Correlation between Odontogenic Infection Severity Level and Leukocytes

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Abstract

Infection in the maxillofacial region is a public health concern, especially if it is related to maxillofacial trauma and other mouth and dental diseases. Increased levels of leukocytes are an indication that the human body is fighting a disease or some other pathological substance. Increased levels of leukocytes can represent not only acute infection but also several chronic diseases. Currently no research has been conducted in Indonesia to investigate the correlation between the severity of an odontogenic infection and the leukocyte level. To determine the correlation between the severity of an odontogenic infection and leukocyte levels. Forty-two medical records acquired from seven Hospitals in Jakarta, Indonesia were reviewed based on the study's inclusion criteria and categorized by the severity of the patient's odontogenic infection and their leukocyte levels. The youngest patient with an odontogenic infection was 2-years-old and the oldest patient was 75-years-old (average age 33.59). Twenty-nine of those patients had a category 2 Flynn Severity Score, 10 patients had a category 1 score, and three patients had a category 3 score.

The submandibular space, the buccal space, and the mediastinum were the facial areas that were most frequently involved in the odontogenic infection. Increased leukocyte levels were found in 25 patients (59.52%), decreased leukocytes levels were found in five patients (12.19 %), and normal leukocyte levels were found in 12 patients (29.26%). No correlations between the leukocyte level and the odontogenic severity score were found.

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Introduction

Infection in the maxillofacial region is a public health concern, particularly due to their great potential of spreading to important and vital anatomical structures.[1] Maxillofacial infection often occurs in people that have limited access to a health facility and cannot obtain medical care in an emergency department or at a regional public hospital.[2] Most maxillofacial infection cases that occur in the head and neck region originate from odontogenic infection in the oral cavity.[3-4] A patient's indifference is an aggravating factor in the severity of maxillofacial infection.[4]

Leukocytes play an important role in cellular and humoral defense against the invasion of foreign organisms. Leukocytes have the ability to engage in amuboid movement and diapedesis so they can leave the capillaries by passing through endothelial cells into connective tissue.[5] A change in the leukocyte level is one of the indicators of the human body's response to acute or chronic pathological processes that are caused by foreign microorganisms.[6] Odontogenic infection can occur at every age and in both genders after tooth eruption in primary and permanent teeth. Odontogenic infection is primarily found in the submandibular space due to the high prevalence of first and third molar caries followed by caries in the maxillary premolars and molars.

If care is not immediately given to a patient with a severity score of 2, the infection will spread deeper into the neck and the risk of respiratory tract infection is higher, placing the patient in the score 3 categories. Patients with a severity score of 3 have a poor prognosis. In these patients, the infection has entered the mediastinum cavity. The severity is also aggravated by the malnutrition caused by

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masticatory disturbance, depressed respiratory function, and hypotension with a loss consciousness. Some patients also experience multiple organ malfunction and septic shock, resulting in death. Based on the explanation provided above, this study is aimed to identify the correlation between the severity of odontogenic infection and the leukocyte levels in patients.

Materials and methods

This study used an analytical retrospective design to investigate thecorrelation between the severity level of odontogenic infection and leukocyte levels. The study's sample included medical records from 37 patients (secondary data) with odontogenic infection in the oral-maxillofacial region; the medical records were obtained from Jakarta general public hospitals from January 1, 2014 to January 1, 2016. The following hospitals were chosen: Tarakan Hospital, Koja Hospital, Cengkareng Hospital, Vudhi Asih Hospital, Pasar Rebo Hospital, Duren Sawit Hospital, and Kepulauan Seribu Hospital. The inclusion criteria were: patients ranging in age from 2 to 80 that had been diagnosed with odontogenic infection in the maxillofacial and that had undergone a peripheral blood examination before antibiotic administration. The exclusion criteria were: patients with systemic disease (diabetes mellitus, radiotherapy, chemotherapy, and autoimmune disease) and those who had undergone peripheral blood examination after antibiotic administration. The data was analyzed using SPPS V.20 and Spearman's correlation coefficient test.

Results

In this study, the subjects were not categorized base on gender. The youngest subject is 2-years-old and the oldest subject is 75-years-old. The average age is 33.59. Based on the results of the Flynn Severity Score for infection, 10 subjects had a score of 1 with buccal facial space, 29 subjects had a score of 2 with submandibular facial space, and three subjects had a score of 3 with mediastinum facial space. In this study, the normal leukocyte value range was differentiated based on age as follows: the >10 category, the 1–2-year-old category, and the 3–9-year-old category. In the >10 category, 10 subjects had normal leukocyte levels, two had leukopenia and 23 had leukocytosis. In the 1–2-year-old category, two subjects had normal leukocyte levels and two had leukopenia. In the 3–9-year-oldcategory, one subject had leukopenia and two had leukocytosis. The result of the Spearman correlation test showed that there was no significant correlation between the infection severity level and the leukocyte level in the patients' blood samples. The p-value was 0.477 and the strength of the correlation as 0.113.

