DISTRIBUTION OF TRACE ELEMENTS IN THE MINERALIZED MATRIX OF HUMAN OSTEOSARCOMA TISSUE

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Osteosarcoma is the most common primary bone malignancy, typically occurring during the adolescent growth spurt, but there is a second, smaller peak in the elderly. It is characterized by the production of tumour osteoid and immature bone matrix by malignant cells. With today's combination of chemotherapy and surgery long-term survival rates of more than 70% have been reported. However, very little is still known about the etiology of the tumour. In order to further improve treatment and to develop new treatment strategies it is pivotal to get more insight into the fundamental biology of the disease.

In recent years, dramatic changes in minor and trace elements were found in various different cancer types - e.g. breast cancer, prostatic carcinoma. These metals bind to proteins - so called metalloproteins - that perform different biological and physiological functions. However, very little is known about trace element levels and accumulations in osteosarcoma.

Six bone samples of human osteosarcomas are obtained following surgical resection at the Dept. of Orthopaedics, Medical University of Vienna, Vienna, Austria. Three samples were histologically identified as high-grade (G3) osteoblastic osteosarcomas and three as chondroblastic sarcomas. The samples contained tumour tissue as well as adjacent normal healthy bone tissue as an internal control. The study was approved by the ethics committee at the Medical University. The undecalcified samples were examined by quantitative backscattered electron imaging using a pixel resolution of 1 µm. Grey-level images were generated to differentiate between healthy bone tissue and the mineralized and non-mineralized tumour tissue. Areas of interest were analyzed with Synchrotron Radiation induced confocal micro x-ray fluorescence analysis (SR µ-XRF) to determine the distribution of Ca, Sr, Zn, Fe in tumour tissue and healthy bone. Measurements were performed at the FLUO beamline at ANKA sing a beam size of 15x12 μm^2 and a depth resolution of 20 µm at Au-Lα, with primary excitation energy of 17 keV.

Our measurements revealed significant differences between healthy bone and calcified cancerous tissue. A positive correlation of Fe and Zn and an accumulation of these elements in calcified cancerous tissue could be observed. Furthermore, the Ca content of mineralized malignant tissues was in general higher than in healthy bone. These findings of differential accumulation of trace elements in normal and malignant bone samples may lead to new insights into basic tumour biology of osteosarcomas.