PO-0861
Whole lung irradiation using VMAT - dosimetric and NTCP benefits vs. second cancer risks
P. Clarke1, S. Padmanaban1, M. Partridge2, T. Foord3, D. Cutter1
1Oxford Cancer Center, Radiotherapy Physics, Oxford, United Kingdom
2CRUK/MRC Oxford Institute for Radiation Oncology, Gray Laboratories- University of Oxford, Oxford, United Kingdom
3Oxford Cancer Center, Clinical Oncology, Oxford, United Kingdom

Purpose or Objective: Whole lung irradiation (WLI) of 12 to 18 Gy is used as treatment for lung metastases in patients with Ewing sarcoma and Wilms tumour. This results in irradiation of normal tissues including heart and breast. Conventionally this treatment has been delivered with standard AP-PA fields. To minimise cardiac radiation dose and reduce the risk of subsequent late complications, we validated the use of VMAT to deliver WLI without increasing the predicted risks of secondary breast cancers compared to AP-PA fields.

Material and Methods: Five female patient datasets (ages ranging from 3 to 18 years) were used for this retrospective study. The planning target volume (PTV) included total lung volume with a 1 cm margin (and adjacent vertebral for three patients). Organs at risks included were heart, breast bud/tissue, liver and thyroid. 6 MV AP-PA (with segments) and RapidArc (2 or 3 full arcs) plans were created using the Eclipse treatment planning system (Version 11). Plans were calculated using the anisotropic analytical algorithm (AAA). The prescribed dose was either 15 Gy in 10 fractions or 18 Gy in 12 fractions based on the patient’s age. PTV D2%, D98% and D50% and mean and maximum doses for heart and breast were obtained. The absolute excess risk (AER) of cardiac mortality at 15 years post treatment was calculated for each plan based on an age-at-exposure adjusted relative risk per Gy obtained from published data (1,2,3,4) combined with contemporary UK population-based absolute risks. The risk of breast cancer induction was calculated using the model proposed by Schneider et al. (2011) (5).

Results: The VMAT plans resulted in a similar minimum PTV coverage when compared to the AP-PA plans whilst reducing the PTV D2% by an average of 6.1% (4.1 - 9.1). The use of VMAT reduced the heart and breast mean dose by an average of 19.1% (11.7 - 30.5) and 16.2% (-2.2 - 30.4) respectively when compared to the AP-PA plans. The difference in AER of cardiac mortality at 15 years was lower for the VMAT plans by 2.9% (-0.8 – 6.8) when compared to the absolute risk (EAR) for breast cancer induction across all coverage when compared to the AP-PA plans. The VMAT plans resulted in a similar minimum PTV coverage when compared to the AP-PA plans whilst reducing the PTV D2% by an average of 6.1% (4.1 - 9.1). The use of VMAT reduced the heart and breast mean dose by an average of 19.1% (11.7 - 30.5) and 16.2% (-2.2 - 30.4) respectively when compared to the AP-PA plans. The difference in AER of cardiac mortality at 15 years was lower for the VMAT plans by 2.9% (-0.8 – 6.8) when compared to the absolute risk (EAR) for breast cancer induction across all coverage when compared to the AP-PA plans. The use of VMAT reduced the heart and breast mean dose by an average of 19.1% (11.7 - 30.5) and 16.2% (-2.2 - 30.4) respectively when compared to the AP-PA plans. The difference in AER of cardiac mortality at 15 years was lower for the VMAT plans by 2.9% (-0.8 – 6.8) when compared to the absolute risk (EAR) for breast cancer induction across all coverage when compared to the AP-PA plans.

Conclusion: With the use of the novel techniques such as p-CSi and BM-HT quality of life impairing acute side effects such as cytopenias and dysphagia can be reduced. We propose WBME to better assess the impact on active bone marrow.

References
all rectum applicators. Simulations in patients 3DCT scan allowed us to evaluate CRT dose to organs at risk and to the target volume. The comparison of dosimetric indices of EBRT and CRT treatment delivery for the high risk target volume showed that the CRT technique delivers higher dose to the target volume for the same dose, or even less for some cases, to the organs at risk.

Conclusion: Monte-Carlo simulations are useful to compute accurate dose distributions in 3DCT patient data for the CRT treatment delivery. Moreover, this comparative study between the EBRT and CRT techniques confirms the role of CRT in curative treatment with organ preservation for early rectal cancers.

