actual indication for protons thus heavily rests on individual clinical and patient dependent a priori risk factors.

Table 1.

Dosimetric parameters for lung and heart for the different techniques and corresponding NTCP for symptomatic radiation pneumonitis (values in Gy or %).

	H-VMAT	L-VMAT (reference)	H-IMPT	L-IMPT
MeanLungDose	18.3±2.6	14.3±1.9	8.9±2.1	8.0±2.3
V20 Lung	34.7±4.2	25.0±2.7	17.0±4.0	14.8±4.4
MeanHeartDose	9.9±3.1	15.9±2.9	3.2±1.1	4.9±1.1
V30 Heart	10.1±5.9	19.1±2.9	4.3±2.0	7.1±2.1
Risk of radiation pneumonitis				
QUANTEC_dose only	17.7±4.5	11.4±2.4	6.2±1.7	5.6±1.6
QUANTEC_low clinical risk[1]	10.1±1.4	6.0±1.5	3.0±0.9	2.6±0.9
QUANTEC_high clinical risk[1]	54.8±6.1	41.2±6.2	25.3±5.7	23.0±5.8

Figure 1.
Estimated NTCP value reductions (arrows) for symptomatic radiation pneumonitis for low (red line) and high (green line) a priori risk patients and patients irrespective of a priori risk factors (blue lines). Marked are the estimated risk reductions of symptomatic radiation pneumonitis for lung-sparing IMPT (grey lines) versus lung-sparing VMAT (black lines).
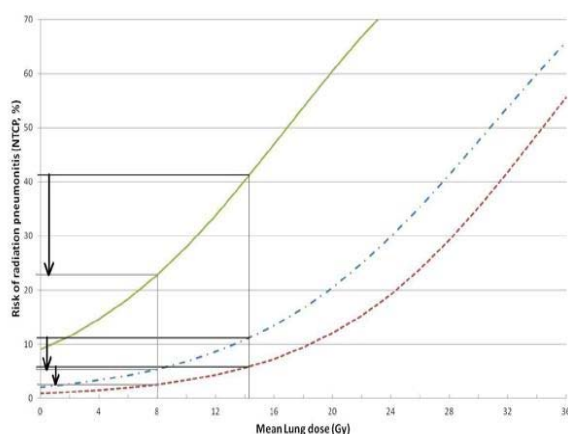
Conclusion: These results demonstrate that the potential of proton therapy to reduce the risk of radiation pneumonitis requires considerable reduction in lung dose, but translation into clinical significance is heavily driven by patient and clinical a priori risk factors. Therefore, multivariable NTCP models should play a major role in identifying patients eligible for proton therapy.
1 Appelt, Vogelius, Farr, Khalik, Bentzen. Towards individualized dose constraints: adjusting the QUANTEC radiation pneumonitis model for clinical risk factors. Acta Oncologica 2014;53:605.

PV-0173
Dosimetric assessment of three-source Co-60 and Linac-based lung SBRT for feasibility of MR-IGRT
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Purpose or Objective: The purpose of this study is to provide a dosimetric assessment for the feasibility of delivering lung SBRT using an integrated three-source Co60 and Magnetic Resonance Imaging (MRI) Guided Radiation Therapy (MR-IGRT) System.

Material and Methods: Ten lung patients who were previously treated with Linac-based SBRT were included. For each patient, GTV, PTV, cord, lungs, heart, esophagus, and ribs were delineated. All Linac-based SBRT plans were generated using VMAT and consist of 2-10 6MV Rapid Arcs. Patients received prescription doses of 48 Gy/4fx to 50 Gy/5fx. The Linac-based plans were imported into the View Ray MR-IGRT system for planning. Three-source Co60 plans were generated using step-and-shoot IMRT and utilized Monte Carlo dose calculation including the magnetic field correction of 0.35T. The PTV coverage for both Linac-based three-source Co60 SBRT plans were such that 95% of the PTV received 100% the prescription dose. Finally, Linac- and three source Co60 – based plans were evaluated using dose-volume constraints for critical structures and target conformity index (CI), homogeneity index (HI) for the PTV.

Results: The differences between PTV HI for Linac- and three-source Co60 -based SBRT plans were not statistically significant, ranging from 1.05 to 1.15. Three patients with the CIs >1.2 had target volumes <20cc although the location of the target did not have much influence on meeting the criteria for the target conformity. For all patients, the critical structure doses, such as maximum cord dose (<26 Gy), dose to <15 cc of the heart (28Gy<15cc), and <5cc of the esophagus (18.8 Gy<5cc) were satisfactory with both techniques. For lung, although both the dose to <1500cc (11.6 Gy<1500cc) and <1000cc (13.6Gy<1000cc) criteria were met with both techniques, on average, the lung volumes receiving the 11.6Gy and 13.6Gy were 59.5% and 61.28% higher with three-source Co60 as compared the Linac-based SBRT plans respectively (P<0.05). As expected, low dose portion of the DVH for all critical structures generally covered much higher percentage of the critical structure volumes with three-source Co60 SBRT plans as compared to the Linac-based SBRT plans.
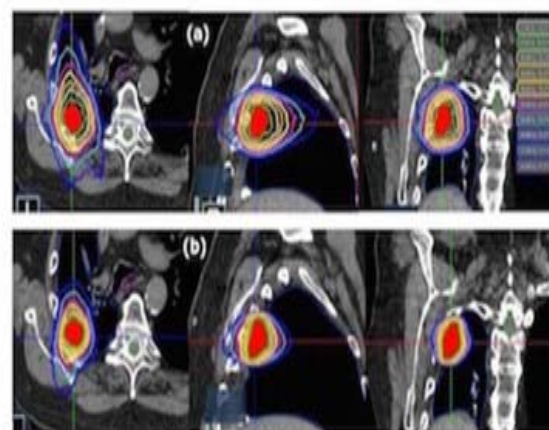

Figure 1: Dose distributions in axial, sagittal and coronal slices obtained with (a) three-source Co[III] MR-IGRT system (View Ray, Inc.) and (b) 3 Rapid Arcs (Varian Eclipse) for one of the lung SBRT cases included in this study (Prescription Dose: 50 Gy/5 fx, green isodose line).

Conclusion: Overall, a three-source Co60 integrated MR-IGRT system produced comparable dose distributions to the ones obtained with the Linac-based lung SBRT. Further studies are needed to evaluate benefits of this novel MR-IGRT system for lung SBRT, especially its ability to image and plan in real time and online adaptive treatment delivery.

PV-0174
Experimental verification of 4D Monte Carlo calculations of dose delivered to a moving anatomy
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Purpose or Objective: To experimentally validate a 4D Monte Carlo (MC) simulation method to calculate the dose