

Effect of chemotherapy on oral health status and salivary alkaline phosphatase among leukemic patients

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ABSTRACT

Background: Leukemia is a broad term given to a group of malignant diseases characterized by diffuse replacement of bone marrow with proliferating leukocyte precursors. Chemotherapy has been increasingly used to treat malignant conditions. The systemic sequelae as a result of these immunosuppressive techniques induce many oral and dental complications. This study was conducted to evaluate the effect of chemotherapy on oral health status and activity of salivary alkaline phosphates enzyme in patients with acute lymphocytic leukemia.

Materials and methods: The study groups included 28 patients with acute lymphocytic leukemia; they were under chemotherapy, aged 20-25 year old. The control group includes healthy subjects matching with study group. Plaque, gingival, calculus and loss of attachment status were recorded. After oral examination, stimulated saliva samples were collected from the subjects (study & control groups) and performed under standard condition following instruction and chemically analyzed for the detection of salivary alkaline phosphates enzyme.

Results The study showed higher mean values of plaque index, gingival index, attachment loss and concentration of salivary alkaline phosphates enzyme among leukemic group than control group with statistically high significant differences.

Conclusions: It was concluded that patients with acute lymphocytic leukemia have poor oral hygiene and need intense oral hygiene program before, during and after chemotherapy.

Key words: Oral health, salivary alkaline phosphates, chemotherapy, acute leukemia. (J Bagh Coll Dentistry 2013; 25(Special Issue 1):137-139).

INTRODUCTION

Acute lymphoblastic leukemia (ALL) is a fast-growing cancer of the white blood cells where the bone marrow makes lots of unformed cells called blasts that normally would develop into lymphocytes. However, the blasts are abnormal. They do not develop and cannot fight infections. ⁽¹⁾Initial signs and symptoms of leukemia can appear in the mouth or neck. These oral presentations may lead the patient to seek dental care, or they may be noticed during a routine dental examination. Oral lesions are more commonly found in patients with acute leukemia; mucosal pallor, mucosal purpura, lymphadenopathy, gingival bleeding, and petechiae are typical manifestations. Gingival swelling is frequently found in patients with acute myelogenous leukemia (AML) but is uncommon in patients with acute lymphocytic leukemia ⁽²⁾.

Immunosuppressive chemotherapy has been increasingly used to treat and, in some cases, cure numerous malignant conditions. The systemic sequelae as a result of these immunosuppressive techniques induce many oral and dental complications. The direct and indirect stomatotoxic effects are associated with the development of ulcerative, hemorrhagic, or infectious complications ⁽³⁾.

Intracellular enzymes are increasingly released from the damaged cells of periodontal tissues into the gingival crevicular fluid and saliva. Several enzymes that are evaluated for the early diagnosis of periodontal disease are aspartate and alanine aminotransferase, lactate dehydrogenase, creatine kinase, alkaline and acid phosphatase ⁽⁴⁾.

The enzyme alkaline phosphatase (ALP) plays a role in bone metabolism. It is a membrane-bound glycoprotein produced by many cells, such as polymorph nuclear leukocytes, osteoblasts, macrophages, and fibroblasts within the area of the periodontium and gingival crevice ⁽⁵⁾.

Untreated chronic periodontitis patients exhibit higher level of alkaline phosphatase in whole saliva than did healthy control. A positive correlation was found for alkaline phosphatase in periodontitis patients with pocket depth. Alkaline phosphatase is released by secondary granules of neutrophils and its concentration increases significantly with plaque accumulation and increasing inflammation. So this enzyme should be considered to be the best indicator for periodontal disease ⁽⁵⁾. Aims of the study were to evaluate the effects of chemotherapy on the oral hygiene, periodontal health and the activity of salivary alkaline phosphates enzyme in patients with acute lymphocytic leukemia (ALL) who received chemotherapy, in comparison with control group matching with the study group, and to evaluate the effect of duration of treatment on

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the attachment loss and the concentration of ALP enzyme.

SUBJECTS AND METHOD

The study groups included 28 patients (19 female, 9 male) with acute lymphocytic leukemia, they were under chemotherapy, (clinically examined at the Centre of Hematology and Scientific Research of Al – Yarmook Hospital) aged 20-25 year old. The patients were selected according to the type of the disease (acute lymphocytic leukemia) and according to the duration of the treatment (from 6 -12 months). They were hospitalized after chemotherapy administration. The control group includes 28 healthy subjects matching the study group by age and gender which were randomly selected from the visitors, companions of leukemia patients in the hospital. Plaque status was evaluated according to the Silness and Loe Index ⁽⁶⁾, gingival condition according to Loe and Silness ⁽⁷⁾, while dental calculus and the loss of attachment were assessed

according to Periodontal Disease Index (PDI) by Ramfjord⁽⁸⁾. After oral examination, stimulated saliva samples were collected from the subjects (study & control groups) and performed under standard condition following instruction cited by Tenovuo and Lagerlof ⁽⁹⁾, and chemically analyzed for the detection of salivary alkaline phosphates enzyme.

