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Abstract

A Graphical and Tabular Method to Gauge Safety of Treatment Parameters in Stereotactic Body Radiosurgery (SBRT)

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Objectives: Radiation oncologists need reliable estimates of risk for stereotactic body radiation therapy (SBRT) in various fractionation schemes for critical anatomical structures. Since estimates of risk continue to evolve as the literature matures, the dose volume histogram (DVH) Risk Map was designed, which includes both graphical and numerical comparisons of published dose tolerance limits and risk estimates, overlaid with clinical data.

Methods: Clinical data and dose response models are combined using an intuitive graph in the DVH Risk Map, with a separate subgraph in 1-5 fractions for each considered volume of anatomical structure. The graphical portion of the DVH Risk Map helps clinicians visualize trends, while the tabular portion provides quantitative precision for clinical implementation. Published dose tolerance limits are partitioned into high-risk and low-risk categories, and dose response modeling of the clinical data is used to estimate the risk level of each selected limit in the map.

Results: DVH Risk Maps for 10 anatomical structures have been accepted for publication in the April 2016 issue of Seminars in Radiation Oncology: optic pathway, cochlea, oral mucosa, esophagus, chest wall, aorta, bronchi, duodenum, small bowel, and spinal cord. The methodology is overviewed and several examples of DVH Risk Maps are presented. For relatively acceptable toxicity like grade 1-3 rib fractures, the high-risk limits have 50% risk and the low-risk limits have 5% risk. For more serious complications like spinal cord myelopathy and aortic bleeding, the high risk limits are closer to 3% and the low risk limits have about 1% risk. These statistically based guidelines help gauge the level of safety for each patient.

Conclusions: Using the DVH Risk Map in our practice has proven to be useful and alleviates the fear of complications when changing fractionation schedules or doses to anatomical structures.

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