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Does Lung Function Imaging Modality Have a Dosimetric Impact On Functional Avoidance Treatment Planning: Assessment Using Prospective Clinical Trial Data

J Belardo

S Zhang

E Castillo

R Castillo

C Rusthoven

See next page for additional authors

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Authors
J Belardo, S Zhang, E Castillo, R Castillo, C Rusthoven, B Jones, M Miften, T Guerrero, I Grills, and Y Chen

benchmark the ability of proton density fat fraction (PDFF) MRI and non-calcium multi-energy CT (MECT) to delineate ABM for individual subjects relative to the gold standard of [^{18}F]FLT-PET imaging. **Methods:** PDFF MRI, non-calcium MECT, and [^{18}F]FLT-PET images were obtained for three Wisconsin Miniature Swine™ subjects. For each subject, a BM contour was created on the CT image and propagated to the MR and PET images. ABM was defined in the PET image as pixels within the BM contour with SUV(bw) above the mean. Prospective ABM contours were created on the MECT image through a lower HU value threshold, above which the marrow is considered active. Prospective ABM contours were defined on the MRI through an upper fat fraction threshold below which the marrow is considered active. These volumes were compared to the PET-determined ABM volume by calculating the DICE coefficient between the MECT and MRI ABM contours and PET ABM contour**. Results:** For the three swine subjects in the PDFF MRIs, maximum DICE coefficients of 0.744, 0.777, and 0.732 occurred at maximum fat fraction values of 50, 55, and 65, respectively. For these same subjects in the MECT images, maximum DICE coefficients of 0.654, 0.63, and 0.654 occurred at minimum HU values of 20, 10, and -10, respectively**. Conclusion:** Image value thresholds were determined for PDFF MRI and non-calcium MECT to maximize similarity between ABM contours as compared to FLT-PET. Both PDFF MRI and MECT show promise in identifying ABM distribution for individual subjects without the need for PET scans.

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WE-C1000-IePD-F6-02, Does Lung Function Imaging Modality Have a Dosimetric Impact On Functional Avoidance Treatment Planning: Assessment Using Prospective Clinical Trial Data: J Belardo[1]*, S Zhang[2], E Castillo[3], R Castillo[4], C Rusthoven[5], B Jones[6], M Mifften[6], T Guerrero[7], I Grills[7], Y Chen[1], F Forghani[8], P Sullivan[2], Y Vinogradskiy[1]</sup>,(1) Thomas Jefferson University Sidney Kimmel Cancer Center, Philadelphia, PA, (2) Abington Memorial Hospital, Abington, PA, (3) University of Texas at Austin, Austin, TX, (4) Emory University, Atlanta, GA, (5) University Of Colorado Anschutz Medical Campus, CO, (6) University of Colorado School of Medicine, Aurora, CO, (7) Beaumont Health System, Royal Oak, MI, (8) Washington University, Creve Coeur, MO

Purpose: Functional avoidance radiotherapy proposes to use functional imaging to design treatment plans that reduce doses to functional regions of lung. Prospective data has shown that reducing doses to functional lung results in reduced pulmonary toxicity. Various lung function imaging modalities have been proposed for functional avoidance; however, there have been no studies evaluating whether using different imaging modalities results in dosimetrically different functional avoidance plans. The purpose of this study was to quantify the differences in treatment plans as a function of lung function imaging modality**. Methods:** 25 lung cancer patients enrolled on a prospective trial underwent nuclear medicine SPECT ventilation/perfusion scans prior to radiotherapy. A functional perfusion ('FuncPerf') and ventilation ('FuncVent') contour was generated by selecting ≥75% perfusion/ventilation values. The similarity between the FuncVent and FuncPerf contours was calculated using DICE coefficients. 2 plans were generated for each patient: a FuncVent-based and FuncPerf-based functional avoidance plan. The differences in mean dose and V20Gy to the FuncVent/FuncPerf structure between the functional avoidance plans based on ventilation/perfusion were calculated (presented as mean [range]). **Results:** The DICE correlation between FuncVent/FuncPerf contours was 0.51 (0.21-0.76). The difference in mean dose and V20Gy to the FuncVent structure between the ventilation/perfusion functional avoidance plans were 0.2 Gy (-0.9-3.4 Gy) and 0.82% (-2.5%-12.4%), respectfully. The differences in mean dose and V20Gy to the FuncPerf structure were 0.6 Gy (-0.3-2.4 Gy) and 1.6% (-0.5%-7.7%), respectfully. There was weak correlation between ventilation/perfusion DICE scores and differences in FuncVent/FuncPerf dose differences (all correlations <0.16)**. Conclusion:** Our data showed that on average, selecting ventilation or perfusion for functional avoidance resulted in similar dosimetric distributions; however, for individual patients the differences could be significant. Our study uses prospective trial data to offer seminal guidance by underscoring the need to individually consider ventilation and perfusion for functional avoidance radiotherapy.

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WE-C1000-IePD-F6-03, Investigating the Feasibility of CT Ventilation Imaging On Fast, Low-Dose 4DCBCT to Enable Daily Adaptive Lung Function Sparing: H Byrne[1]*, O Dillon[1], S Blake[1], J Kipritidis[2], R O'Brien[1], P Keall[1],(1) ACRF Image X Institute, The University of Sydney, Sydney, AU (2) Northern Sydney Cancer Centre, Royal North Shore, Sydney, AU

Purpose: CT ventilation imaging (CTVI) creates a 3D map of lung ventilation from 4DCT images. CTVI enables functional lung sparing during planning leading to lower treatment toxicity. Applying CTVI to 4DCBCT could enable daily adaptive lung function sparing. Advances in 4DCBCT include faster acquisition with lower dose. This lower dose results in lower 4DCBCT image quality, that affects the CTVI quality. Therefore, the purpose of this work is to investigate the feasibility of CTVI on low-dose 4DCBCT to enable daily adaptive lung function sparing**. Methods:** In the ADAPT clinical trial (NCT04070586), 4DCT scans and fast (1-minute) low-dose (200-projection) 4DCBCT scans were acquired per patient for two treatment fractions. For five patients selected from the trial, CTVI was generated from the

