Serum Zinc in Iraqi Acute Leukemic Patients

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Abstract

***Background*:** Leukemia is a group of malignant disorders associated with increased numbers of blood white blood cells**.** Acute leukemia occurs at all ages**.** Because zinc influences many body systems and functions, zinc is an essential nutrient for tissue growth, cellular division, protein synthesis DNA and RNA replication it also ought to play a critical role in the growth of tumor. In this study, serum zinc was estimated in leukemic patients and compared with healthy subjects.

Methods: The subjects in the present study were; fourty-four depressed patients aged (14-48 year), thirty-one apparently healthy subjects were selected as control group. Their sex and age were comparable to that of patients. Determination of serum zinc was carried out using flame atomic absorption spectrophotometer.

Results: The results showed a significant decrease in serum zinc at ($p<0.05$) in leukemic patients as compared with healthy control.

***Conclusion*:** The decrease in serum concentration of zinc in leukemia can be explained by means of the changes in immunity system and the need for zinc to synthesize nucleic acid and tumor cell division in this disorder in addition to other possible mechanisms.

Keywords: leukemia, zinc, inflammation.

Al- Kindy Col Med J 2009; Vol .5 (1) p :5-7

Introduction

Leukemia is a group of malignant disorders of the haemopoietic tissues characteristically associated with increased numbers of primitive white cell (blasts) in the bone and subsequent increase in the number of blood white blood cells [(1)]. The course of the disease may vary from a few days or weeks to many years depending on the type of leukemia [(2)].

Leukemia is classified on the basis of cell type involved and the state of maturity of leukemic cells. Thus, acute leukemia are characterized by replacement of the bone marrow with very immature cell (blasts) and by rapidly fatal course in untreated patients while chronic leukemia are characterized by well differentiated (mature leukocyte) and with a relatively indolent course [(2)].

The incidence of leukemia of all types in the population is approximately 10 per 100,000 per year of which just under half are acute leukemia. Males are affected more frequently than female. Acute leukemia occurs at all ages while chronic leukemias occur mainly in middle and old age [(1)].

In acute leukemias (whether Lymphoblastic or Myeloblastic), the neoplastic blasts have a prolonged rather than shortened generation time. Thus, the accumulation of blasts results from clonal expansion and failure of maturation of the offspring into functional mature cells .As blasts accumulate in the marrow, they suppress normal hematopoietic cells [(3)].

Trace element plays an important role in biological processes through their action as activators or inhibitors of enzymatic reaction, or by influencing the permeability of cell membrane or by its essential role of direct anti-oxidant enzyme [(4-6)].

Zinc influences many body systems and functions including growth, bone formation, brain development, reproduction, fetal development, sensory functions, immune mechanisms [(7-8)], and membrane stability and wound healing [(9-12).]

Because zinc is an essential nutrient for tissue growth, cellular division, protein synthesis DNA and RNA replication it also ought to play a critical role in the growth of tumor [(13)].

It has been reported that, in many neoplastic diseases including leukemia, alteration in plasma zinc level was reduced at the onset and relapse. While in complete remission and in off therapy it was in the normal range. Zinc plasma deficiency is present in all patients at the onset and during relapse. An impairment of peripheral immune efficiency in all patients is commonly found [(14)].

Because leukemia associated with different types of immunological changes [(15-16)], and zinc plays important roles in immunity, this work try to study the possible changes in serum zinc as parameters of immunity in leukemia patients.

Methods

Patients: Forty-four acute lymphocytic leukemic patients in addition to thirty one healthy individual as control were participated in this study. These cases were collected from different hospitals in Baghdad city. The ages of those patients were ranged from 6-19 years. Venous blood samples were collected and then separated and stored at (-20ºC) until analysis.

Assay: 0.1ml of serum diluted to total volume of 1ml using 6% n-butanol solution [(17)] and analyzed for their zinc content using atomic absorption spectrophotometer (Shimadzu AA-646) using a zinc hollow cathode lamp at wavelength 213.9nm.

Results

The result of this work is in accordance with other results. Begnine *et al* (1987) [(20)] noticed that, zinc deficiency could contribute to immune dysfunction in

CLL. Furthermore, zinc is an essential metal for maintaining the integrity of immune system [21].

The underlying requirement of zinc in maintaining immuncompetence requires further study, but may be a result of its requirement in many enzyme systems, or its ability to stabilize biologic membrane [21]. Several laboratories have found that zinc deficiency depresses antibodies responses possibly owing to a loss of T-helper–cell function [22]. Zinc deficiency affects the biological activity of thymus hormones and has a major effect on cell mediated immunity perhaps as a result [23-24]. Zinc is the most important trace elements for immune function and its deficiency is associated with immune abnormalities and increase susceptibility to infectious diseases.

In zinc deficiency, the function of leukocytes is impaired. It is difficult to determine whether the decrease in serum zinc is the result of a real or an apparent zinc deficiency. In stress, which may be present in patients with leukemia, the decrease of zinc reflects an apparent zinc deficiency because of redistribution of serum zinc into the liver and because of decrease in serum albumin concentration where over 70% of the serum zinc is bound to albumin [25].

In cell line experiments[26]., zinc deficiency suppresses c-myc gen transcription which is followed by suppression of proliferation and induction of differentiation of HL-60 cells (Human promyelocytic Leukemia cell line)

The data of this research that carried out on Iraqi patients are well agreed with the findings of other researches studied serum zinc in leukemic patients [20, 27]. Different types of cancers showed identical results. Serum zinc levels were significantly higher in healthy control subjects as compared with patients with lymphoma, acute leukemia or chronic leukemia [27].

The data of an important research [6] suggested that serum zinc deficiency is present in all patients at the onset and during relapse, and that such a deficiency causes a decrease in the activity of thymulin despite a nearly normal production of the thymus. In addition, an impairment of peripheral immune deficiency in all patients is commonly found.

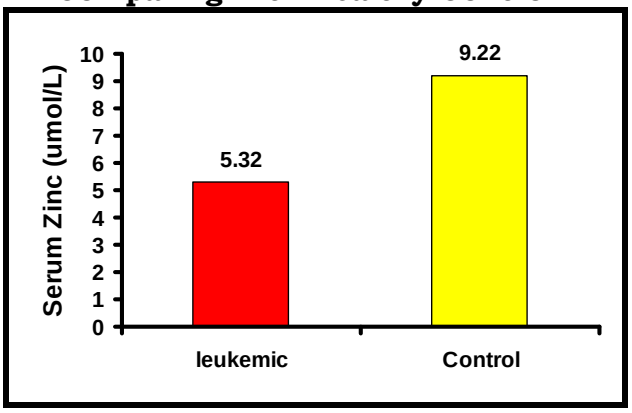
Further studies of serum trace elements are needed in leukemic patients as well as studying the immunological changes in this type of malignant disease are required.

Discussion

Serum zinc showed a decrease at ($p<0.05$) as compared with healthy controls as shown in Figure [1]. The main explanation for this result is through the mutual correlation between zinc deficiency and immunity [9] and between immunity and leukemia[18-19]

(Figure-1)

Serum Zinc in Leukemic Patients In Comparing with Healthy Control



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Al- Kindy Col Med J 2009; Vol .5 (1): p7

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Received at: 29-3-2007 **Accepted at**: 10-10-2007