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Blood and Fingernail Copper (Cu) and Magnesium (Mg) Levels of Children With Acute Lymphoblastic Leukemia

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Abstract: In this study, serum and fingernail Cu and Mg levels of 10 children with acute lymphoblastic leukemia and 12 healthy children were determined.

Copper and magnesium levels of the sera and supernatants were measured by atomic absorption spectrophotometer. (Perkin-Elmer 400).

Fingernail Cu and Mg levels of the patients were 8.67 ± 5.35 and 0.22 ± 0.12 $\mu\text{mol/mg}$ of nail respectively. The values for control subjects were 4.27 ± 2.32 and 0.14 ± 0.03 $\mu\text{mol/mg}$ of nail. Serum Cu and Mg levels of

the patients were 525.1 ± 160.9 $\mu\text{g/dl}$ and 2.42 ± 0.54 mg/dl , and those of controls were 115.0 ± 70.7 $\mu\text{g/dl}$ and 2.20 ± 0.70 mg/dl respectively. The differences between serum Cu and fingernail Cu and Mg levels of the two groups were statistically significant which might be an index for the activity of the disease.

Key Words: Leukemia, copper, magnesium, fingernail

Introduction

Trace elements are widely investigated because of their numerous biochemical functions (1-3). Many investigators have determined plasma trace element levels of cancer patients (2,4,5). Most of them found that plasma Cu levels of leukemic patients were higher (4-7) than those of control subjects while the findings about plasma Mg levels were different. In this study we determined serum and fingernail Cu and Mg levels of children with acute lymphoblastic leukemia (ALL) in order to find whether these results can be used in the diagnosis and follow-up of the disease.

Materials and Methods

This study was carried out on 10 children with ALL aged between 2 to 13 years, before treatment. Control subjects were 12 healthy children in the same range of age.

Blood samples were obtained by venapuncture into disposable syringes. Fingernail samples were obtained with a razorblade after cleaning of fingernails with ethyl alcohol. 5 mg of samples were weighed and transferred into deionized tubes. 2 ml of oxalic acid (0.5 M) was added and incubated at 120 °C for two

hours. Then the samples were deproteinized with 2 ml of 40 % trichloroacetic acid (TCA) and centrifuged at 3000 g for 10 minutes. Copper and magnesium levels of the sera and supernatants were measured by atomic absorption spectrophotometer (Perkin-Elmer 400). All glasswares were soaked in diluted nitric acid solution for 24 hours and then washed with redistilled water five times. Statistical analysis was done by student's t-test.

Results

Fingernail Cu and Mg levels of patients with ALL were found as 8.67 ± 5.35 and 0.22 ± 0.12 $\mu\text{mol/mg}$ of nail respectively. Those of control subjects were found as 4.27 ± 2.32 and 0.14 ± 0.03 $\mu\text{mol/mg}$ of nail.

Serum Cu and Mg levels of patients were found as 525.1 ± 160.7 $\mu\text{g/dl}$ and 2.42 ± 0.54 mg/dl and those of controls were 115.0 ± 70.7 $\mu\text{g/dl}$ and 2.2 ± 0.7 mg/dl respectively. The differences between serum Cu and fingernail Cu and Mg levels of patients and controls were statistically significant ($p < 0.01$ for fingernail Mg and $p < 0.001$ for both serum and fingernail Cu). The results are shown in table I. As seen from the table, both serum Cu and fingernail Cu and

Parameter	Group	$\bar{X} \pm SD$	Significance
Serum copper (mg/dl)	Children With ALL	525.1±160.97	p<0.001
	Control	115.0±70.71	
Fingernail copper (µmol/mg)	Children With ALL	8.67±5.35	p<0.001
	Control	4.24±2.32	
Serum Magnesium (mg/dl)	Children With ALL	2.42±0.54	Not significant
	Control	2.2±0.7	
Fingernail Magnesium (µmol/mg)	Children with ALL	0.22±0.12	p<0.001
	Control	0.14±0.03	

Table 1. Serum and fingernail copper and magnesium levels of patients with ALL and control subjects

Mg levels were significantly higher than those of controls.

Discussion

Trace element levels of various body fluids have been determined in different disease states in order to obtain information about the pathophysiology of diseases or to use the values for different purposes such as diagnosis, management and activity of diseases (2,4,5,8).

Also nail copper was reported to represent a tissue determination that merits exploration in the assessment of copper nutriture (9).

In the studies performed on leukemic patients, serum Cu levels were found to be higher than those of controls (2,4,6,10). That was attributed to high percentage of blood cells in bone marrow or in peripheral circulation (4,6,11). The findings about serum Mg levels of patients under treatment were found to be

higher after treatment than before treatment. This was explained by the amount of Mg arised from cells destroyed as a result of chemotherapy (8,10).

Some investigators thought that serum Cu and Mg levels may be used as an index for the activity of leukemia (8).

As it is seen from Table-I, our serum findings of Cu and Mg levels are in agreement with those of - other researchers. Van Stekelenburg and coworkers (9) showed that mean fingernail and toenail copper levels were higher in infants with cystic fibrosis than in controls. We haven't encountered any study about fingernail Cu and Mg levels of leukemic patients. Therefore, this is the first study which shows such a significant alteration in these parameters.

Although the reason for these significant alterations is not known, we believe that they may provide valuable information about the activity of the disease.

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