In radiotherapy of cancer patients, accurate dose delivery is of the utmost importance. Not only to deliver the required dose to the tumor, but also to minimize the dose to the surrounding healthy tissue. Setup verification is therefore an essential part in the radiotherapy chain. Since the late 1950’s to present day, setup verification using in-room imaging, has evolved dramatically. As a result of this the role and responsibilities of the RTT’s in assessing these images and the impact on patients’ treatment has changed accordingly.

Initially, the most commonly used in-room imaging modality was megavoltage films. Only the bony structures could be visualized on these films. The RTT or the physician checked the position of the patient using these films, typically only during the first treatment session. A big step forward occurred in the 1990’s with the introduction of portal imaging as a digital replacement of megavoltage films. The images were directly available and registration was automated. However, anatomical information was still limited and in 2D. The most used treatment techniques (AP/PA, 3vs or 4vs) resulted in large treatment fields and unnecessary irradiation of healthy tissue.

Not only bony structures, but also soft tissue can be visualized more accurately with the introduction of advanced in-room imaging techniques in the beginning of this century, like CT-on rails and Cone-Beam CT. Also advanced treatment techniques like IMRT and VMAT are becoming standard clinical practice. Together with improved in-room imaging target volumes can be reduced and healthy tissue can be spared. An important role for the RTT’s is to verify not only setup but also to ascertain if changes in anatomy during the RT course could result in under dosage of the tumor or over dosage of the organs at risk, resulting in an adaptation of the treatment plan. Moreover, the creation of a library of plans and daily selection of the optimal plan based on anatomical information is currently being evaluated.

In the last decade, the role of MR in radiotherapy has become increasingly important. The excellent soft tissue contrast of MR not only allows accurate tumor delineation, but also functional information of the tissue becomes available. As tumor delineation becomes more accurate, target volumes can be more accurately defined.

The development towards the integration of an MR and a treatment machine considerably improves the soft-tissue contrast and even functional information is available for image guidance. This improved image quality has the potential to enable daily re-planning in clinical practice. MR guidance entails an important change for the RTT’s, not only in image evaluation but also in decision making concerning the treatment. Changes in tumor position or tumor behavior are available during treatment and personalized intervention/adaptation of the plan becomes possible.

Conclusion: In-room image guidance is continuously evolving from setup verification on low contrast 2D megavoltage films with standardized treatment fields, towards MR guidance and adaptation, minimizing target volumes and optimizing treatment for the individual patient.

SP-0028
Adaptive procedures in lung
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Survival rates for lung cancer patients treated with radiotherapy (RT) are poor partly due to the high rates of local recurrence. It has been shown that the local control rate may be improved for non-small cell lung cancer patients by increasing the RT dose. However, this requires high precision in the daily RT delivery, in order to minimize margins and avoid unacceptable normal tissue toxicity.

Large treatment margins have been used for lung tumours to account for respiratory motion and interfractional changes in the position of the primary tumour and the lymph nodes. The respiratory motion may be taken into account by use of time resolved 4D CT scans, whereby the respiratory motion of the individual patient is visualized. Implementation of gated treatment may lead to a larger margin reduction. The use of FDG-PET for target identification and delineation has increased the accuracy due to its high sensitivity and specificity.

The anatomy of the patient may change during the treatment course which leads to interfrational shifts in the position of the tumour and the lymph nodes. The most commonly used setup is based on the bony anatomy of the patient. However, a soft tissue match using the tumour reduces the treatment margins significantly. Minimal margins require daily online tumour match using for instance CBCT scans before each treatment fraction. In the majority of the patients, one or more of the lymph nodes are found to be malignant which complicates the soft tissue match as the nodes and the primary tumour may be subject to different interfrational shifts and thus, setup on both targets will not be perfect. It was found that setup on the primary tumour lead to underdosage of the lymph nodes in 10% of the patients[1]. In order to account for this, a threshold value for the interfrational shift may be used to select patients with systematic deviations above the threshold for re-scanning and re-planning, i.e. adaptive radiotherapy (ART).

