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UNIVERSITÄT LEIPZIG

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Prof. Chris HJ Terhaard

Professor image guided radiotherapy for head and neck cancer
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Prof.dr. Terhaard received his MD degree from the Radboud University Nijmegen Medical Centre in 1981. He was resident in Internal Medicine (1982-1983) and Radiology (1984) and completed his residency in Radiation Oncology at the University of Utrecht in 1988. He was subsequently appointed as a radiation-oncologist at the Medisch Spectrum Twente (Enschede), and in 1995 he returned as a staff clinician to the University Medical Centre Utrecht. He completed his PhD at the University of Utrecht in 1991.
The subject of his PhD was Radiotherapy for laryngeal cancer: Prognostic factors and treatment results. Terhaard is a radiation oncologist with special interest in Head and Neck oncology associate professor of the ImagO graduate school. He is coordinator of several Dutch Head and Neck Oncology Cooperative Group studies, and involved in several Dutch Cancer Society research grants.
He is actively involved in the education of medical students, and chief-instructor for the residents in training for radiation oncologist in Utrecht. He is member of many boards, founding member of the ESGS (European Salivary Gland Society), and secretary of the board of the Dutch Head and Neck Oncology Cooperative Group.

ABSTRACT

Lecture "The role of MRI in radiotherapy for head and neck cancer"

Intensity modulated radiotherapy (IMRT) makes it possible to treat head and neck cancer more precisely, and to better spare the normal structures at risk, as is demonstrated in many studies. This makes an accurate delineation by the radiation oncologist of the tumor (GTV), an accurate knowledge of the presumed subclinical spread of the tumor, and a valid delineation of the critical structures, a crucial part in the planning of the radiotherapy of the patient. In most institutes only planning CT-scans are used for delineation purposes. However, functional information obtained from FDG-PET and anatomical and functional information of MRI might improve the accuracy of the delineation. MRI has the advantage that the soft tissues are more visible compared to CT. Here, it is crucial that the interpretation of the new images obtained from the MRI scan can be verified with the help of the gold standard: tissue examination. In Utrecht CT, MRI and FDG PET scans are made in the radiation mask. The value of using imaging to determine the GTV can be demonstrated in comparative studies. In Utrecht, for 27 patients who had their larynx removed because of cancer, PET, CT and MRI images had been linked to tissue examination. Before surgery, the scans were made in a radiation mask. After surgery, before and after fixation, a CT scan was made of the specimen. The specimen was sliced and the slices were linked to the images of the CT, MRI and FDG-PET scans. A pathologist has drawn the tumour on the specimen. Two radiation oncologists and a radiologist have drawn on the CT and MRI images. GTV delineation of FDG-PET images was automatically

performed. Results of the study will be shown. Tumor and inflammation reaction are probably easier to distinguish with MRI than with CT. On the basis of the link of the discovered tumour expansion in the specimen to signal intensity differences discovered with MRI, guidelines are drawn up to guide the radiation oncologist when drawing the tumour.
The increased precision of the radiation also requires more precise control of the radiation setting at the time the patient is effectively undergoing radiation treatment. This will become possible in the near future, thanks to the introduction of the MRI accelerator. The combination of a MRI (1.5 Tesla) and the accelerator makes oneline monitoring possible of the tumour, normal structures as salivary glands and swallowing muscles, and motion during radiation treatment. The treatment delivery may be adapted based on these findings, including changes seen by the use of diffusion weighed MRI.
By optimal use of imaging, the margins used with radiotherapy of head and neck tumours can be made smaller. In addition, improvement of radiation technology and putting into service the MRI accelerator will lead to better cures for head and neck tumours, with fewer complications.

Prof. Chrit Moonen

Full professor at the Image Sciences Institute, Division Imaging at the University Medical Center Utrecht (The Netherlands)

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Main field of research

I moved from Bordeaux to the University Medical Center in Utrecht, the Netherlands, in 2011 creating a research group on MRI guided Molecular Interventions as part of the new Center for Image Guided Oncological Interventions. In particular, I am working on MRI guided Focused Ultrasound for cancer ablation, as well as for image guided drug delivery, and collaborate closely with the radiotherapy group on the development of MRI guided Linear Accelerator.

Motivation

The ESMI is playing an important role in shaping the Molecular Imaging community within Europe, and as a major partner of the World Molecular Imaging Society (WMIS). I am looking forward to helping the ESMI continue and expand this role, to further develop as a Society with clear benefits to its members, and to help grow and structure the network of Molecular Imaging. Primary objectives are to further strengthen the foundation of the ESMI as an international society with outstanding scientific meetings and workshops, excellent courses, and increasing participation of young scientists and clinicians at all levels of the Society. Close links with sister societies will be encouraged in the field of training, collaboration with industry, and science. As a member of the ESMI Council since 2009, I recently created with Dr. Twan Lammers the ESMI study group on Image Guided Drug Delivery. I would like to encourage the formation of more Study Groups to further develop the research and (clinical) applications of Molecular Imaging.

ABSTRACT

Lecture “New technologies for non-invasive Tumor treatment”

High Intensity Focused Ultrasound (HIFU)

Ultrasound can be focused within a region with a diameter of about 1 mm. The bio-effects of ultrasound can lead to local tissue heating, cavitation, and radiation force, which can be used for a variety of medical therapies such as tissue ablation, image guided drug delivery, and immune stimulation.

Tissue ablation
HIFU whether guided by ultrasound or MR imaging is a clinically approved technology for treatment of uterine fibroids, bone metastases and prostate cancer. Clinical research is ongoing in many other applications such treatment for essential tremor, breast cancer, liver, kidney and pancreas.

Image guided drug delivery (IGDD)
HIFU can be used in many different ways for IGDD: 1) local drug release from nanocarriers circulating in the blood, 2) increased extravasation of drugs and/or carriers, and 3) enhanced diffusivity of drugs. When using nanocarriers sensitive to mechanical forces or to temperature, their content can be released locally. Thermo-sensitive liposomes have been suggested for local drug release in combination with local hyperthermia more than 30 years ago. Microbubbles may be designed specifically to enhance cavitation effects. Preclinical work over the last 10 years has demonstrated that HIFU and microbubbles can lead to local and temporary opening of the blood-brain-barrier which is the most important impediment for pharmacological treatment of nearly all diseases of the central nervous system. Real-time imaging methods, such as magnetic resonance, optical and ultrasound imaging have led to novel insights and methods for IGDD Image guidance of ultrasound can be used for: 1) target identification and characterization; 2) spatio-temporal guidance of actions to release or activate the drugs and/or permeabilize membranes; 3) evaluation of biodistribution, pharmacokinetics and pharmacodynamics; 4) Physiological read-outs to evaluate the therapeutic efficacy.

Immune system stimulation
HIFU can be used for immune system stimulation in various ways. Its associated mechanical effects can release tumor antigens that can activate dendritic cells. With many drugs under development for immune system stimulation (or inhibition of tumor associated immune suppression), there clearly is a bright future for combinatory approaches, together with HIFU. It has been shown that ultrasound can decrease Alzheimer related plaques in the brains of animal models. This effect has been tentatively attributed to immune system stimulation.