

Effect of heavy metal and some trace element levels on radiotherapy taken breast cancer patients

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Abstract

Objective: The aim of this article is to research the effects of radiotherapy on trace elements and heavy metals in patients with breast cancer. Breast cancer is a common disease worldwide. Breast cancer risk increases with age and occurs at much higher levels in postmenopausal women. During radiation therapy for the treatment of breast cancer, damage to tissue may result. Depending on the treatment technique applied, other areas apart from the treatment area may be affected. For example, the lungs may be negatively affected, resulting in decreased lung capacity. Consequently, free radicals may be formed as a result of oxidative stress incurred due to insufficient lung capacity.

Plan and design: In this review article, approximately 110 articles were consulted.

Result: Radiotherapy may cause damage to or loss of tissue, and may have negative effects on trace element levels. Consequently, levels of heavy metals and trace elements may be altered during radiotherapy.

Conclusion: An increase in heavy metals leads to greater oxidative stress, which is associated with a higher risk of cancer. Normal levels of Zn may also decrease the risk of cancer.

Keywords: trace elements, heavy metals, radiation therapy.

Introduction

Breast cancer is a common disease worldwide. Breast cancer risk increases with age and occurs at much higher levels in postmenopausal women. Among women, breast cancer is the second most common type of cancer resulting in death, after lung cancer.

Radiation therapy can be used to treat all types of solid tumors including brain, breast, stomach, larynx, esophagus, and other head and neck cancers. Postsurgical radiotherapy can be used in the adjuvant treatment of breast cancer to prevent local recurrence. Radiotherapy is also used in order to prevent recurrence after a local recurrence, thus showing the importance of treatment modality.

Trace elements play a very important role in human health, even though they are found in very minute amounts. Levels of Cu and Mg before and after radiotherapy in breast cancer patients have been shown to be statistically significant when compared with a healthy control group [1]. Serum Cu levels were found to be lower in lung cancer patients than in healthy people [2]. Levels of Ni were found to be increased in 15 patients with breast cancer [3].

Manganese and zinc, which are necessary for the superoxide dismutase enzyme system to function, are known to inhibit radiation-induced toxicity. In a study on colorectal cancer patients, varying levels of Fe, Cu, Mn and S were found [1-4]. Levels of Na, Mg, Ca, Se, Rb and Mo were observed to decrease in the plasma of lung cancer patients undergoing radiotherapy. However, levels of Al, S, V, Fe, Cu, Al, Co, Co, Mn, Hg and Pb increased [5]. While cadmium (Cd), cobalt (Co), antimony (Sb), barium (Ba), mercury (Hg) and lead (Pb) levels were found to increase prior to radiotherapy, the levels remained constant following radiotherapy [5]. In a study conducted with patients with locally advanced lung cancer, head and neck cancers, and cervical cancer who underwent radiotherapy, Se levels were examined before and after radiotherapy. Se levels decreased in response to therapy, and the rise in SA levels was interpreted as an enhanced response [6].

Recently, Zn levels in breast cancer patients were found to be significantly higher than in the control group [7].

However, in another study, no significant difference between Zn levels in breast cancer patients and the control group was observed [8]. In the literature, levels of Fe, Cu, and Zn are considered biomarkers of breast cancer [9]. Cu levels in breast cancer patients were also found to be higher than in the control groups in two separate studies [8, 9]. Cu and Zn levels have been observed to increase in breast cancer patients compared to control groups [10]. The importance of Zn as a carcinogenic agent is still subject to controversy. Zn may influence some cancers in several ways [11]. Deficiencies of trace elements such as Cu and Mg have been implicated in various reproductive disorders including infertility, miscarriage, cancer of the reproductive organs, pregnancy-induced hypertension, placental abruption, premature rupture of membranes, still births and low birth weight [12]. Although little research on the interaction between Co and cancer has been published so far, a few studies which have been published are intriguing. Exposure to Co has been shown to convert human osteoblast-like cells into the tumorigenic phenotype and to activate the expression of genes related to cancer [13, 14]. Cd is a very toxic heavy metal and, unlike organic compounds, it is not biodegradable and has a very long biological half-life [15]. In one study, increased Cd levels were found in the serum of lung cancer patients [16]. Usually, carcinogenic elements can act as epigenetic carcinogens and carcinogenic metals can be genotoxic [17]. In one study, significant differences in the levels of Fe, Cu and Zn, were detected in some types of cancer [18]. Fluctuations in the concentrations of elements such as Zn, Cu, Mg, Pb, Mn, Cd, Co and Fe were also detected at significant levels in the blood of ovarian cancer patients [19]. Significant changes in serum levels of trace elements have been observed in prostate cancer patients [20]. Zn concentrations in ovarian and cervical cancer patients have been reported at lower concentrations with respect to control groups [21, 22]. Zn may be protective against lung cancer. In addition, it was found that low levels of zinc could induce the pathogenesis of lung cancer. Lower levels of zinc might have an important role in the pathogenesis of lung cancer [2]. In one study, levels of Cd and Pb were found to be increased in patients with malignant glioma cancers [23]. In another study, it was also shown that concentrations of Cd and Pb in the serum samples of patients with renal cancer were increased compared to the control group [24]. Serum trace elements were significantly lower in breast cancer patients compared to controls in one study [25]. In another study, Zn, Cu, Se, and Fe concentrations were high in cancer patients. In addition, in the same study, it was shown that the changes in trace element levels in serum and tissue might be of benefit as biomarkers during the initial plastic process [26]. Serum zinc levels were unchanged in patients with early breast cancer and

benign breast disease [27]. Low selenium levels were detected in patients with diseases such as various cancers, muscular dystrophy and heart disease [28]. According to some studies, various trace elements were thought to play a role in carcinogenesis of breast cancer [29, 30]. Fe levels in breast cancer patients have been reported at higher concentrations with respect to control groups [7, 8].

The implementation of proper radiotherapy in the treatment of breast cancer can significantly prolong survival time in patients [31]. In one study, high Cu / Zn ratios following radiotherapy was found to be potentially useful in assessing possible improvements in breast cancer patients [10]. Although there have been some studies on breast cancer carcinogenesis, the role of trace elements has not been fully clarified yet [32]. For women in the United States, breast cancer continues to be one of the most common cancers [33, 34]. In one study, cadmium was found to cause early puberty and possibly increase the risk of breast cancer [35]. In a recent study, cadmium was reported to cause DNA damage in breast cancer patients [36]. Lead levels in breast cancer patients' tissue were significantly higher in both malignant and benign tissue [37]. In a study of 20 breast cancer patients, high nickel levels were found [38]. In another study, chromium levels were found to be significantly higher in breast cancer patients than in the control group [39]. Breast cancer patients were found to have significantly higher iron levels in another study [40].

Result

During radiation therapy for the treatment of breast cancer, damage may occur to tissue, even to tissue which is not located in the treatment area, depending on the treatment techniques applied. Radiotherapy may also cause loss of tissue, and may have negative effects on trace element levels. Consequently, levels of heavy metals and trace elements may be altered during radiotherapy. An increase in heavy metals leads to greater oxidative stress, which is associated with a higher risk of cancer. Normal levels of Zn may also decrease the risk of cancer.

Conclusion

As a result; radiotherapy for breast cancer should be examined, when the treatment of oxidative damage of the lung volume is controlled.

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