive rise in serious antibiotic resistance, presumably because of increasingly injudicious use.[2]

Estimation of C-reactive protein (CRP) concentrations was first introduced in 1930 in patients with pneumococcal pneumonia. It is synthesised by hepatocytes, and is one of the "acute phase proteins" in plasma. The primary signal for its synthesis is the production of interleukin-1 by macrophages at the site of tissue injury.[4] Generally, CRP is present in small amounts in a normal healthy person (less than 10 mg/L), and is involved in the innate immune system where its functions are activation of complement, clearance of antigens, and mediation of phagocytosis by the activation of neutrophils.[1,3]

* Corresponding author.
[1] The First and second authors have contributed equally to this manuscript.

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We know of only a few studies that have investigated the changes in CRP concentrations associated with acute odontogenic infections.[3]

In severe infections or inflammatory reactions, a rise in the concentration of CRP in serum is seen up to 1000-fold within just a few hours of the development of clinical symptoms,[1,3] and concentrations are raised in almost all inflammatory, infectious, and neoplastic diseases.[2]

CRP rises considerably within 4–6 hours, peaks at 24–48 hours after the acute infection has developed, and falls rapidly after the inflammation has resolved. Its rapid rise and fall with the inflammatory process makes it a much more sensitive indicator of inflammatory process than the erythrocyte sedimentation rate (ESR) or white cell count (WCC).[5–9] The half-life of CRP in the circulation is not significantly influenced by age or sex, and its serum concentration is largely governed by the rate at which it is produced and released into the blood. The close association between serum CRP concentration and the nature and intensity of the activating stimulus has allowed it to be used to discriminate bacterial from viral infections, and gauge therapeutic responses for inflammatory diseases.[3]

Aetiology of acute odontogenic infections

Most common aetiological factors of odontogenic infections are periapical lesions (66%-70%) and dental caries (33%-80%). Other causative factors are pericoronitis, alveolar osteitis, periodontitis, and odontogenic and non-odontogenic cystic lesions.[10]

Signs and symptoms

Severe maxillofacial odontogenic infections present common signs and symptoms other than the usual signs of infection, and may present with trismus, dysphagia, fever, pain, swelling, and respiratory distress. Fever has been reported to be a common finding in odontogenic infections by several authors, as well being linked to prolonged hospital stay, but it is non-specific and it can easily be influenced by antipyretic drugs.[10]

Local spread of infection

The general spread of odontogenic infections is towards the lowest point of resistance, and its course is usually governed by two factors – the thickness of the surrounding bone, and the attached muscles. They may spread to deeper spaces, and have the potential to lead to life-threatening conditions such as compromise of the airway.[10]

Patients and methods

We studied patients who visited the emergency department at the Padeh Poria Medical Centre (a level IIa trauma centre) for treatment of acute odontogenic infections of the head and neck.

A total of 137 patients who required admission to hospital were treated between October 2014 and June 2015 by the Department of Oral and Maxillofacial Surgery, and 100 met our inclusion criteria. Thirty were too young, and seven refused admission.

On admission an oral and maxillofacial surgeon examined each patient, and then evaluated the changes in their clinical condition after treatment. The examination followed the standard protocol of the maxillofacial department. Panoramic and periapical dental radiographs were taken and, for patients in whom deep head and neck spaces were involved, a contrast-enhanced CT.

Criteria for admission were swelling of the face or neck that suggested an abscess or cellulitis, and one or more of the following: temperature above 38.3 °C, WCC count greater than 10.8×10^9/L, CRP concentrations of more than 10 mg/L, a compromised airway, trismus, involvement of the lower eyelid, and dysphagia. Antimicrobial drugs were given, usually intravenously, and the abscess was drained.

Antecubital venous blood was drawn on admission and on the day of discharge for measurement of C-reactive protein (CRP) concentrations (reference range <110 mg/L). Body temperature was measured orally at least twice daily, and mean (SD) laboratory values were calculated.

Surgical treatment

The treatment of acute odontogenic infections by drainage under antimicrobial cover is well known, and early intervention is essential. Our protocol includes incision and drainage under local anaesthesia with 2% lidocaine and 1:100 000 epinephrine. For patients with infections of the deep spaces and severe trismus the abscess is drained under general anaesthesia. Diseased teeth are extracted, any abscess is drained by an intraoral or extraoral approach according to its site, and a rubber drain is fixed in place for two days. Any sample of pus is sent for microbiological culture, and antibiotics are given orally or intravenously.

Imaging

All patients had primary diagnostic panoramic radiographs, followed by additional periapical radiographs if necessary.

A contrast-enhanced computed tomographic (CT) scan was taken for patients in whom moderate to severe deep space infections were diagnosed to confirm the diagnosis, evaluate all anatomical spaces involved, and assess the potential for compromise of the airway. Although different imaging techniques are available, CT is considered to be the gold standard (Fig. 1).

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