The Prevalence of Low Selenium Levels in Adult Patients Undergoing Bone Marrow Transplantation: A Brief Communication

Molouk Hadjibabaie  
Faculty of Pharmacy, Medical Sciences, University of Tehran, Tehran, Iran

Masoud Iravani  
Hematology-Oncology and BMT research Center, Medical Sciences, University of Tehran, Tehran, Iran

Ahmad Reza Shamshiri  
Faculty of Health and Institute of Health Research, Medical Sciences, University of Tehran, Tehran, Iran

Zahra Zaker  
Faculty of Pharmacy, Medical Sciences, University of Tehran, Tehran, Iran

Asadollah Mousavi, Kamran Alimoghaddam, and Babak Bahar  
Hematology-Oncology and BMT Research Center, Medical Sciences, University of Tehran, Tehran, Iran

Ebrahim Kalantar  
Iran University of Medical Sciences, Department of Immunology, Tehran, Iran

Ardeshir Ghavamzadeh  
Hematology-Oncology and BMT Research Center, Medical Sciences, University of Tehran, Tehran, Iran

Selenium (Se) is an essential trace element, and its deficiency is considered to be important in various types of cancer. There are just a few data regarding this issue among adult patients with hematological malignancy. Serum Se levels were determined in 22 adult patients candidates for bone marrow transplantation (BMT) in Iran. The mean serum Se levels before BMT was 19.91 µg/l (from 12.00 to 62.00 µg/l), and almost all the patients had low Se serum levels (normal serum Se level: 46–143 µg/l). The level of Se 20 days after BMT was 22.53 µg/l, which did not show any significant changes. Most of the patients did not suffer from malnutrition, as they had mostly normal albumin levels. Even though the results of this study showed that Se deficiency is common among our hematological malignant patients, it can not be concluded that these low Se levels are causally related to cancers for which BMT is undertaken. Further studies are needed to evaluate the Se levels at diagnosis before treatment effects.

INTRODUCTION

Selenium (Se) as an essential trace element in humans and has been known for its function as an antioxidant, which is increasingly considered being important to human physiology. The deficiency of Se is considered to be important to the pathophysiology of conditions ranging from depression to atherosclerosis to cancer (1). Se is well known to be an integral component of the enzyme glutathione peroxidase, which plays an important role in cellular defense against oxidative damage (2). A possible protective effect of Se against human malignancy was suggested in 1969 because the population with a higher Se intake showed a decreased cancer incidence (3). In recent decades, a possible association between Se deficiency and various types of cancer has been indicated (4). This is due to anticarcinogenic properties of Se and epidemiological observations relating low serum Se levels to an increased risk of hematological malignancies (5) and other types of solid tumors (4,6,7). Evaluation of the dietary intake of Se in more than 25 countries found an inverse correlation with total age-adjusted cancer mortality (8). Data from intervention studies have supported the role of Se in human cancer prevention (9,10). The purpose of our study was to prospectively determine the prevalence of low Se levels and malnutrition status in adult patients with hematological neoplasms undergoing bone marrow transplantation (BMT) procedure.
PATIENTS AND METHODS

Twenty-two adult patients with hematological malignancies, admitted to the Hematology-Oncology and Bone Marrow Transplantation Research Center at Shariati Hospital in Tehran, Iran from April to October 2006, were enrolled into this study. No particular malignancy types were excluded from the study. The mean age of the patients was 27.8 yr, with a range of 17–52 yr. There were 12 males and 10 females. Table 1 summarizes the patient demographics and diagnosis individually. Patients were prospectively evaluated for serum Se and albumin levels as a nutritional status index before receiving conditioning regimen and 20 days after transplantation. All patients received pretransplant conditioning regimen including busulphan (Bu)/cyclophosphamide (CY), or CCNU (lomustine)/ VP16 (etoposide)/cyclophosphamide or melphalan. Graft versus host disease (GVHD) prophylaxis consisting of cyclosporine A (CSA), low dose methotrexate (MTX) was given to all patients. Methylprednisolone was administered to patients with uncontrolled GVHD. Serum Se levels were determined by electrothermal atomic absorption spectrometry (Unicam 929-UK) according to the method described by Compilo (11). Normal values for serum Se ranged between 46–143 µg/l.

All patients signed an informed consent form. The data are summarized as mean and standard deviation.

RESULTS

All patients were on remission state and were scheduled for marrow or peripheral blood stem cell transplantation (PBSCT). Serum Se levels were low in almost all patients before BMT shown in Table 1. The mean and standard deviation of the patients’ Se levels before transplantation were 19.91 ± 10 µg/l. There were no significant changes in serum Se levels 20 days after transplantation (22.53 ± 11 µg/l). The albumin levels were normal almost in all patients. The mean and SD of the patients’ albumin levels were 4.12 ± 0.2 g/dl. Normal values for serum albumin ranged between 3.5 and 5.2 g/dl.

DISCUSSION

BMT is a therapeutic procedure that consists of administration of high-dose chemotherapy followed by intravenous infusion of hematopoietic stem cells to reestablish marrow function in patients with damaged or defective bone marrow. Se has a key role in the maintenance of normal health in human population (12). There is increasing evidence that the deficiency of Se may have several short- and long-term medical immune responses or even cause cancer (13). In a study evaluating the serum Se in 184 healthy individuals living in Tehran, Iran found that the serum concentration of Se was normal (100.6 ± 12.8 µg/l) and similar to other nationalities in the Middle East (14). So low Se levels are not common in general population in Tehran. The result of our study demonstrated that low Se levels may be common in hematological malignant patients. This could be partly explained by the group of enzymes like glutathione peroxidases (GPs); oxidative damage of DNA and other biologically active molecules that may initiate carcinogenesis (15,16), whereas GPs facilitate scavenging of various potentially dangerous free radicals with prominent oxidative capabilities (1,17,18). Because Se is an essential trace element for normal structure and functioning of GPs (1), low levels of Se can lead to oxidative damage. In recent published study’s results regarding the role of Se in epilepsy and other neurological disorders, it appears that Se can be used as an adjuvant for the treatment of degenerative or free radical diseases such as neurological disorders, inflammatory diseases, or cancer (19).

The results of this study are in agreement with some studies demonstrating low Se levels in children with cancer (20–26). One study showed that Se deficiency was common among newly diagnosed pediatric cancer patients, Se levels were lower in widespread disease than localized disease, and low Se levels were more prevalent in widespread disease patients than in localized disease patients (27). In one study that evaluated the levels of Se in adult patients with different types of leukemia,
the authors found that there were low Se levels in leukemia patients before initial treatment (28).

Another study also reported that pretreatment serum Se levels were lower in adult patients with acute, non lymphocytic leukemia than in controls; but 7 days after the initiation of chemotherapy, serum Se increased significantly (29).

In our study, patients had received their initial treatment and were in remission before determining the first level of Se; and 20 days after receiving high dose chemotherapy, there was no significant changes in Se status, and the levels were subnormal for almost all patients.

All patients in our study almost had normal albumin level, so even though it may be argued that these patients, due to widespread nature of their disease, have reduced appetite and decreased food intake to explain their low Se levels, we may conclude that nutritional status did not determine serum Se levels in our study population. In summary, even though the results of this study are preliminary, it can be concluded Se deficiency is commonly found among hematological malignant patients undergoing bone marrow transplantation which can not be explained by malnutrition in this group of patients. However, the role of Se deficiency as a cause or consequence of cancer development remains unclear. Further clinical intervention trials are needed to provide better insights on the effect of Se deficiency in cancer development.

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REFERENCES