ART is a radiation treatment process where the treatment plan can be modified using systematic feedback of measurements [2]. In case of anatomical changes this implies re-scanning and re-optimization of the treatment plan. Tumour shrinkage and irreproducible fixation may lead to systematic interfrational shift of the tumour and the lymph nodes. Large anatomical changes are observed in 23 % of the patients[3]. These changes include appearance / disappearance of an atelectasis, pleural effusion or pneumonia/pneumonitis. These changes may lead to geometrical changes of the targets and/or to dosimetrical changes due to changes in the density of the tissue (see Fig 1). In both cases underdosage of the tumour/lymph nodes or overdosage of the normal tissue may result. It has been shown that anatomical changes have a larger impact on the dose distribution than changes in the respiratory motion or interfractical shifts[4]. Therefore, most patients experiencing anatomical changes may benefit from ART[3,5,6].

In addition, tumour shrinkage during the RT course, enables dose escalation to the primary tumour with without increasing the normal tissue toxicity[7]. The implementation of ART requires education of the radiation therapists. In our clinic, a programme with e-learning, hands on training and an individual test was setup before clinical start. Furthermore, ART requires a well-defined workflow for re-scanning and re-planning of quite a lot of patients. And finally, daily online soft tissue matching followed by evaluation of the tumour and lymph nodes will prolong the treatment time compared to a bony anatomy match. In our clinic the treatment time was prolonged by 3 minutes.
It is also increasingly understood that the “consequential effect” has a critical role in the development of chronic toxicity and that it is driven by factors beyond the control of the oncologist. One of the most important of these is the composition of the gut microbiota; another is the role of the immune system. Introducing techniques already used by other disciplines to manipulate these factors will deliver future great rewards in terms of reducing chronic toxicity. GI toxicity is a major limiting factor to the advance of oncological treatments. Many new solutions have emerged but require the harnessing of a multidisciplinary approach in a way that oncology has rarely used up to this point.

SP-0030
Having guts: saving the organ
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Intestinal radiation injury may severely hamper quality of life during and after treatment of abdominal tumors. Even though novel technical advances in treatment delivery have enabled more selective irradiation of the tumor, normal tissue radiation injury remains the most important dose limiting factor of radiotherapy. Hence, there is an urgent need for agents that can be administered during radiotherapy to prevent and/or reduce radiation-induced intestinal injury. These agents should of course not hamper the anti-tumor effect of radiation and, ideally, even improve radiation-induced tumor cell kill.

Preclinical studies have shown that the novel Somatostatin analogue Pasireotide effectively reduces radiation-induced intestinal injury by preventing post-irradiation pancreatic enzyme-dependent intestinal auto-digestion. In our experiments Pasireotide was shown to preserve the intestinal mucosal surface and to prevent intestinal bacterial translocation after radiation exposure. Pasireotide did not protect the intestinal stem cells and the beneficial effect of Pasireotide could be reversed by pancreatic enzyme substitution. Therefore, Pasireotide does not seem to act as a cytoprotector, but to mitigate intestinal radiation injury by inhibiting pancreatic exocrine secretion.

Until recent, knowledge on the effects of Pasireotide on the radiation-induced tumor response was scarce or non-existing at all. Pre-clinical studies have shown that Pasireotide may have a direct inhibiting effect on the growth of certain tumors such as neuroendocrine cancers. Moreover, it may reduce tumor growth by reducing the availability of growth factors such as IGF-1 and VEGF. However, no studies have been performed to assess the effect of Pasireotide on radiation-induced tumor growth delay. As Pasireotide can only be considered for clinical use if it does not hamper the anti-tumor effect of radiotherapy, we tested the effect of Pasireotide on tumor response to radiation in an animal model. The results of this recently performed study may enable a trial to test the potential beneficial effect on intestinal radiation injury in patients.

SP-0031
Radiation induced proctopathy: lessons learned from prospective clinical trials
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The increasing number of dose escalation and hypofractionation prostate cancer trials is providing us excellent opportunities to learn more about ano-rectal,