2247 A Comparative Analysis Between 3D Non-coplanar Beam Technique (NCBT) versus Single-isocenter Multi-segment Conformal Arc (SiMs) Technique for Liver Stereotactic Body Radiotherapy (SBRT)

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Purpose/Objective(s): SBRT has shown considerable promise in the management of patients with primary or metastatic liver tumors. However, SBRT treatments are generally associated with extensive dosimetric preparation, prolonged patient immobilization, and lengthy delivery times. The SiMs technique simplifies SBRT planning and reduces the time required for treatment delivery. This study was undertaken to compare SBRT with NCBT to treatment planning and delivery with the SiMs technique.

Materials/Methods: Six liver SBRT cases that were originally planned and treated with NCBT were re-planned using the SiMs technique. Five tumors were metastases and one was a primary intrahepatic cholangiocarcinoma. Mean GTV diameter was 3.9 cm (range: 2.4 - 5.9 cm), mean GTV volume was 21.6 cc (range: 4.9 - 53.8 cc), and mean PTV volume was 107.3 cc (range: 37.8 - 152.8 cc). Patients received 24 - 60 Gy in 3 fractions, while adhering to normal tissue sparing constraints. The SiMs technique requires identification of an isocenter which allows dynamic arc rotation 360 degrees around the patient. Six equal isocentric dynamic conformal arc segments are constructed, and three of the segments are modified superiorly and inferiorly along their PTV-defined dynamic field aperture to correct for estimated dose falloffs secondary to respiratory motion. Finally, the treatment plans are normalized so as to maximize PTV coverage. NCBT plans were delivered at 600 or 1000 MU/min, while the SiMs plans were planned for 600 MU/min. We compared the SiMs plans to the NCBT plans with attention to the dosimetric quality and treatment delivery times.

Results: The SiMs plans and the NCBT plans offered comparable PTV coverage, conformality, and normal tissue sparing. However, the average treatment delivery time per fraction was 14.3 min (12.9-16.8 min) for the SiMs technique, compared to 25.8 min (20.3-40 min) for the NCBT plans, reflecting a 44.4% decrease. Also, the SiMs plans required only one interruption to enter the room as compared to standard NCBT (average 11 interruptions).

Conclusions: The SiMs technique is dosimetrically similar to standard 3D NCBT, yet it appreciably simplifies the planning and delivery process of SBRT. In all cases, use of the SiMs modality yielded equivalent or superior conformality while maintaining adequate normal tissue sparing. SiMs radiotherapy is delivered faster, thereby notably decreasing potential movement error and time required for treatment. Thus far, the SiMs technique is promising and we have adopted it as our primary SBRT method. The results from this analysis suggest the need to conduct a larger study, and to compare these SBRT modalities in treating other organ sites.

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