

The Surgical CTV, PTV, and PRV - A New Concept for Optimizing Pancreatic SBRT and Facilitating Dose Escalation in the Context of Anticipated Surgical Resection

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Abstract

Objectives: Stereotactic body radiation therapy (SBRT) is an increasingly utilized component of treatment in the neoadjuvant management of locally advanced/borderline resectable pancreatic adenocarcinoma. Historically, ablative delivery has been limited to prescription doses associated with low toxicity exposure risk to nearby organs at risk. Technological advancements in image-guided radiation therapy (IGRT) have emboldened radiation oncologists to pursue more aggressive treatments with higher doses to increase the probability of resectability and margin negative resection, the most important prognostic factor in pancreatic cancer outcomes. Many practitioners are pursuing dose escalation protocols, but dose escalation in the pancreatic SBRT setting is fundamentally limited by the tolerance constraints of surrounding radiosensitive viscera. Significant effort is currently directed at facilitating dose escalation including using MR-guide RT, adaptive CBCT, and even placement of hydrogel in the peri-ampullary pancreaticoduodenal recess.

Methods: Here, we present the surgical CTV, PTV, and PRV, a new way of planning of pancreatic SBRT, or at least standardization and amalgamation of the efforts of others to dose escalate to the most surgically relevant portions of the tumor. In this methodology, we also describe a standardized technique of using planning organ at risk volumes and dose painted PTV, but adjusted for the consideration that some of the organs at risk will no longer be present at their time of risk after definitive surgery.

Results: In the borderline-resectable scenario showcased here, use of the surgical dpPTV resulted in only 2.3cc of dose reduced PTV, in comparison to 24.1cc of dose reduced PTV using traditional dpPTV method employed for the clinical plan, a 90% improvement. PTV prescription coverage improved from 41.8% to 86.7%.

Conclusions: The surgical planning volume construct has the potential to significantly aide the planner in dose escalating the most important portions of the tumor, and also in not compromising coverage for eventually irrelevant organ at risk constraints. This approach, however, requires careful planning and collaboration with the surgical oncologist.

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Abstract

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