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Research Activities

Division of diagnostic imaging

1. Computed tomography scoring system as a predictor of metastasis to the neck in patients with head and neck cancer

Nodal metastasis is the most important prognostic factor in patients with head and neck cancers. We proposed a computed tomography (CT) scoring system that comprises the size, shape, extracapsular spread, and focal defects of lymph nodes. Its clinical applicability was assessed by comparison with surgical specimens of neck dissection.

2. CT of eosinophilic chronic rhinosinusitis

Eosinophilic chronic rhinosinusitis is a newly recognized subtype of chronic rhinosinusitis, which is characterized by peripheral blood eosinophilia and massive infiltration of eosinophils in the nasal mucosa. We proposed CT diagnostic criteria for eosinophilic chronic rhinosinusitis and analyzed their clinical usefulness.

3. Morphological and hemodynamic evaluation of the cardiovascular system with dual-source CT

Detailed anatomic features of normal cardiac structures, such the foramen ovale, and hemodynamic information in cases of complex congenital cardiac anomalies have been evaluated with a dual-source CT unit and an ultra-high speed scan technique.

4. Imaging ovarian borderline tumors

The CT and magnetic resonance (MR) findings of ovarian borderline tumors (OBTs) were assessed. The appearance of OBTs differs between histological types. They often mimic malignant tumors, with such CT and MR features as solid portions and wall thickening. Calcifications are often present. Representative histological types of OBTs are serous and mucinous tumors. Serous tumors tend to be smaller than mucinous tumors. They usually have solid portions and show characteristic papillary projections. Mucinous tumors are usually large and multicystic. They often have localized wall thickenings or small solid components or both.

5. Usefulness of contrast-enhanced MR for evaluating the therapeutic effects of biological agents against tumor necrosis factor α for psoriatic arthropathy

MR was performed before and after the start of the treatment, and the presence or absence of enthesitis, synovitis, bone marrow edema, and bone erosion was evaluated in patients with psoriatic arthropathy. In patients with active psoriatic arthropathy, the contrast-enhancement effect was present in enthesitis and the synovitis. These contrast-enhance-

ment effects disappeared where good therapeutic effects were obtained. Contrast-enhanced MR is useful for evaluating therapeutic effects in patients with psoriatic arthropathy.

6. Retro-odontoid soft tissue thickness measured with cervical spine MR

The relationship between retro-odontoid soft-tissue thickness (RSTT) and patients' age and sex and degenerative changes of the cervical spine were analyzed with MR of the cervical spine. Increased RSTT was associated with age, degeneration of the cervical spine, and a history of long-term dialysis. These results suggest that cervical spine degeneration and instability cause retro-odontoid pseudotumor formation.

Division of Ultrasound

1. Clinical usefulness of sonographic contrast examination of breast tumors

The efficacy and safety of ultrasonograpy with contrast enhancement using Sonazoid microbubbles for the diagnosis of breast lesions were analyzed. Ultrasonograpy with contrast enhancement had significantly better diagnostic accuracy and specificity than did noncontrast studies and caused no serious adverse reactions.

2. Power Doppler ultrasonography for evaluating the activity of rheumatoid arthritis

Power Doppler ultrasonography was performed in the bilateral wrists, elbows, shoulders, knees, and ankles of patients with rheumatoid arthritis. The synovial blood flow signals were scored with a 3-grade scale, and the total of the scores in the 10 joints was regarded as the total signal score. The total signal score was strongly correlated with serum levels of vascular endothelial growth factor, angiopoietin 1, and angiopoietin 2.

Division of Nuclear Medicine

1. Usefulness of the fractional uptake method and cerebral blood-flow scintigraphy to determine the quantity of cerebral blood flow in childhood

Quantifying cerebral blood flow with cerebral blood-flow scintigraphy in childhood is difficult. We assessed the usefulness of the fractional uptake method for determining the quantity of cerebral blood flow with a whole-body scan. In patients with low mean blood flow less than 20 ml/100 g/minute, the quantitative value determined with the fractional uptake method was higher than the value determined with autoradiography or the graph-plot method. In other patients, the quantitative values obtained with the fractional uptake method correlated well with values obtained with other methods.

2. Physiological changes in the accumulation in I-123 iomazenil brain single-photon emission CT during childhood

Physiological regional accumulation on I-123 iomazenil brain single-photon emission CT (SPECT) changes markedly during childhood, especially before the age of 3 years. We compared regional accumulation in the brain on anatomically standardized I-123 iomazenil brain SPECT images, which were obtained with the 3-dimensional stereotaxic region of interest template, a fully automated software program for analyzing regions of interest. In neonates, physiological accumulation was low throughout the brain and was lowest is the frontal lobe. As infants aged, accumulation in all regions increased, especially in the occipital lobe and in the cerebellum. The peak of accumulation was in subjects aged 3 to 17 months. The rate of change in physiological accumulation was least in the

frontal lobe.

