Quantitation of Circulating Immune Complexes in Patients with Chronic Periapical Lesions

S. ANIL1, K.R. SHANAVAS2, V.T. BEENA3, P. REMANI4 and T. VIJAYAKUMAR5

(Received 2 December 1992 and accepted 3 June 1993)

Key words: circulating immune complexes, periapical cysts, periapical granuloma

Abstract

Quantitation of circulating immune complexes (CIC) was done in 45 patients with chronic periapical lesions. The levels were compared with those of age-matched healthy individuals. Both patients with chronic periapical granuloma and periapical cysts showed significantly higher levels of CIC than the controls. This observation indicates that the continuous presence of root canal antigens may cause elevated levels of circulating immune complexes. The possibility of chronic periapical lesions acting as foci of infection is discussed, and the importance of early treatment of these conditions is emphasized.

Introduction

Chronic periapical lesions of pulpal origin are developed to defend the host against egress of antigens from the root canal system into the periapical tissues. The most common types of these lesions are periapical cysts and periapical granulomas. The reported prevalence of periapical cysts and granulomas in various studies ranges from 6% to 54% for cysts and from 45% to 84% for granulomas[11]. Many investigators have shown that the root canal system can be an effective route for host sensitization[2,3]. The antigens from the root canal system enter the periapical tissues and may produce non-specific inflammatory responses as well as specific immunologic reactions, by interacting with antibodies secreted specifically against them. This may eventually lead to formation and accumulation of immune complexes either locally or in the general circulation[4,5].

Immune complexes play a pathological role in the initiation of tissue injury in many infections, autoimmune diseases and neoplasms[6,7]. Both cell-mediated and humoral immune responses play an important role in the pathogenesis of periodontal infections due to the action of microorganisms and their products. We have previously reported elevation of circulating immune complexes in patients with periodontitis[8,9]. TORABINEJAD AND KETTERING[10] observed significantly elevated levels of local immune complexes in patients with periapical lesions.

The aim of the present study was to quantitate the level of circulating immune complexes in the sera of individuals with chronic periapical lesions.

Materials and Methods

The study population comprised 45 individuals who had sought dental treatment at the outpatient department of the Dental College and Hospital, Trivandrum, India. Of the 45...
individuals, 24 had chronic periapical granuloma and 21 had periapical cysts of more than 3 months duration. The control group comprised 40 age-matched healthy individuals. None of the subjects selected had any history of systemic, autoimmune, collagen, or allergic disorders and were not receiving any medication.

Collection of serum

Blood was collected from each patient and control by venipuncture into sterile, siliconized vacutainer tubes. It was allowed to clot at 37°C for 60 min, then the serum was separated, aliquoted and stored at −70°C until use.

Detection of immune complexes

The polyethylene glycol (PEG) precipitation method with slight modification was used for this purpose[11]. Serum was diluted 1:3 with 0.1 ml borate-buffered saline (BBS), pH 7.4; 0.22 ml of diluted serum was mixed with 2 ml of 4.6% PEG (mol. wt. 6000) in BBS. The final serum dilution was 1:30 and the final PEG concentration was 3.75%. The mixtures were incubated at 4°C overnight. Each sample was matched with a control tube containing a serum sample and BBS alone. The increase in turbidity due to CIC insolubilization was calculated by subtracting the OD450 of the buffer-treated sample from the OD450 of the PEG-treated sample. PEG-CIC values were recorded as OD450 × 103 and expressed as the PEG index. Statistical analysis of the data was done using Student’s t test.

Results

Table 1 shows the age and distribution of the subjects in each group. Table 2 shows the concentration of circulating immune complexes in the three groups of subjects studied. Elevation of CIC was observed in subjects with periapical granuloma and periapical cysts in comparison with the control group (P<0.001). Even though an elevation of CIC was observed in patients with periapical granuloma in comparison with patients with periapical cysts, the difference was not statistically significant.

<table>
<thead>
<tr>
<th>Description</th>
<th>Normal controls</th>
<th>Patients with periapical granuloma</th>
<th>Patients with periapical cysts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects</td>
<td>40</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td>Age in years (Mean ±SD)</td>
<td>24±5.1</td>
<td>24±5.6</td>
<td>25±5.2</td>
</tr>
</tbody>
</table>

Table 2  CIC levels in patients and controls

<table>
<thead>
<tr>
<th>Subjects</th>
<th>CIC levels (PEG Index)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal controls (N=40)</td>
<td>38.2±2.43</td>
</tr>
<tr>
<td>Patients with periapical granuloma (N=24)</td>
<td>69.4±3.06</td>
</tr>
<tr>
<td>Patients with periapical cysts (N=21)</td>
<td>67.2±3.08</td>
</tr>
</tbody>
</table>

All values are Mean±SEM.
N: Number of subjects
Discussion

Pathological changes in the dental pulp result in the root canal system harboring bacteria and other potential antigens, such as bacterial components, bacterial products and denatured host tissues. Various classes of immunoglobulins have been detected in biopsy specimens from periapical lesions[12,13]. A combination of immunoglobulins with their specific invoking antigens results in the formation of immune complexes. This phenomenon usually has a protective effect for neutralization and eventual elimination of antigens. However, immune complexes may cause tissue damage at the site of their formation or at a distant site[14].

Several methods have been used to detect immune complexes in the circulation. PEG precipitation was found in this study to be an easy and reproducible method for detecting the presence of circulating immune complexes.

Chronic periapical lesions of pulpal origin defend the host against egress of antigens from the root canal system into the periapical tissues. It has been well established that dental infections act as a focus for cardiac, renal, ocular, joint and many other diseases. Although controlled studies have found no cause-and-effect relationship between dental infections and systemic diseases, OKADA et al. proved that the host can be sensitized with products from dental foci, especially through dental pulp canals due to vascular and lymphatic anastomosis[2,5].

The present study revealed significantly increased CIC levels in patients with chronic periapical lesions. TORABINEJAD et al. did not observe any significant increase in the level of CIC in 30 patients with periapical lesions. They attributed this either to confinement of the immune complexes in the periapical lesions, or to an extremely small amount of the complexes reaching the circulation, thus producing no detectable change[15]. The present results are in good agreement with studies done on other chronic dental infections[8,9,16,17].

The findings of our study support the view of OKADA and associates[2] that early management of these lesions is important in order to prevent them acting as foci of infection. As the presence of CIC in serum does not necessarily lead to disease in all cases, establishment of a cause and effect relationship between chronic periapical lesions and systemic immune complex-associated disease is difficult. Removal of the source of antigen is one of the steps recommended by the World Health Organization to attenuate the deleterious effects of immune complexes[18]. Since CIC have the potential to cause systemic illness in certain individuals, the source of antigen should be eliminated. Further studies will contribute to a better understanding of CIC in periapical lesions and their systemic implications.

Acknowledgement

Financial assistance from the Kerala State Committee for Science Technology and the Environment, Government of Kerala, India, is gratefully acknowledged. We also express our sincere thanks to Dr. M. Krishnan Nair, Director, Regional Cancer Centre, Trivandrum.

References


