Conclusions: Both DWI and $^{18}$F-FDG PET/CT are useful tools to identify those patients who are candidates for a wait and see policy or a local excision. We hope to improve the predictive value of functional imaging by integrating them with molecular markers.

Symposium: MR-only workflow in external-beam radiotherapy

SP-0020
Full integration of MRI in the work flow of external-beam radiotherapy

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The use of imaging is a crucial part of radiotherapy (RT), and it is used to localize both tumours and sensitive organs. Imaging is also the input to treatment planning calculations and for patient set-up. Magnetic resonance (MR) imaging provides excellent soft tissue contrast, and it also offers functional information of the tissues. Therefore, a major argument for replacing CT with MR in the RT process is the significantly improved spatial definition of target and risk organ volumes. However, in order to fully integrate MR into the RT workflow, CT-information also needs to be replaced by MR-data for accurate dose calculations and generation of reference images for patient positioning. Accordingly, the MR-only scenario in RT requires a substantial amount of research, development and hard work, before it can be brought into clinical practice.

In Sweden, we have addressed the task by a national network called the “Gentle Radiotherapy” project, which was initiated in 2014. The aims of the project are to facilitate a fully integrated MR in the workflow of RT, and to promote the use of MR in clinical studies. The project is supported by the “Swedish Innovation Agency” (VINNOVA). The members of the consortium are six University Hospitals and six industrial partners. The work is divided into five dedicated work packages (WP): 1) Optimisation of sequences and protocols for RT applications, 2) MR-based treatment planning, 3) Image registration and automatic segmentation, 4) QA of MR-only workflow, and 5) ‘Functional MRI’ and clinical studies. About 50 researchers and clinicians are actively working in the five work packages, but even further scientists are involved. The mixture of clinical practice, academic science and industrial innovation creates a vibrant research environment. Besides the national project meetings, an educational series of web-based seminars on relevant topics of MR in RT is being developed. The expected final outcome of the project is clinical procedures, scientific research as well as new industrial products. The present status of the national Gentle radiotherapy project will be reviewed and a few results will be presented.

In one subproject of Gentle Radiotherapy methods for creating CT equivalent data from MR-images are studied, i.e. synthetic CT images (sCT) for MR-only workflow. The Statistical Decomposition Algorithm (SDA) automatically decomposes and analyzes a standard type MRI image volume with respect to a plurality of tissue types, using a template assisted classification method. In a preliminary study, sCT images generated by the SDA were evaluated by comparing dosimetric accuracy between sCT and conventional CT for a set of six prostate tumor patients. Average mean absorbed dose difference to target was 0.1±0.2% (1 s.d.) between CT and sCT. Even with a restrictive gamma criteria (2% local dose/1mm), the pass rate was exceeding 99.9% in the transversal isocenter plane (superficial points excluded) for all cases. A study including more patients is in progress. This study is a good example of how an industrial partner works closely with academia/clinic in order to develop a new tool.

SP-0021
Generation of density maps for dose calculations from MRI using atlas methods

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Introduction: Several different methods of mapping electron densities to MRI scans for dose calculation purposes have been proposed. These can be broadly grouped into classification based methods or atlas based methods. The classification methods estimate the tissue type from the MRI signal using single or multiple MRI scan sequences and assign an appropriate density. The atlas based methods use deformable image registration techniques to register single or multiple MRI atlas scans to a patient MRI scan and then assign densities. In this work a method that combines multi-atlas deformable registration to the patient MR scan and