Bibliography:

PO-0863
Localizing the benefit of a hydrogel rectum spacer for prostate IMRT within the ano-rectal wall
B.G.L. Vanneste1, F. Buettner2, M. Pinkawa3, P. Lambin1, A.L. Hoffmann4
1MAASTRO clinic, Radiation Oncology, Maastricht, The Netherlands
2European Bioinformatics Institute, European Molecular Biology Laboratory, Hinxton- Cambridge, United Kingdom
3Radiation Oncology, RWTH Aachen University, Aachen, Germany
4University Hospital Carl Gustav Carus at the Technische Universität Dresden, Radiotherapy, Dresden, Germany

Purpose or Objective: In previous studies the dosimetric impact of an implanted rectum spacer (IRS) in prostate cancer patients undergoing intensity-modulated radiation therapy (IMRT) has been assessed by dose-volume histograms (DVHs) and dose-surface histograms (DSHs) obtained from 3D dose distributions of the ano-rectal wall (ARW). Unfortunately, spatial information is lost when analyzing DVHs or DSHs. This hampers to study the correlation between the shape and location of the ARW dose distribution and clinical outcome. Dose-surface maps (DSMs) have been suggested as a valuable tool for taking the spatial-dosimetric information into account. The purpose of this study is to assess spatio-dosimetric differences in DSMs obtained from planned ARW dose distributions in patients receiving IMRT with and without IRS (IMRT+IRS; IMRT-IRS, respectively).

Material and Methods: In 26 patients with localized prostate cancer a hydrogel rectum spacer (SpaceOAR®, Augmenix) was injected under transrectal ultrasound guidance in Denovilliers’ space between the prostate and the rectal wall. Per patient, two IMRT treatment plans (78 Gy in 39 fractions) were designed, based on CT scans acquired before and after hydrogel injection. DMSs of the ARW were generated from the planned 3D dose distributions by virtual unfolding the rectum contour as described in Buettner et al. (Fig. 1a-b).

Various shape-based dose measures were extracted from the DSMs. First, dose clusters were generated by thresholding the DSMs at 38 dose levels ranging from 5-79 Gy. Then, for each dose level an ellipse was fitted to the largest dose cluster. Lateral (posterior-anterior-posterior) and longitudinal (superior-inferior) extents were quantified by projecting the major and minor axes of this ellipse to the main axes of the DSMs. The non-circularity of the dose clusters was described by the eccentricity of the ellipse. The contiguity of the ARW dose distribution was assessed by the contiguous-DSH (cDSH), reflecting the single largest contiguous ARW area fraction as function of the dose threshold at the given level. Statistical differences were assessed with a one-sided paired Wilcoxon signed rank test.

Results: Lateral extent, longitudinal extent as well as cDSH were significantly lower in IMRT+IRS than for IMRT-IRS at high-dose levels. Largest significant differences were observed for cDSH at dose levels >50Gy, followed by lateral extent at doses >57Gy, and longitudinal extent. For these three features, no significant differences were observed for low to medium dose levels. For eccentricity no significant differences were found, independent of the dose level.

Conclusion: Significant spatio-dosimetric differences in ARW DSMs exist between prostate cancer patients undergoing IMRT with and without IRS. The IRS particularly reduces the lateral and longitudinal extent of high-dose areas (>50 Gy) in anterior and superior-inferior directions.

PO-0864
A planning study investigating different planning techniques for SBRT of NSCLC
C. Moustakis1, I. Ernst1, F. Ebrahimi Tazeh Mahalleh1, U. Haverkamp2, H.T. Eich1, M. Guckenberger3
1University Muenster, Radiation Oncology, Münster, Germany
2University Zurich, Radiation Oncology, Zürich, Switzerland

Purpose or Objective: SBRT is a novel treatment procedure, which is used for the particular localization of the tumor to deliver targeted high doses with greatly precise fields. Different irradiation techniques provide a wide spectrum of therapy options. The aim of this work was to evaluate the clinical benefits and potential dosimetric of different planning methods against each other for the treatment of NSCLC.

Material and Methods: In this study, three diagnosed patients with NSCLC metastasis, were chosen. One had a peripheral metastasis in the left lung, the other had a metastasis in the right lung, and the last one had a central metastasis located near to vertebral body. The delineated structures (PTV and OARs) on CT were shared among 22 clinics with the request to generate an irradiation plan with their own internal criteria. Three fractions of 15 Gy were prescribed to the PTV-enclosing 65%. All together it was...