Leukocyte value (/µL)	Frequency
Age > 10 years old	
4500 – 11000	10
< 4500	2
>11000	23
Age 3 – 9 years old	
5700 – 16300	0
< 5700	1
>16300	2
Aged 1 – 2 years old	
6.000 – 17500	2
< 6.000	2
> 17500	0

Table 1. Leukocyte count.

Discussion

The age of the subjects ranged from 2 to 75, and the average age was 33.59. As seen in Table 1, most of the subjects with an odontogenic infection were adults in their 30s. This finding is similar to the results reported in other epidemiological studies on odontogenic infection.[7] In this age group, the pathogenesis of caries has reached the pulp chamber in permanent teeth due to poor oral hygiene.[7] The incidence of odontogenic infection is lower in people who is older than 60, because it is shown that 25% of them may already have complete edentulism. From the data, the degree of infection severity can be analyzed using the Flynn Severity Score, which is based on the risk of infection in the respiratory tract. A score of 1 indicates the lowest risk of a respiratory tract infection. While a score of 2 indicates a moderate risk of respiratory tract infection, pain is a clinical symptom; other noticeable symptoms include a large area of swelling and masticatory performance disturbance. Most of the subjects from this present study can be placed in the mandibular infection category.[8,9] This was in line

with the theory of the spread of infection to the submandibular region because the highest prevalence of caries occurs in the first and third mandibular teeth.

In this study, the reference for a normal leukocyte value is based on Chermecky.[8] The level of leukocytes in blood is based on age: the >10 category, the 1–2-year-old category, and the 3–9-year-old category. There were 34 subjects in the >10 category; of those, 10 subjects had a normal leukocyte level, 23 had leukocytosis, and two had leukopenia. In the1–2-year-old category, two subjects had normal leukocyte levels and two had leukopenia; none of the subjects in this category had leukocytosis. In the 3–9-year-old category, one subject had leukopenia and two had leukocytosis. The number of subjects in >10 category was greater than the number of subjects in the two other age categories; thus, this study's findings are different from the results reported in other epidemiology studies that said that age does not have a significant impact on the prevalence of odontogenic infection. This could be due to the fact that the clinical symptoms of odontogenic infection in children are addressed more promptly because parents usually seek immediate help at the nearest health care facility. In this present study, the leukocyte levels increased in 25 subjects. In the 1–2-year-old category, four subjects had no increase in their leukocyte levels, 12 had normal leukocyte levels and five had decreased leukocyte levels. Leukocyte levels will increase if there is an infection in the body, but that increase can have a negative correlation with the severity of infection for a variety of reasons, such as the number of focal infections, the patient's nutritional status, education level and lifestyle, the administration of antibiotic therapy before treatment, and antibiotic resistance.[10,11] This study used the Spearman's correlation coefficient test to find the correlation between the infection severity level and the leukocyte level in blood. No significant correlation was found between the infection severity level and the leukocyte level in the blood.

The reason for this statistical result is that most of the patients came to the hospital more than three days after the peak inflammation period. Peak inflammation occurs when the level of leukocytes is the highest in the blood[6] because some of the white cells are increasing in response to the acute inflammation, and then they gradually decrease. The spread of infection to the face is caused by the boundary between the infected area and the face being destroyed by pus; thus, if the infection spreads deeper into neck it can result in higher or lower leukocyte levels.[12] In some hospitals, such as Koja Hospital, Duren Sawit Hospital, and Kepulauan Seribu Hospital, no oral surgeons are available to treat odontogenic infection patients. All the odontogenic infection patients in these hospitals are treated by a general surgeon. Thus, the need for an oral surgeon in those hospitals is high. Another obstacle in this study is the lack of medical records in some of the hospitals, so the sample size for the study was limited. Moreover, medical record ware written differently in every hospital, so those should be standardized. Additional research on the use of antibiotic therapy for odontogenic infection is needed to assess treatment success. Obtaining a blood culture should be a standard protocol to successfully select the antibiotic treatment and prevent antibiotic resistance.

Conclusions

There was no correlation between gender and the incidence of odontogenic infection among the subjects in the medical records from seven hospitals in Jakarta. The leukocyte level does not always increase as the infection severity increases. Dental health education should be given to patients beginning in early childhood, especially in terms of how to maintain good oral hygiene. Further research should investigate the correlation between the severity of odontogenic infection and C-reactive protein (CPR) levels or procalcitonin (PCT) serum levels, because these are better indicators of the severity of an infection than the leukocyte level in blood, and the findings could be used to evaluate the treatment progression of antibiotic administration.

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