Department of Radiology

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General Summary

The division of diagnostic imaging

1. Diffusion-weighted magnetic resonance imaging of 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 are now evaluating the tumors described below to clarify the usefulness and applicability of DWI.

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

• Usefulness in evaluation of primary lesions, nodal metastasis, and metastasis to the liver of colorectal cancers in comparison with examination of surgical specimens

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

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

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

Liver parenchyma/volumetry, vascular structures, and the biliary system should be assessed before partial hepatectomy is performed. To establish an imaging strategy before partial hepatectomy we obtain imaging data of the liver in both the arterial and portal phases 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 on heavily T2-weighted images

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

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

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

5. Sonazoid is a second-generation sonographic contrast material. We investigated the MI value of the ultrasound beam, several postprocessing image reconstructive methods, and the application of software to obtain the most useful images with various

types of sonographic equipment, using the contrast material.
6. In a collaborative study with the department of digestive internal medicine, we investigated the timing of liver tumor imaging with contrast materials.
7. To obtain images of sentinel lymph nodes, we performed harmonic sonographic imaging of the pig after subcutaneous injection of contrast material.
8. To clarify the method for obtaining precise 3D images of the vascular structure of superficial soft-tissue tumors, we examined the breast and thyroid tumors using 3D/4D transducer 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., Ltd., we developed microbubble contrast materials with antibodies to perform molecular imaging and establish a new drug delivery system.
10. We evaluated the usefulness of several elastic imaging methods to accurately 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 mlicrocatheter 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. Fatty acid metabolism of the rat heart in renal failure
Cardiovascular disease is the best predictor of mortality in patients with chronic renal disease. The imaging of fatty acid analogues is useful for diagnosing changes in myocardial metabolism due to uremia and dialysis. We investigated the metabolism of iodine-125-labeled 15-(p-iodophenyl)-3-(R,S)-methyl pentadecanoic acid (BMIPP) the hearts of rats with renal failure. The fatty acid metabolism in the hearts of rats with renal failure was decreased. Examination with BMIPP may provide information about the severity and prognosis of cardiovascular events complicated by renal failure.
13. Palliative pain relief treatment with strontium-89 for multiple bone metastases
The osteophilic radiopharmaceutical Sr-89 has been used as a palliative treatment for patients with bone pain caused by bone metastases. Sr-89 is a suitable isotope because it is a pure beta emitter. We obtained Sr-89 images with bremsstrahlung in patients 1 week after injection. Abnormal uptake was seen in all and was consistent with the results of Tc-99m hydroxymethylenediphosphate imaging. Imaging with Sr-89 has not been previously reported. The number of cases of bone metastasis is increasing; therefore, we expect this drug to be useful. We are attempting to determine the effectiveness of Sr-89 and combined therapy with zoledronic acid or other anticancer agents.

The division of radiation therapy
1. Factors affecting treatment outcomes for patients with T2N0 glottis carcinoma

treated with definitive radiotherapy

Purpose: To determine the prognostic factors affecting local outcomes for patients with T2N0 glottis carcinoma treated with definitive radiotherapy.

Methods: The subjects were 48 patients with T2N0 squamous cell carcinoma treated with definitive radiotherapy from 1992 through 2005. The cumulative rates of overall survival, cause-specific survival, local control, and larynx preservation were calculated with the Kaplan-Meier method, and the prognostic significance of patient's age, number of subsites involved, impaired vocal cord mobility, anterior commissure involvement, total dose, and overall treatment time were analyzed with the log-rank test in univariate analysis, and with Cox regression in multivariate analysis. The length of follow-up ranged from 13 to 141 months (median, 62 months).

Results: Five-year survival rates were: overall, 95.3%; and cause-specific, 97.9%; and 5-year rates were local control, 61.4%; and larynx-preservation, 76.4%. Multivariate analyses of the 5 variables showed that overall treatment time significantly influenced the probability of local control and that impaired mobility and overall treatment time affected the probability of larynx preservation.

Conclusion: Our study showed that longer overall treatment time significantly worsenes the rates of local control and larynx preservation for patients with T2N0 glottis carcinoma treated with definitive radiotherapy. Therefore, we advocate a shorter treatment course.

2. Multicenter randomized trial for high dose rate prostate brachytherapy combined with 3D conformal radiotherapy and long-term adjuvant hormonal therapy for high-risk prostate cancer

For the past 2 years we have treated high-risk prostate cancer with such multimodality treatments as high dose rate (HDR) brachytherapy, 3D conformal radiotherapy (CRT), and long-term adjuvant hormonal therapy. In these primarily experiences, we have gradually increased the prescribed doses for both HDR brachytherapy and 3D-CRT to enhance the local control of high-risk prostate cancer. Although systemic therapy is needed for high-risk patients, the optimal duration of the adjuvant hormonal therapy combined with the HDR brachytherapy and external beam treatment remains unclear. Therefore, we have planned a multicenter prospective randomized trial for high-risk prostate cancer to determine the optimal duration of adjuvant hormonal therapy with HDR brachytherapy and 3D-CRT. The duration of adjuvant hormonal therapy will be randomized to two arms as 1 year or 2 years. The prescribed doses to the planning target volume of the prostate are 22 Gy (11 Gy$\times$2 fractions) and 40 Gy (2.5 Gy$\times$16 fractions), respectively.

Publications

Naruo K, Tozaki M, Fukuda Y, Fukuda K. Enhancement of the liver on dynamic MDCT: investigation among three groups consisting of noncirrhotic patients and cirrhotic patients with and without a large portosystemic shunt. *Radiat Med* 2007; **25:** 106–12.

Mogami T, Harada J, Kishimoto K, Sumida S. Percutaneous MR-guided cryoablation for malignancies, with a focus on renal cell carcinoma. *Int J Clin Oncol* 2007; **12:** 79–84.