

AbstractID: 3706 Title: FMISO-PET Hypoxia Imaging: A Novel Method to Plan IMRT-Based Boost Radiation to Hypoxic Subvolumes

Purpose: To investigate the use of [F-18] fluoromisonidazole (FMISO) PET and intensity modulated radiation treatment (IMRT) planning to escalate the dose to hypoxic subvolumes in patients with advanced head and neck tumors.

Method and Materials: Seventy-three patients with head and neck cancer underwent FMISO-PET scans, with fifty-three of them also undergoing FDG-PET scans as part of ongoing research studies. An initial treatment plan used a PTV defined with a 0.5-cm margin around physician-defined primary GTVs and affected nodal systems. The prescription dose is 70 Gy to the PTV and 50 Gy to the affected nodes, while sparing the spinal cord, mandible, and parotid glands. Physician-defined regions of enhanced FMISO signal were used to define boost volumes on coregistered FMISO-PET/CT images. The boost plan prescription dose to the hypoxic subvolumes is an additional 10 Gy.

Results: Initial results from example treatment plans for two head and neck cancer patients are as follows (average over patients): to the PTV $V_{100} = 87.2\%$, $D_{\min} = 6081$ cGy, $D_{10} = 7303$ cGy and to the nodal system $V_{100} = 95.9\%$, $D_{\min} = 4764$ cGy, $D_{10} = 5280$ cGy. The IMRT boost plan yields $V_{100} = 95.1\%$, $D_{\min} = 979$ cGy, $D_{10} = 1012$ cGy to the hypoxic PTV. The critical structures of interest received the following dose distributions from the composite IMRT plans: cord $D_1 = 3890$ cGy, left (contralateral) parotid gland $D_1 = 1965$ cGy, right parotid gland $D_1 = 4907$ cGy (same side as primary tumor), and mandible $D_5 = 6220$ cGy.

Conclusion: We demonstrate the feasibility of directing dose-escalated IMRT to hypoxic subvolumes in head and neck cancer using coregistered FMISO-PET and CT images. Ongoing research and patient studies are expected to provide conclusive information on the clinical role of this procedure.