Estimation of copper & zinc in plasma of acute lympoplastic leukemia

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Abstract

Several works have shown that a definite relationship that exists between trace elements & certain diseases. the aim of this study is to investigate the change in plasma copper & zinc of acute lympoplastic leukemia. 41 subjects were participating in this study; 20 healthy subjects & 21 patients suffer from acute lymphoblastic leukemia (ALL). Blood samples were collected & plasma copper & zinc concentrations were measured. Plasma zinc is significantly lower in ALL patients than control by 11% ($p<0.01$), whereas plasma copper is higher in ALL patients than control by 14.7%. In the present study, p.cu/p.zn ratio of control (19%) was lower than that of ALL patients (24.7%). The higher ratio of patients is due to reciprocal changes of copper & zinc. This index may better than copper or zinc alone.

Key words: acute lympoplastic leukemia, plasma copper, zinc

Introduction

The availability of effective treatment for malignant diseases are depends on the presence of sensitive biological markers that correlates with disease activity. Several works have shown that a definite relationship that exists between trace elements & certain diseases (1, 2,3). Plasma copper (p.cu), plasma zinc (p.zn) and selenium are among several biochemical that have been used (4,5,6). Many reports had suggested that copper & zinc might reflect disease activity (4, 5).

Therefore, the aim of this study is to investigate the change in plasma copper & zinc of acute lympoplastic leukemia.

Patients & Methods

41 subjects were participating in this study; 20 healthy subjects & 21 patients suffer from acute lymphoblastic leukemia (ALL). The study was conducted at children hospital in Baghdad medical city. Blood samples were collected & plasma copper & zinc concentrations were measured by X-ray flourence technique (XRF) (6). The XRF involves the measurement of intensity of an admitted X-ray from the sample. Plasma copper / plasma zinc ratio (p.cu/pzn ratio) was determined by dividing p.cu concentration by p.zn concentration & multiply by 100. Data were analyzed by using student T test & presented as mean & standard deviation (SD).

Results

20 patients suffering from ALL (aged 6.8 ± 4 years) & 21 healthy subjects aged 7.9 ± 3.5 years were participated in this study.

Table 1 shows the age of patients, the mean, standard deviation, & the range of plasma zinc & copper. Plasma zinc is significantly lower in ALL patients than control by 11% ($p<0.01$). Whereas plasma copper is higher in ALL patients than control by 14.7% ($p<0.01$).

It was found that the range of p.cu in patients was 1.103 to 1.879 ug/ml (mean value is 1.568 ± 0.184), while, the range for control subjects was 0.931 to 1.774 mg/ml (mean 1.367 ± 0.199).

Moreover, the range of p.zn in patients was 5.584 to 7.293 (mean 6.39 ± 0.478 ug/ml), while the range of p.zn in control was 6.568 to 8.088 (mean 7.195 ± 0.475 ug/ml). There is 11.2% reduction in

plasma zinc in ALL patients comparing with control subjects.

There was a significant difference in P.cu / p.zn ratio between ALL patients (24.7%) & control subjects (19%). In other words, P.cu / p.zn ratio is higher in patients than control subjects.

Discussion

Plasma copper was found to have a positive relationship with disease activity that p.cu concentration increases as disease activity increases. This finding was reported previously in other type of cancer such malignant lymphoma (3) & breast cancer (4). But this result was not reported previously in ALL.

In the present study, the plasma zinc of ALL patients is lower than that of control subjects ($p<0.01$). Zinc is active element everywhere in the body as co-factor for more than 70 enzymes; also it helps in the function of white blood cell (WBC) in immune system. The zinc content of WBC in human leukemic patients is decreased to about 10% of normal amount (7,8). Also, this finding was reported previously in other type of cancer such malignant lymphoma (3,9) & breast cancer (4), but not reported previously in ALL. For this reason & others, zinc supplementations have been reported to improve & increase immune function (10, 11). This effect may be especially important in the elderly according to double blind study that found a zinc supplement is important for patients with recurrent infection (12,13,14).

By using plasma copper / p.zn ratio, which is show better index for pathological changes of disease activity. In the present study, p.cu/p.zn ratio of control (19%) was lower than that of ALL patients (24.7%). The higher ratio of patients is due to reciprocal changes of copper & zinc. This index may better than copper or zinc alone.

Therefore, conclusion could be drawn as plasma copper, plasma zinc & its ratio may be useful indexes for diseases activity & a good biological marker for ALL patients. So, that zinc supplement have been reported to increase immune function (15,16).

There are claims that copper aids the body in functions such as the healing process, expelling toxins from the body, and preventing heart problems. There are also claims that copper actually promotes cancer growth. Proponents of this theory recommend a low copper diet and use of chelating agents that bind to copper and promote its elimination from the body (see Chelation Therapy), (17,18,19,20).

Copper is a trace mineral that is needed for many important body processes. Animal studies have shown that copper is useful in maintaining antioxidant defenses. Antioxidant compounds block the action of activated oxygen molecules, known as free radicals, which can damage cells. While the involvement of copper in the cancer process via antioxidant effects is still unclear, copper complexes have been shown to have anti-cancer properties in lab studies (21,22,23,24).

Other lab and animal studies suggest that high copper levels may be linked to liver cancer and brain tumors. More recently, many studies have shown that blood copper levels are higher in several types of cancer as well as in other diseases. To add to the confusion, blood tests can show high copper levels even when there is little copper in the tissues. These high copper levels may be due to injury, disease, or inflammation (23,25,26).

Because copper is needed to form new blood vessels, one group of researchers used a copper-lowering drug to find out if it helped patients with advanced kidney cancer. Some patients' cancers stopped growing during the 6-month treatment period. A few people had low white blood counts during treatment, requiring that treatment be stopped until they recovered. This was a small study, and further research is needed to find out if it can help more people with advanced cancer (27).

Another study measured copper levels in the blood of people who died from heart disease, and noted that their levels were high (28). It is not known whether the lab testing truly reflected copper levels in the body tissues, or exactly what caused the high levels. In contrast, a recent study gave copper supplements to healthy women with no signs

of copper deficiency. Their cholesterol and triglyceride levels improved, as did some other markers of heart disease risk. This small study did not look at actual heart disease, however. Further research is required to see if copper can affect heart disease risk (28,29, 30).

In others studies, serum levels of copper showed gradual increase from precancer to the cancer group (oral squamous cell carcinomas) as compared to normal subjects, which was statistically significant. (31,32)

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Table (1): The mean, SD, & range of plasma copper (ug/ml) & plasma zinc (ug/ml) concentrations in healthy & ALL patients.

Elements	Mean ± S.D	Range
A-zinc		
Patients	6.39 ± 0.49	5.584 – 7.293
Control	7.195 ± 0.48	6.568 – 8.088
B-Copper		
Patients	1.568 ± 0.18	1.103 – 1.879
Control	1.367 ± 0.19	0.931 – 1.774