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Very Rare Cancers in Children − From TREP to EXPeRT

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Malignant tumours are relatively uncommon in children, especially when one compares them to adult cancer. The impossibility to perform meaningful studies on the few patients treated in each centre has encouraged Pediatric Oncologists to search for national and international collaboration to perform research and find support. The products of this increasing collaboration are evident in the progressive raise of the survival results obtained in nearly all pediatric tumours.
Unfortunately some children did not benefit from this effort, i.e. those affected by exceptionally rare tumours. Some of these tumours are typical of pediatric age, such as pleuropulmonary blastoma or pancreatoblastoma, and are very rarely encountered in the daily practice even in large hospital. Others are typical of the adulthood, such as thyroid carcinoma, thymic tumours, renal carcinoma, so pediatric oncologists may feel themselves unprepared to confront with them.
These different entities constitute a group of tumours, and more importantly of children, the pediatric oncology community have found little interest to be involved with. This is reflected in the survival results that did not changed substantially over the years and are unsatisfactory for some hystotypes. To overcome this problem national groups specifically focussing on rare cancers in childhood have been founded. The TREP project that was launched in Italy in 2000 represents a successful model of creating a network dedicated to rare tumours. In fact it provides not only a registry for case registration but also guidelines for the different tumours, and a network of experts that can assist clinicians in patient management. Groups with similar aims have been created more recently in other European countries and, in June 2008, a new cooperative group denominated EXPeRT − European Cooperative Study group for Paediatric Rare tumour, has been founded. The main aim of EXPeRT is to empower the research on rare pediatric tumours promoting collaboration between the founder national groups: Italy, France, United Kingdom, Poland and Germany. Data exchange, retrospective and prospective studies, international recognized guidelines, expert consultation and international case registry are the undergoing initiatives. The formation of similar Groups in other countries is expected and supported. This will hopefully improve the quality of research and the treatment results for children that have been until recent years partially neglected.

Scientific Symposium (Sat, 24 Sep, 16:00−18:00)
New Image Guided Cancer Therapies

106 INVITED

Application of MRI for Radiotherapy Dose Painting

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The treatment with radiotherapy has reached unprecedented levels of accuracy due to the introduction of sophisticated delivery techniques and in-room image guidance to ensure precise targeting. High-quality imaging is essential to realize these treatments. To date, CT is the standard imaging modality for target delineation as well as in-room image guidance. However, a growing number of groups have started to explore the use of MRI for radiotherapy because of its superior soft-tissue contrast.
The use of MRI for in-room treatment guidance is currently investigated in several initiatives. The key advantage of an integrated MRI-accelerator is that imaging of the patient is possible concurrent with the irradiation. This allows on-line monitoring of organ motion and may be exploited for high-precision tumour tracking.
With this high level of accuracy in radiation delivery, the definition of the target for irradiation becomes critical. For tumour delineation and characterization both anatomical and functional MRI techniques are used. At a high spatial resolution, these images can be used to identify the boundaries of the target volume. In particular when combinations of imaging techniques are used, the heterogeneity of a tumour can be assessed. Potentially, this information can be used to modulate the dose in the target, depending on the cell density and biological characteristics of the tumour. This approach is called dose painting.
Also during follow-up, the use of MRI can be of importance. By imaging prostate patients with a PSA relapse after treatment, the location of the recurrent tumour can be compared with the location of the primary tumour and the delivered dose. This makes a more detailed evaluation of clinical outcome feasible, and helps strengthen the end points of clinical trials.
In conclusion, the superior soft-tissue contrast of MRI and its versatility in anatomical and functional contrast leads to an increased use during all stages of a radiotherapy treatment: for tumour characterization and delineation, for treatment guidance and for follow up. This will allow us to take the optimal benefit of high-precision delivery techniques.

107 INVITED

Fluorescence Guided Cancer Therapy

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Substances that emit fluorescence after light activation has provided a powerful tool for imaging both at the subcellular level and the tissue level. The use of fluorescing drugs for cancer diagnosis and therapy is an emerging field and has already been used clinically to guide resection of tumours. In this presentation, approaches for fluorescence guided cancer therapies will be presented with the main focus on photosensitizers as the fluorescing substance. Photosensitizers are light-sensitive drugs that absorb light at specific wavelengths leading to a short-lived high energy-state of the drug. The energy is released either as heat or fluorescence or transferred to oxygen resulting in formation of reactive oxygen species of which singlet oxygen is the most common. The emission of fluorescence makes it possible to use these photosensitizers in diagnosis of i.e. bladder cancer (clinically approved in EU) and the fluorescence guided resection of gliomas (clinically approved in EU).
In addition to diagnosis and therapy, certain photosensitizers can also be used to enhance anti-cancer drug delivery; this strategy is called photochemical internalization (PCI). PCI is an efficient and specific drug and gene delivery technology established in our lab for the light-induced endosomal or lysosomal escape of molecules sequestered in these organelles. PCI of different model drugs has been documented in >80 malignant and non-malignant cell lines and >10 different tumour xenograft models. A clinical phase I/II study, PCI of Bleomycin, primarily enrolling patients with head & neck cancer is in progress. Preliminary results are promising, with strong tumour response observed in all patients (n = 19).

108 INVITED

MRI Guided Focused Ultrasound in Brain

Abstract not received

109 INVITED

MRI-Guided Focused Ultrasound Applications in the Body

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The ability of High Intensity Focused Ultrasound (HIFU) to generate precise tissue necrosis deep inside the body, using an external applicator, is unique. The key differentiation to other non-invasive techniques is the fact that the passage of ultrasound energy through intervening tissue has no apparent cumulative effect on that tissue. Especially abdominal structures, but also long bones, are promising targets for HIFU treatments, since the coupling of the applicator to the tissue is easily possible through a gel or water filled pads, and also a clear soft tissue pathway of the Ultrasound beam to the target can be found in most cases. When combined with image guidance, especially by MRI, highest clinical effectiveness and safety are expected, for four reasons. a) Targeting accuracy. Since MRI allows temperature monitoring, fine test sonications allow for an accurate positioning of the beam. b) Ablation efficiency. MRI temperature monitoring enables thermal dose mapping, so that tissue is ablated reliably independent of the tissue properties. c) Safety. MRI monitors temperature not only in the target region, but also at critical structures. d) Motion detection and compensation. MR-guided HIFU is clinically established for the treatment of uterine fibroids, with 7000 patients treated so far. The second approved application is the palliative treatment of bone metastasis, which clinically is still in early phase. There are several other body applications in development, from prostate cancer, breast cancers, liver cancer, kidney cancer to pancreatic cancer. There is even research in head and neck tumours ongoing. This article is going to review the most recent technological developments in MR-guided HIFU for prostate, breast, liver and kidney cancer, as well as remaining technical and clinical challenges.

110 INVITED

Image-Guided Radiation Therapy − From Current Concept to Future Perspectives

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The field of radiation therapy has undergone a remarkable transformation over the past decade through the rapid and broad adoption of on-line image-guidance techniques. Motivated by early work using electronic portal