

Increased Zinc accumulation in mineralized osteosarcoma tissue measured by SR- μ XRF analysis

M. Rauwolf⁽¹⁾, B. Pemmer⁽¹⁾, A. Roschger^{(2)†}, A. Turyanskaya⁽¹⁾, S. Smolek⁽¹⁾,
A. Maderitsch⁽¹⁾, P. Hischenhuber⁽¹⁾, C. Weixelbaumer⁽¹⁾, M. Foelser⁽¹⁾, R. Simon⁽³⁾,
S. Lang⁽⁴⁾, S. E. Puchner⁽⁵⁾, R. Windhager⁽⁵⁾, K. Klaushofer⁽²⁾, P. Wobrauschek⁽¹⁾,
P. Roschger⁽²⁾, J.G. Hofstaetter^(6,2), C. Strelti⁽¹⁾

⁽¹⁾ Atominstitut TU Wien, Stadionallee 2, 1020 Vienna, Austria

⁽²⁾ Ludwig Boltzmann Institute of Osteology at the Hanusch Hospital of WGKK and AUVA Trauma Centre Meidling, 1st Med. Dept., Hanusch Hospital, 1140 Vienna, Austria

⁽³⁾ Karlsruhe Institute of Technology (KIT), ANKA synchrotron radiation source, Germany

⁽⁴⁾ Department of Pathology, Vienna General Hospital, Medical University of Vienna, Vienna, Austria

⁽⁵⁾ Department of Orthopaedic Surgery, Vienna General Hospital, Medical University of Vienna, Vienna, Austria

⁽⁶⁾ Orthopaedic Hospital Vienna-Speising, 1130 Vienna, Austria

Abnormal tissue levels of certain trace elements such as Zinc (Zn) were reported in various cancer types. However, very little is known about the role of Zn in osteosarcoma.

Using confocal synchrotron radiation micro X-ray fluorescence analysis (SR- μ XRF), we characterized the spatial distribution of Zn in high-grade sclerosing osteosarcoma tissue of nine patients (4 f/5 m; 7 knee/1 humerus/1 femur) following chemotherapy and wide surgical resection. Zn levels in mineralized osteosarcoma tissue were compared to levels in adjacent normal healthy tissue. Quantitative backscattered electron imaging (qBEI) as well as histological examinations were also performed. This study is a continuation of previous measurements. We have enlarged the number of patients and measured areas, and improved our statistic approach.

We can report the following results: On average, the ratio of medians of Zn count rates (normalized to calcium) in mineralized tumor tissue was about 6 times higher than in normal tissue. There was no difference in Zn levels between tumor fraction areas with a low and a high fraction of mineralized tissue, which were clearly depicted using qBEI. Moreover, we found no correlation between the Zn values and the type of tumor regression according to the Salzer-Kuntschik grading.

The underlying mechanism of Zn accumulation remains unclear. Given the emerging data on the role of trace elements in other types of cancer, our novel results warrant further studies on the role of trace elements in bone cancer.

† Now at Max Planck Institute of Colloids and Interfaces, Department of Biomaterials, Potsdam, Germany