Microstructural analysis of trabecular bone using monochromatized X-ray CT in bone metastasis from prostate cancer
Teruki Sone (5604)\textsuperscript{a}, Tsutomu Tamada (5596)\textsuperscript{b}, Takenori Yamashita (5246)\textsuperscript{b}, Nobunari Macha (5252)\textsuperscript{b} and Hidenao Miyoshi (6092)\textsuperscript{a}

Departments of \textsuperscript{a}Nuclear Medicine and \textsuperscript{b}Radiology, Kawasaki Medical School

Purpose: Prostate cancer frequently metastasizes to bone inducing osteoclastic lesions. However, morphological details of bone metastasis of prostate cancer have not been clarified. The objective of this experiment was to investigate trabecular bone structure and calcification degree of bone metastasis from prostate cancer using Synchrotron Radiation microcomputed tomography (SR-CT).

Methods: Small cubes of lumbar vertebrae were excised post mortem, from the metastatic sites of a 77 years old male with prostate cancer, from the non-metastatic sites of an 84 years male without malignant disease. Three-dimensional imaging was performed by taking two-dimensional radiograph as the specimens were rotated through 180° in 0.5° increments. The energy was set to 20KeV. The radiographs were reconstructed one slice at a time using a standard Fourier-filtered back projection algorithm. Each reconstructed slice was then stacked, providing data for (750) three-dimensional (3D) images with an isometric voxel size of 6 microns. The 3D images were segmented into bone and marrow fractions, and purified using a cluster labeling algorithm. The trabecular bone was then analyzed for mineral density and morphological parameters.

Results: A histogram of the cancellous bone from metastatic specimen is shown in Figure 1. The asymmetry in the peak shape was a result of a partial volume effect caused by a surface elements on trabecular bone. By stripping two layers of voxels off the bone surfaces, the symmetric distribution of the mineral phase was obtained. The reduction of mineral density was shown in the metastatic bone compared as the control (Figure 2). The mineral density, determined after the correction of partial volume effect, was 6.05 ± 0.66 and 7.39 ± 0.37 cm\textsuperscript{-1} for metastatic and non-metastatic bone, respectively. Samples from the metastatic sites showed thinner trabeculae with various thickness (49.8 ± 26.2) compared to non-metastatic controls (64.0 ± 22.3).

Conclusion: The degree of calcification was reduced in osteoblastic metastasis, which would reflect the increased bone turnover and shortened mineralization phase. The SR-CT provides access to the 3D quantitative evaluation of bone mineralization.

---

Evaluation of changes of tumor vessels during and after anticancer drug injection using monochromatized X-ray

T. Yamashita (0005246), \textsuperscript{a}S. Imai (0005251), N. Maehara (0005252)\textsuperscript{b} and K. Umetani (0001460)\textsuperscript{b}

\textsuperscript{a}Department of Diagnostic Radiology, Kawasaki Medical School, \textsuperscript{b}JASRI, SPring-8

Purpose: To evaluate changes in tumor vessels after chemotherapy with cisplatin using moving images of monochromatized X-rays.

Materials and Methods: Japanese white rabbits were used throughout the study. VX2 carcinomas were transplanted into the auricles of 30 rabbits and three days later the rabbits were divided into three groups, each consisting of 10 rabbits; an untreated control group, a group given cisplatin (0.25mg/kg) by intraarterial injection over 5 min. (IA) and a group given cisplatin (1.0mg/kg) by drip infusion over 15min. (DIV).

In all three groups, tumor vessels in the VX2 carcinomas were evaluated microangiologically 5 min., 15 min. and 30 min. after chemotherapy. Microangiographs of VX2 carcinomas were obtained with a synchrotron radiation system. Non-ionic contrast media with 40% iodine was injected into the auricular artery by an automated injector.

Results: In the control group, the number of tumor vessels remained stationary during the experimental time. In the IA group, the number of tumor vessels had decreased after 5 min. and even 30 min. later the vessels were in a state of reduction. In the DIV group, the number of tumor vessels had decreased after 15 min. and even 30 min. later the vessels were in a state of reduction. Changes in vessels of approximately 50 to 200 μm in diameter in the central zone of tumor were observed in both groups. Changes in normal vessels were not seen. Based on the changes in the tumor vessels that were observed, the effect of cisplatin upon the tumor vessels or tumor cells (expect vasospasm associated with cisplatin and contrast media) was considered significant and beneficial. Even 30 min. later the tumor vessels were in the state of reduction and no changes in normal vessels were seen.

Conclusion: The monochromatized x-ray system may be a useful tool for changes in tumor vessels after chemotherapy. Hereafter, we intend to evaluate the changes in tumor vessels after injection of several anticancer drugs.