Department of Radiology

Kunihiko Fukuda, *Professor*
Junta Harada, *Professor*
Yukio Miyamoto, *Professor*
Shunichi Sadaoka, *Associate Professor*
Hiroya Ojiri, *Associate Professor*
Norio Nakata, *Associate Professor*
Masao Kobayashi, *Assistant Professor*
Chihiro Kanehira, *Professor*
Toru Sekiya, *Professor*
Hiroshi Sekine, *Professor*
Mayuki Uchiyama, *Associate Professor*
Manabu Aoki, *Associate Professor*
Yoshimitsu Sunagawa, *Assistant Professor*
Takuji Mogami, *Assistant Professor*

Research Activities

Division of diagnostic imaging

1. A computed tomography scoring system as a predictor of neck metastasis 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 consists of 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. The value of specific magnetic resonance features in the evaluation of suspected placental invasion

We evaluated magnetic resonance (MR) imaging findings that may help predict the presence of placenta accreta, placenta increta, or placenta percreta. MR can be a useful adjunct to ultrasound in diagnosing placenta accreta prenatally. Three features that are seen on MR in patients with placental invasion appear to be useful for diagnosis: uterine bulging, abnormal placental flow voids, and the presence of dark intraplacental bands on T2-weighted imaging.

4. Imaging features of primary fallopian tube cancer, with a focus on diffusion-weighted images and contrast-enhancement patterns

We reviewed MR and CT findings of 6 patients with pathologically diagnosed primary fallopian tube cancers. These cancers are small, solid, malignant tumors that are often sausage-shaped and show restricted diffusion, early enhancement, and rim enhancement. Both MR and CT play important roles in the detection and staging of primary fallopian tube cancers.

5. Tomosynthesis to detect fragility fractures of the pelvis

The aim of this study was to evaluate the diagnostic performance of tomosynthesis in visualizing fragility fractures of the pelvic bone, with the use of MR and CT as references, and to determine whether tomosynthesis is more effective than X-rays for detecting these lesions.

6. 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.

7. Imaging ovarian borderline tumors
The CT and 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.

8. 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 synovitis. These contrast-enhancement effects disappeared where good therapeutic effects were obtained. Contrast-enhanced MRI is useful for evaluating therapeutic effects in patients with psoriatic arthropathy.

9. Evaluation of bone marrow signal abnormalities at cruciate ligament enthesis
Bone marrow signal changes of the tibial cruciate ligament enthesis are frequently observed. Tubular lesions were observed in approximately 30%, and cystic lesions in 10%. Tubular lesions may represent vascular structures penetrating from the surface of the cruciate ligament to the tibia. Furthermore, a correlation was observed between cystic lesions and the severity of osteoarthritis. This outcome suggests that mechanical stress to an enthesis causes tubular structures to be modified into cystic lesions.

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 (Daiichi Sankyo Co., Ltd., Tokyo) 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. Physiological change of 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. The aim of this study was to compare 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. A total of 172 patients aged 1 month to 15 years with convulsive disease were examined with iomazenil SPECT in cooperation with Saitama Children's Medical Center; no significant abnormalities were found. We assessed regional accumulation to leverage regional corrected counts/pixel (regional mean counts/pixel/dose administered/patient body surface area) corrected by the time between the measurement of dose and the scan.

In neonates, physiological accumulation was low throughout the brain and was lowest is the frontal lobe, in accordance with cerebral blood flow. As infants aged, accumulation in all regions increased, especially in the occipital lobe and, to a lesser extent, in the cerebellum. The peak iomazenil uptake was in the cerebrum in patients aged 4 to 6 months and in the cerebellum in patients aged 7 to 9 months. The rate of change in physiological accumulation was lowest in the frontal lobe. Decreasing iomazenil uptake in the cerebrum and cerebellum is believed to be related to synapse elimination in the developing cerebrum and cerebellum.

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 study of radiosensitization therapy via topical injection of low-concentration hydrogen peroxide and hyaluronate

Radioresistant tumors are hypoxic and have increased peroxidase activity. Hydrogen peroxide and hyaluronate are injected topically at low concentrations and are then degraded to produce oxygen. Tumor tissue can be re-oxygenated by inactivating peroxidase/catarase. In this way, low-linear energy transfer radioresistant tumors can be transformed into radiosentive tumors. The purpose of this study was to confirm the local enhancement effect of radiotherapy with this method, which was established by Kochi University as Kochi Oxydol-Radiation Therapy for Unresectable Carcinomas (KOR-

TUC).

2. There are various treatment options for prostate cancer. In radiotherapy for prostate cancer, progress has recently been made in ultrahypofractionation. Stereotactic body radiotherapy (SBRT) has attracted considerable attention as a modality allowing the clinical use of ultrahypofractionation. The use of SBRT and intensity-modulated radiotherapy for treating lung cancer has proceeded in our department. We also plan to use SBRT and intensity-modulated radiotherapy to treat prostate cancer.

3. Evaluation of clinical outcomes of current chemoradiotherapy for esophageal cancer refractory to docetaxel, cisplatin, and fluorouracil

The combination of docetaxel, cisplatin, and fluorouracil (DCF) is a candidate regimen for induction chemotherapy for esophageal cancer, due to its high efficacy. Therefore, the treatment of DCF-refractory tumors is extremely difficult. We evaluated the efficacy of locoregional control and overall survival after concurrent chemoradiotherapy with fluorouracil and cisplatin for DCF-refractory esophageal cancer.

Publications

Nakata N, Suzuki N, Hattori A, Hirai N, Miyamoto Y, Fukuda K. Informatics in radiology: Intuitive user interface for 3D image manipulation using augmented reality and a smartphone as a remote control. *Radiographics.* 2012; **32:** E169-74.

Tojo S, Kawakami R, Yonenaga T, Hayashi D, Fukuda K. Factors influencing on retro-odontoid soft-tissue thickness: analysis by magnetic resonance imaging. *Spine (Phila Pa 1976).* 2013; **38:** 401-6.