Conclusion: The 5-year toxicity profile and cosmetic results are similar at patients treated with BCS followed by either APBI using IBT or conventional WBI with a tumor bed boost. A non-significant trend toward less late skin side effects and better cosmetic results has been observed in the APBI arm.

Award Lecture: K. Breur Award Lecture

SP-0482
Whither fractionation?
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Traditional delivery of radiotherapy uses daily fractions of 1.8-2Gy building up to a therapeutic dose over 6 to 8 weeks of treatment. This reflects application of the fundamental principles of radiotherapy in which repair, repopulation, reoxygenation and redistribution in the cell cycle are considered important in defining the response of tumour and normal tissue. However the relevance of this approach in an era of more precise image guided dose delivery where the exposure of normal tissue is minimised and high individual doses can be delivered must be questioned. There are two scenarios in which single dose radiotherapy has been evaluated and found to be highly effective. The first is in the extensive work which has been undertaken over several decades to establish the role of single dose palliative radiotherapy. The best example of this is in the management of metastatic bone pain where single dose radiotherapy is considered the standard of care but other palliative scenarios in non-small cell lung cancer, oesophageal cancer, rectal, bladder and prostate cancer are also relevant to this approach. The second scenario is that of curative treatment for localised prostate cancer using high dose rate brachytherapy (HDRBT). Dose escalation using HDRBT is well established as an effective therapy in prostate cancer and there is now a substantial database of large published series using HDRBT alone demonstrating high biochemical control rates. It is now feasible to deliver single dose radical radiotherapy using HDR BT with low toxicity and high disease control rates challenging the conventional and modest hypofractionation schedules used with external beam. The relevance of conventional fractionation can now be challenged in the era of modern image guided radiation delivery for both palliative and radical treatment. A sufficiently high dose delivered accurately to the target volume is all that is required.

Joint Symposium: ESTRO-ASTRO: In room adaptive imaging with a focus on MRI

SP-0483
A Linac: physics perspective
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The MRI linac originates from the desire to bring sight to the radiation oncologist. So to offer truly simultaneous soft-tissue visualization during radiation delivery. In UMC Utrecht, in collaboration with Elekta and Philips, a hybrid 1.5 T MRI radiotherapy system has been developed to facilitate this. Later also other systems emerged; in the Cross Cancer Institute in Edmonton a rotating 0.5 T MRI linac has been developed and the Viewray company has launched a 0.3 T Cobalt 60 system into the clinic. The systems will be briefly presented.

The common ground of the systems is the soft-tissue guidance. As will be shown, MRI offers a wealth of contrasts for anatomical and physiological information but also motion data. Exploiting these data for treatment guidance and treatment adaptation requires a new workflow with more online decisions, such as contouring, plan adaptation or full re-planning to initialize the treatment. Moreover, the continuous anatomical imaging during radiation delivery enables new direct anatomical triggers for gating and tracking, but equally important, this imaging can be used for dose reconstruction while accounting for intra-fraction motion. The latter is a valuable input for dose response assessment and can also be used for quality assurance (QA) purposes.

The QA for these systems need to be revisited, not only because of the new on-line plan adaptations but also due to the fact that the dose is delivered in the presence of a (perpendicular or parallel) magnetic field. This will alter the dose distribution which needs to be verified. Also the radiation detectors are potentially affected and their performance need to be validated (and corrected if necessary) for use in the presence of a magnetic field. This implies new machine QA, patient QA and workflow QA procedures.

The promise of hybrid MRI linac technology is to enable real-time plan adaptations in order to maximize the dose to the target while continuously minimizing the dose to the surrounding organs at risk. The efforts to move from pre-treatment planning to once daily (on-line) plan adaptation and ultimately to real-time plan adaptations will be presented.

In conclusion, the technology of hybrid MRI radiotherapy systems is there while the full clinical value needs to be established. This is an exciting new clinical arena and at the same time poses new challenges for on-line and ultimately real-time, adaptive radiotherapy.

SP-0484
First two years clinical experience with low-field MR-IGRT -system practicality and future implications
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Purpose: We report on the first two years of clinical operation of the first magnetic-resonance imaging-guided radiation therapy (MR-IGRT) program, experiences with patient treatments, and implications for future development and clinical work. We previously reported on initial clinical implementation of this system. The purpose of this work is to analyze clinical practicality of MR-IGRT implementation and operation of online adaptive RT.

Methods and Materials: The MR-IGRT system consists of a split 0.35T MR scanner straddling three 1Co heads mounted on a ring gantry, each head equipped with independent doubly-focused multileaf collimators. The MR and RT systems share a common isocenter, enabling simultaneous and continuous MR imaging during RT delivery. The system is also capable of online plan adaptation where patients can be imaged, planned, verified, and treated all in a single treatment session. To assess the clinical practicality of the system, makeup of treated cancer sites, distribution of available treatment techniques, total number of patients, maximum number of patients treated daily, and the utilization of advanced treatment techniques were evaluated. The system was clinically implemented in January of 2014 and data was collected over a 24 month consecutive period. The adaptive feature was clinically implemented in September of 2014.

Results: During the initial 2 years of the operation, more than 20 cancer sites in 263 patients were treated. The maximum number of daily treatments was 18. Top 3 treated cancer sites were breast, lung, and bladder with 22%, 13%, and 9% of the total treatments, respectively. The utilization after WBI: 1.4% after APBI; p=0.04) difference: 2% (95% CI: -3.9 - 0.1%). The rate of excellent/good cosmetic results judged by the patients was 87.2% versus 90.4% (p=0.06) in the WBI and APBI group, and 86.7% versus 88.2% (p=0.07) scored by the physicians.