

Recent Topics of Synchrotron X-ray Imaging for Medical Research in Japan

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Various types of medical research using x-ray imaging with synchrotron radiation (SR) such as angiography, monochromatic x-ray computed tomography (CT), and radiography are being developed in Japan.¹ Here, I introduce recent topics of SR x-ray imaging performed in Japan.

SR coronary arteriography (CAG) is quite an important medical application. By the use of two-dimensionally (2D) spread SR beam and a 2D x-ray detector, the first human intravenous CAG was carried out in four patients at KEK in May, 1996. Significant coronary stenosis was observed in two patients; however, further improvement of the image quality is required for clinical practice. We have also carried out aortographic CAG on seven dogs. On 2D aortographic CAG, stenosis of canine coronary arteries was detected clearly, and coronary arteries less than 0.2 mm in diameter were imaged. In this 2D method, delayed coronary flow was also observed in a coronary artery with 99% stenosis. Image quality of 2D aortographic CAG was quite similar to that of conventional selective CAG because of less contrast dilution and enough sensitivity of the imaging system for such situations. With prospective future application of SR, several studies have been carried out on the synchrotron x-ray CT, phase-contrast x-ray CT, fluorescent x-ray CT, and 3D x-ray CT with a fluorescent x-ray source. Phase-contrast x-ray CT could reveal various structures of human pathological specimens. Following preliminary experiments, a new system to image slightly larger objects (more than 20 mm) is being constructed. By fluorescent x-ray CT, the human thyroid gland and carcinoma could be described, and iodine content was evaluated quantitatively. 3D x-ray CT with a fluorescent x-ray source has clearly demonstrated coronary arterial images of a phantom.

Thus, x-ray imaging technique with SR might be the new powerful tools for biomedical research.

¹Takeda, T., et al.: Medical applications with Synchrotron radiation in Japan. *J. Synchrotron Rad.* 5;326-332, 1998.