Poster Viewing Abstract 3389; Table Chest wall dosimetric data

	PTV (cc)	V10 (cc)	V20 (cc)	V30 (cc)	V40 (cc)	V50 (cc)	V60 (cc)	dmax (Gy)
Average CW: UNC experience	54.9	255	78	32	19	11	5	65.4
Average ribs: UNC experience	54.9	19	12	6	3	1	0	57
CW: 1) Typical linac-based gated SBRT plan	26	244	47	13	5	0	0	49.3
CW: 2) Static RR plan, with ITV	26	99	28	10	4	1	0	50.7
CW: 3) Typical static RR plan (no ITV)	18	68	13	2.8	0.3	0	0	47.2
CW: 4) Same RR plan as 3, but accounting for motion	18	67	12	2.4	0.1	0	0	44.5

expansion, 2) a RR plan using the same target volume as the linac-based SBRT plan, to examine for any effect related to pencil-beam conformity, 3) a typical RR plan (no ITV, and PTV expansion around GTV: 8 mm sup/inf and 5 mm radial), and 4) the same RR plan as 3, but translating the dose cloud to 10 equidistant points along the vector of tumor movement, to estimate the effect of linear motion on dose to the CW.

Results: For our cohort with CW lesions, the average distance to CW and PTV volume was 1.4 cm and 54.9 cc, respectively. Table shows dosimetric data for the cohort and the representative patient's treatment plans.

Conclusions: Compared to the linac-based plan and static RR plan, the plan which factored in motion reduced the dmax by 4.8 and 2.7 Gy, respectively. The change in dmax from the static RR plan to the plan that factored in motion was consistent with the aforementioned equation, which predicted a reduction of 2.4 Gy. The low rate of CW toxicity with RR suggests that high dose delivered to the CW is most responsible for rib fracture.

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3390

Evaluation of a 3D Pretreatment Plan Verification Process for Stereotactic Radiosurgery (SRS) Treatments

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Purpose/Objective(s): Pre-treatment plan verification and QA for SRS treatments is currently performed using mainly: point, 1D and 2D dosimeters, which are often non-water equivalent and exhibit restricted spatial resolution. These methods present well-known problems that are enhanced when very small target volumes are irradiated. The aim of this study is to address these problems using VIPET polymer gel dosimetry, combined with EBT2 film dosimetry, for 3D pre-treatment SRS plan verification of a very small target volume.

Materials/Methods: VIPET polymer gel substance was prepared and filled a small volume cylindrical container. The gel-phantom was CT-scanned and transferred to the TPS. A very small target volume SRS plan (single isocenter - multiple non-coplanar arcs) was used for the irradiation of the gel-phantom. It was subsequently MR-scanned in order to extract the delivered 3D high spatial resolution relative dose distribution. The measured relative dose values were compared in 3D to the corresponding TPS calculations. EBT2 film dosimetry was also applied for inter-comparison of 2D dose maps at the horizontal plane that includes the isocenter.

Results: A 3D-gamma index comparison between the 3D-gel measurements and 3D-TPS calculations showed an acceptable agreement when 2 mm and 3% criteria were selected. However, by using 1 mm and 1% criteria, significant discrepancies are observed. The 2D dose maps comparison using polymer-gel measurements, EBT2 measurements and TPS calculations revealed a satisfying agreement by the choice of 2 mm - 3% 2D gamma-index criteria.

Conclusions: Polymer gel dosimeters are capable for 3D high spatial resolution dose measurements. Moreover, they are tissue-equivalent. These unique combined characteristics, makes them an ideal choice for pre-treatment plan verification of very small target volumes SRS plans, overcoming the problems of conventional dosimeters. It is proposed that the presented methodology can be used for routine pre-treatment plan verification and QA in SRS treatments as a 'stand-alone' method or as a complementary to the conventional dosimetry methods.

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3391

Heterogeneous Dose Prescription for Early Stage Lung Cancer Stereotactic Body Radiation Therapy (SBRT): Implications on Dose Gradient

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Purpose/Objective(s): Rapid dose fall-off in the normal tissues surrounding a lung SBRT target is critical to avoid significant toxicity. This study aims to explore the relationship between tumor dose prescription and steepness of dose gradient for lung SBRT plans.

Materials/Methods: This study is based on 20 4DCT simulation scans of patients with stage I non-small cell lung cancer, previously treated by SBRT to 60 Gy in 5 fractions. For each simulation CT, three plans, each consisting of 11 beams (9 equally-spaced beams with entry over the ipsilateral hemithorax + 2 non-coplanar beams), were generated for static-gantry IMRT delivery technique. The prescribed dose (PD) was consistent with the clinically delivered plan, with 95% of the PTV exposed to 60 Gy. We varied stipulations for dose heterogeneity within the target (homogeneous plans − maximum dose approximating 120% of PD; moderately heterogeneous plans − maximum dose approximating 135% of PD, and extremely heterogeneous plans − maximum dose approximating 150% of PD). For each of the 60 plans, the mean distance per 10% change in isodose from the 100% to 50% isodose line was calculated.

Results: We found that increasing target dose heterogeneity related to steeper dose gradients. The mean maximum dose was 121.5 ± 6.5% of PD for the homogeneous plans, 137.3 ± 6.3% of PD for the moderately heterogeneous plans and 156.4 ± 5.9% of PD for the extremely heterogeneous plans. The mean distance per 10% change in isodose line was 2.71 ± 0.3 mm in homogeneous plans, 2.64 ± 0.3 in moderately heterogeneous plans, and 2.59 ± 0.3 mm in extremely heterogeneous plans ($p < 0.001$ for all comparisons).

Conclusions: Heterogeneous dose prescription for lung SBRT achieved steeper dose gradients outside the target volume. This benefit may further improve the already low SBRT-related complication rates, and the inherent increase in Equivalent Uniform Dose (EUD) may yield advantages with respect to local tumor control.

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3392

Small Animal Irradiation Using Robotic Radiosurgery and Micro-CT Images

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