

AbstractID: 10506 Title: Swallowing-Induced Target Motion and Dosimetric Impact for Head and Neck Cancer Radiotherapy as Assessed by Dynamic MRI

Purpose:

Deglutition (i.e., swallowing) results in dynamic changes in the geometry of aerodigestive tract anatomy, which may affect the doses delivered to targets and critical structures in head and neck cancer radiotherapy. The purpose of this study was to determine (1) whether MRI could be used to capture the motion of swallowing, (2) the geometrical variation induced by deglutition, and (3) the dosimetric impact of deglutition on head and neck cancer radiotherapy.

Method and Materials:

Five patients with aerodigestive tract cancer were imaged in treatment position on a 3.0T Siemens Verio scanner. Two time series of single-slice sagittal images were acquired using a 2D FLASH sequence (6.667 frames/sec with and 3.257 frames/sec without parallel imaging). Swallowing frequency and duration were determined from time series data and motion was assessed using contours of gross tumor volumes (GTV) drawn during one swallowing event. Using each patient's IMRT plan and swallowing frequency and duration results, dosimetric impact was assessed by worst-case scenario of the GTV moving completely out of the treatment field during deglutition.

Results:

Deglutition was non-periodic, with frequency and duration ranging from 2.89-24.18 mHz and 3.86-6.10 sec. Dynamic changes in GTV position, size, and shape resulted from deglutition, ranging from 0-28.36mm and 0-60% change in area of GTV projection. Deglutition resulted in a 1.4-14.3% reduction in dose delivered to GTV.

Conclusion:

MRI is able to capture the motion of swallowing with or without the use of parallel imaging. Deglutition is non-periodic, and results in dynamic changes in GTV position, size, and shape. The overall impact of deglutition on dose delivery for head and neck cancer, although generally insignificant, can be non-negligible for patients with extremely high swallowing frequency and long duration.

Conflict of Interest:

Partially supported by Siemens Healthcare and the MCW Cancer Center Meinerz Fellowship.