Department of Radiology

Kunihiko Fukuda, *Professor*
Junta Harada, *Professor*
Shunichi Sadaoka, *Associate Professor*
Mayuki Uchiyama, *Lecturer*
Norio Nakata, *Lecturer*
Chihiro Kanehira, *Professor*
Toru Sekiya, *Associate Professor*
Yukio Miyamoto, *Associate Professor*
Manabu Aoki, *Lecturer*
Hiroya Ojiri, *Lecturer*

General Summary

The division of diagnostic imaging

1. Diffusion-weighted magnetic resonance imaging in neoplastic lesions

Diffusion-weighted imaging (DWI) is a new magnetic resonance (MR) technique that evaluates the diffusion capacity of water molecules. With recent advances, the usefulness of DWI for detecting neoplastic conditions has been explored. We evaluated the tumors described below to clarify the usefulness and practicality of DWI.

• Detectability of hepatocellular carcinoma (HCC) with DWI in comparison with findings with dynamic computed tomography (CT) and CT portography/CT hepatic arteriography.

• Usefulness in evaluation of primary lesions, nodal metastases, and metastatic liver tumors of colorectal cancers in comparison with surgical specimens.

• Usefulness in evaluation of disease extent of breast cancers in comparison with surgical specimens.

• Usefulness in evaluation of prostate cancer: Setting of optimal b factor for detection of prostate cancer in high-risk groups and the adequate prostate-specific antigen level for performing DWI.

2. Multidetector-row CT as preoperative evaluation for partial hepatectomy

Liver parenchyma/volumetry, vascular structures, and the biliary system should be assessed before partial hepatectomy. To establish imaging strategies for evaluation before partial hepatectomy we obtain imaging data on the arterial and portal phases of the liver with dynamic CT after drip-infusion cholangiography-CT. Both 2-dimensional (D) and 3D displays of the biliary system and vascular structures are provided to surgeons.

3. Evaluation of the lymphatic system of the trunk with heavily T2-weighted images

A study to evaluate the usefulness of nonenhanced 3D heavily T2-weighted images obtained with 2D prospective acquisition and correction in visualization of the lymphatic system of the trunk.

4. Evaluation of the enhancement of the deep venous system in the lower extremities with different total doses and concentrations of iodine in contrast media.

The study to assess the effects on enhancement in the deep veins of the lower extremities of different total iodine doses and concentrations with spiral CT venography.

5. Sonazoid (NC100100; Nycomed Amersham, Oslo, Norway) is a second-generation sonographic contrast agent. We investigated the mechanical index of the ultrasound beam and several postprocessing image-reconstructive methods and evaluated the appli-

cation of software to obtain the most useful images with various types of sonographic equipment, using contrast materials.

6. In collaboration with the Division of Gastroenterology and Hepatology, Department Internal Medicine, we investigated the most useful timing for liver tumor imaging with contrast agents.

7. To obtain images of sentinel lymph nodes using contrast material, we performed harmonic sonographic imaging in pigs after subcutaneous injection of contrast material.

8. To clarify the method for obtaining precise 3D images of superficial soft-tissue tumors with vascular structures, we examined tumors of the breast and thyroid gland using 3D/4D transducers with B-flow imaging and developed the most useful 3D imaging method.

9. In collaboration with The Department of Clinical Examination, Tokyo Rika University, and the Aloka Co. (Tokyo), we developed a microbubble contrast agent containing antibodies to enable molecular imaging and establish a new drug-delivery system.

10. We evaluated the usefulness of several elastic imaging methods to correctly diagnose superficial soft-tissue tumors.

11. Investigation of the physical properties of microcatheters smaller than 2.2-Fr

Various types of medical equipment are used for interventional radiology, and microcatheters are required to reach narrow, distal vessels for such techniques as transcatheter arterial embolization. We reported the physical properties of an advanced microcatheter previously. The physical properties of microcatheters with tip diameters of 1.8-Fr to 2.2-Fr were reviewed. We measured tip hardness, the smoothness of the interior and exterior surfaces, the flow rate, flexibility of the guide wire, the ability to maintain shape, resistance to kinking, visibility, intensity of pulling, and pressure resistance. The apical flexibility of the catheters was good, but flow rate, visibility, and pressure resistance were problematic.