RESULTS

Table (1) is showing higher means values of plaque and gingival indices among leukemic group than control group with statistically high significant differences (P 0.01). Mean value of calculus index has been shown no statistical differences between study and control groups. Statistically, highly significant differences (P 0.01) were also found among study group in mean values of attachment loss (mm) and alkaline phosphatase concentration (IU/L).

Table 1: Mean values of plaque, gingival, calculus indices, loss of attachments and alkaline phosphatase concentration among study and control groups

Variables	Patients (ALL)	Controls	t-value
	Mean± SD	Mean± SD	
PII	1.96 0.25	1.54 0.32	5.37*
GI	1.83 0.39	1.43 0.31	4.18*
CaII	0.24 0.93	0.01 0.02	NS
Loss of attachment (mm)	0.63 0.48	0.09 0.23	5.29*
ALP (IU/L)	20.03 5.00	6.21 2.54	13.02*

* Highly significant (P 0.01) , df= 54
NS= not significant

A high significant correlation was found for the duration of the treatment with loss of attachment and concentration of alkaline phosphatase enzyme in saliva (P 0.01) as

Table 2: Correlation coefficients between duration, loss of attachment (mm) and alkaline phosphatase (IU/L) among study groups

Parameter	Loss of attachment		ALP	
	r	p	r	p
duration	0.69*	0.00	0.48*	0.009

* Highly significant

demonstrated in Table (2). This study also has been shown significant correlation between loss of attachment and concentration of alkaline phosphatase enzyme (P 0.05), Table (3).

Table 3: Correlation coefficients between loss of attachment (mm) and alkaline phosphatase (IU/L) among study groups

Parameter	ALP	
	r	p
Loss of attachment	0.44*	0.01

* Significant

DISCUSSION

This study has been shown higher mean value of plaque index among patients with acute lymphocytic leukemia than healthy subjects which may be related to neglect or poor oral health measures, as most of patients reported their afraid from brushing their teeth due to bleeding

and susceptibility to infections. Previous studies showed that patients undergoing cytotoxic chemotherapy and radiation therapy often experience poor oral hygiene during and after treatment despite the supervised oral hygiene and conventional antimicrobial regimens ^(2,10).

Periodontal diseases are among highly prevalent oral disorders and can affect up to 90% of the worldwide population. The severity of the disease ranges from gingivitis to various classes of periodontitis and mostly due to plaque formation and accumulation which may explain the higher mean value of gingival index that observed among patients in the study group⁽¹¹⁾. It is known that a reduced salivary flow rate (due to chemotherapy induced salivary gland hypoplasia) favors dental plaque accumulation, which if left uncontrolled, may trigger periodontal inflammation in immuno-compromised patients⁽¹²⁾. This fact could be related to the higher mean values of plaque, gingival and attachment loss recorded in this study.

Saliva is an important physiologic fluid that contains a highly complex mixture of substance. Saliva contains locally and systemically derived biomarkers of periodontal disorders and can therefore, be recommended as patient specific diagnostic test⁽¹³⁾. ALP is very important enzyme as it is part of normal turnover of periodontal ligament, root cementum and bone homeostasis, it will be released from the damaged cells of periodontal tissues into the gingival crevicular fluid (GCF) and saliva⁽¹¹⁾. Evaluation of some salivary enzymes has been used as markers for the early diagnosis of periodontal disease. Higher level of ALP has been demonstrated in this study among patient with leukemia which may be due to an increase in the inflammation and bone turnover rate as ALP is produced by PMNs, osteoblasts, macrophages, fibroblasts and plaque bacteria within periodontal tissues or periodontal pocket^(13,14). The increased activity of ALP is probably a consequence of destructive process in the alveolar bone in advanced stages of development of periodontal disease⁽⁵⁾.

A high significant correlation was found for the duration of the treatment with loss of attachment and concentration of alkaline phosphatase enzyme. Previous studies were reported higher bone ALP after chemotherapy and suggested that chemotherapy depressed bone formation and enhanced bone resorption during this period^(15,16).

The study also showed a significant correlation between the enzyme activity and the value of the attachment loss. This is probably a consequence of pathological processes in periodontal tissues from where this intracellular enzyme is increasingly released into saliva.

In conclusion, the findings of this study showed that patients with ALL are at high risk of dental problems and its recommend that frequent dental examinations and intense oral hygiene program

before, during and after chemotherapy are necessary in these patients.

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