Division of Interventional Radiology

1. Efficacy and safety of our new technique of ipsilateral percutaneous transhepatic portal vein embolization

Percutaneous transhepatic portal vein embolization was performed to increase the volume of the left hepatic lobe before hepatic resection in 8 patients. With ultrasonic guidance, a balloon catheter was introduced into the right portal vein. A gelatin sponge was injected via the sheath while the right portal vein was occluded with a balloon. Two weeks after the procedure the volume of the left hepatic lobe was assessed with either CT or scintigraphy. The volume of the future liver remnant was increased by 46.5% ± 31.5%. There was no complications or progressive liver insufficiency after embolization or resection.

Division of Radiation Therapy

1. Clinical evaluation of re-irradiation for in-field relapse after definitive radiotherapy in head and neck cancer

Because of various morbidities, cure is difficult to obtain after in-field relapse following definitive radiotherapy for head and neck cancer. In cases of solitary recurrence, re-irradiation can be a curative treatment even if the dose is greater than a tolerable level. We have been reviewing cases treated with re-irradiation and are analyzing the efficacy and late complications of re-irradiation.

2. Effect of drug therapy in the induction of bronchiolitis obliterans organizing pneumonia after breast-conserving therapy

Bronchiolitis obliterans organizing pneumonia (BOOP) is a complication of whole-breast irradiation for breast cancer. The incidence of BOOP after radiotherapy is 1.84%, and the interval between radiotherapy and the appearance of BOOP ranges from 2.5 to 9 months. The incidence of BOOP is greater with a longer duration of endocrine therapy, although the relationship is not statistically significant. We have been analyzing the effects of drug therapies, such as chemotherapy, molecularly targeted therapy, and endocrine therapy, on the induction of BOOP.

3. Clinical evaluation of shorter-fraction radiotherapy following breast-conserving therapy

Whole-breast irradiation after breast-conserving therapy is a standard treatment for breast cancer. However, radiation therapy requires a long period of treatment. Hypofractionated radiotherapy requires only 3.5 weeks and can achieve the same degree of local control and the same severity of acute reaction as can standard radiotherapy. We have been evaluating the efficacy of a short course of whole-breast irradiation after breast-conserving therapy.

4. Randomized clinical trial of triple-modality therapy for clinically localized high-risk prostate cancer

For several years we have been treating high-risk prostate cancer with triple-modality therapy. However, the optimal duration of combination neoadjuvant hormonal therapy (NHT) with adjuvant hormonal therapy (AHT) in the setting of high-dose-rate brachy-

therapy (HDR-BT) and external beam radiotherapy has been controversial. To evaluate the efficacy of AHT, we randomly assigned patients with clinically localized high-risk prostate cancer into 2 arms: Arm 1, NHT + HDR-BT + 3-dimensional conformal radiotherapy (3DCRT), and Arm 2, NHT + HDR-BT + 3DCRT + AHT.

5. Computer simulation of skin erythema caused by radiotherapy

We generated a dynamic model (the generalized linear quadratic model) of fractionated radiotherapy that incorporated the "time factor" to simulate the time-dose-fractionation effect on both cancerous and normal tissues. With this model, skin erythema caused by radiotherapy could be demonstrated on a computer display.

6. Database of patients undergoing radiotherapy

To review the structure of radiation oncology in our hospital, a radiation oncology database has been created, with registration starting in June 2011.

Publications

Ariizumi M, Harada J. Investigation of ice ball fractures using 1.47-mm argon-based cryoneedles. *Teion Igaku.* 2011; **37:** 78-81.

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Kano A, Ujita M, Kobayashi M, Sunakawa Y, Shirahama J, Harada T, Kanehira C, Fukuda K. Radiographic and CT features of radiation-induced organizing pneumonia syndrome after breast-conserving therapy. *Jpn J Radiol.* 2012; **30:** 128-36.

Shimizu T, Ujita M, Numata T, Harada T, Kuwano K, Fukuda K. A case of Mycobacterium avium pleuritis and pneumothorax in a rheumatoid arthritis patient treated with a TNF-α antagonist (in Japanese). *Nihon Kokyuki Gakkai Zasshi.* 2011; **49:** 583-7.