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International Harmonization of Technical Approaches to Kidney Stereotactic Ablative Body Radiotherapy: An International Radiosurgery Consortium of the Kidney (IROCK) Contouring Project

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Abstract
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Abstract

Objectives:

Stereotactic ablative body radiotherapy (SABR) is an emerging treatment for patients with primary renal cell carcinoma (RCC), however variation in treatment protocols can exist between institutions. The goals of this study were to measure the variation in contouring RCC tumors for patients being treated with SABR and to develop consensus recommendations.

Methods:

An international panel of 16 radiation oncologists was created from the IROCK meeting during ASTRO 2023. Four patient cases were discussed: Case 1, a renal tumor greater than 10 cm in size with an IVC tumor thrombus; Case 2, a central renal tumor abutting the renal hilum; Case 3, a local recurrence of RCC post-nephrectomy; and Case 4, a residual tumor post-radiofrequency ablation (RFA). For each case, panelists were asked for radiation planning details and to contour the target volumes on representative axial images using the EduCase online contouring platform (RadOnc eLearning Center, LLC., https://www.educase.com/). Consensus target volumes were derived using the STAPLE algorithm and were edited based on consensus discussions amongst the panel. Comparison of panelist contours with the edited consensus contours were performed using the Dice-Similarity Coefficient (DSC), the Mean Distance to Agreement (MDA) and the Hausdorff Distance (HD). The DSC measures the overlap between two contours, so a higher DSC suggests greater agreement. The MDA and HD represent the mean and maximum distances between points on the two contours, so higher MDA and HD represent lower agreement.

Results:

Altogether, the panel included radiation oncologists from Canada, the USA, Australia, the Netherlands, and India. All panelists had previously treated at least 10 patients with SABR for primary RCC. The median (IQR) DSC amongst panelists for Case 1, Case 2, Case 3, and Case 4 were 0.85 (0.79 – 0.85), 0.90 (0.85 – 0.93), 0.91 (0.88 – 0.93), and 0.75 (0.60 – 0.79), respectively. Using an ANOVA analysis, for all cases, the DSC, MDA, and HD were not statistically different between panelists ($p = 0.15$, $p = 0.07$, and $p = 0.99$, respectively). Qualitatively, Case 1 and Case 4 showed the most variation amongst the panelists' contours. For Case 1, there was variation in the extent of the IVC tumor thrombus that was included in the target volume. For Case 4, there was variation in whether to include the gross residual nodule only or the entire ablation cavity in the target volume.

Conclusion(s):

There was good agreement from our international expert panel on contouring renal tumors in all four cases. Variation arose from panelists including differing amounts of the IVC tumor thrombus and the post-RFA cavity in their target volume contours for two cases. Consensus recommendations based on this study may help improve the quality of SABR for RCC moving forward.