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Heavy metals effect on breast cancer progression

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Abstract

Background: Breast cancer is the most frequent localization of malignant process in American women and women of European countries. To date it is not possible to control the morbidity growth due to lack of effective ways of primary prevention. Comparing the incidence of breast cancer in developed countries with the countries of Asia and Africa, there is the fact of population predominance lesion in more urbanized countries. This suggests that the environment along with other factors, occupies a significant place in the initiation and progression of breast neoplasia. The impressive rates of industrial development led to the pollution of soil, surface water and, as a consequence, food by heavy metal salts.

The purposes of this paper are as follows: the chemical composition determination of neoplastic breast tissue, evaluation of the DNA methylation level, study of prognostic-important receptors expression in the breast cancer cells, establishing linkages between all the derived indicators.

Methods: In our study we used the following methods: studying of the chemical composition of breast cancer tissue by atomic absorption spectrophotometry and energy-dispersion spectrometer; immunohistochemical study of ER, PR, HER2/neu, p53, Ki-67, E-cadherin and MGMT receptors; DNA extraction and investigation by oscillating infrared spectroscopy method.

Results: The total amount of heavy metals in breast cancer tissue ranged from 51.21×10^{-3} to 84.86×10^{-3} µg/kg. We have got the following results: the growth of heavy metals in neoplastic tissue is accompanied with the increase of HER2/neu, p53, Ki-67, MGMT expression and decrease of ER and PR expression. The increment of pathological DNA methylation is accompanied with the increasing amount of heavy metals in tumor tissue.

Conclusions: Heavy metals through different pathogenetic links stimulate the progression of breast cancer and reduce its sensitivity to treatment. DNA of tumor tissue has a different level of methylation which changes with the amount of heavy metals in cancer cells. This is displayed on the synthesis of prognostically important receptors in neoplastic tissue.

Keywords: Breast cancer, Heavy metals, DNA methylation, Receptors

Background

Breast cancer (BC) is the most frequent localization of malignant process in American women and women of European countries [1]. In Ukraine, this pathology is found in 16,000 women each year (the incidence is 64.5 per 100,000 women) [2]. Nowadays it isn't possible to control the growth of morbidity due to lack of effective ways of primary prevention. Comparing the incidence of BC in developed countries with the countries of Asia and Africa, unfortunately, there is the fact of predominance lesion of population in more urbanized countries [3]. Thus, this suggests that the environment along with other factors, occupies a significant place in both the initiation and progression of breast neoplasia [4]. The impressive rates of industrial development led to the pollution of soil, surface water and, as a consequence, food by heavy metal salts.

During investigation of the environment in Ukraine it was found that the amount of iron, chromium, copper, nickel, lead and zinc salts in the ground were increased [5].

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