12. The analysis of the lung deposition of inhaled technetium-99m diethylenetriamine pentaacetic acid aerosol

Technetium-99m diethylenetriamine pentaacetic acid (^{99m}Tc-DTPA) radioaerosol scintigraphy can be used to evaluate the transport system of ciliated epithelium in the proximal airways and the permeability of the alveolar capillary membrane. We investigated whether mucociliary clearance affects the evaluation of alveolar capillary membrane clearance. The half-time ($T_{1/2}$) of DTPA clearance was categorized into 6 groups (group 1: clearance from all lung field including the hilar proximal airways; group 2: clearance excluding 5×5 pixels of the hilar proximal airways; group 3: clearance excluding 8×8 pixels; group 4: clearance excluding 11×11 pixels; group 5: clearance excluding 14×14 pixels; and group 6: clearance excluding 17×17 pixels). There was no significant difference in the $T_{1/2}$ of DTPA clearance between the groups ($p=0.481$). The ^{99m}Tc-DTPA clearance from the peripheral alveolar capillary membrane does not affect clearance from the ciliated epithelium transport system of the proximal airways.

13. To evaluate the therapeutic response of cortical bone and bone marrow metastases from neuroblastoma: Comparison with ^{123}I-metaiodobenzlguanidine and ^{99m}Tc-

methylene diphosphonate scintigraphy
In studies of stage IV neuroblastoma, ^{123}I-metaiodobenzlguanidine (^{123}I-MIBG) scanning or MR imaging have shown diffuse or multifocal nodular bone marrow abnormalities. We have speculated that ^{123}I-MIBG-positive lesions without abnormalities on ^{99m}Tc-methylene diphosphonate (^{99m}Tc-MDP) bone scintigraphy represent bone-marrow metastasis and that ^{123}I-MIBG-positive lesions with abnormalities on ^{99m}Tc-MDP bone scintigraphy represent cortical bone metastasis with marrow metastasis. The aim of this study was to evaluate the therapeutic response of cortical bone and bone marrow metastases. There were no lesions in the skeletal system with positive findings on bone scanning that ^{123}I-MIBG imaging failed to detect. Cortical bone metastases showed a good response to induction chemotherapy at least once previously. Diffuse and multifocal bone marrow metastases showed a response behind cortical bone metastases or was refractory to therapy. This outcome suggests that bone metastases from neuroblastoma progress to diffuse and multifocal nodular bone marrow lesions and then advance to dissemination to the cortical bone.

The division of radiation therapy
1. Prognostic factors of T2N0 laryngeal cancer
The purpose of this study was to review treatment results and determine prognostic factors related to local outcomes in 48 patients with T2N0 squamous cell carcinoma treated with definitive radiotherapy. The cumulative probabilities of local-relapse-free survival and larynx-preserving survival were 61.4% and 76.4%, respectively. Multivariate analyses showed that the number of subsites involved and overall treatment time significantly affected the probability of local-relapse-free survival and that age, impaired mobility, and overall treatment time affected the probability of larynx-preserving survival.
2. Standardization of postoperative dosimetry for prostate brachytherapy with I-125
We compared the postoperative variables of 2 patients who had been treated with prostate brachytherapy to review differences between 30 institutions. The difference between institutions in prostate volume was as high as a factor of 2.61. The effect of prostate volume was D90＞V100＞U-D30. Postoperative dosimetry in prostate brachytherapy varied greatly between institutions, suggesting that standardization of postoperative dosimetry is needed.
3. Hematopoietic stem cell transplantation following preparation with total body irradiation, busulfan, and cyclophosphamide for nonlymphocytic leukemia
Seventy-three patients with nonlymphocytic leukemia (30 with acute myeloid leukemia, 29 chronic myeloid leukemia, and 14 with myelodysplastic syndrome) were treated with transplantation during the past 15 years. They underwent hematopoietic stem cell transplantation after a pretransplant conditioning regimen including 10 Gy of total body irradiation, 8 mg/kg of busulfan, and 120 mg/kg of cyclophosphamide. Treatment failed in 16 patients. Ten patients died of leukemia. The 5-year overall survival rate was 56.6% (standard, 71.0%; high, 41.9%). This strategy was especially effective for high-risk leukemia.

Publications

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Hosonuma T, Tozaki M, Ichiba N, Sakuma T, Hayashi D, Yanaga K, Fukuda K. Clinical usefulness of diffusion-weighted imaging using low and high b-values to detect rectal cancer. *Magn Reson Med Sci* 2006; **5:** 173–7.