Purpose: To determine the dose-response curve for the esophagus, using esophageal thickening as a surrogate for radiation injury

Methods: 15 esophageal cancer patients were selected who had received weekly 4DCT images throughout their course of concurrent chemo-radiotherapy (IMRT) to a total of 50.4Gy. Each patient had a length of at least 4cm of esophagus that was outside the GTV but received the full prescription dose. The weekly CT images were registered with the original treatment planning CT images using deformable registration techniques, and the esophagus contours mapped to the weekly images. The relative change in esophagus size was calculated as the average ratio of the cross-sectional area of the esophagus (minus air) in the weekly images to the area in the planning images for a 1cm long region of the esophagus in the center of the CTV (i.e. away from the GTV and field edge). We are considering this region to be 'normal esophagus.'

Results: Thirteen of the 15 patients experienced mild esophagitis. The average relative expansion increased as the treatment progressed. For all patients the esophagus was thicker at the final week of treatment than its pre-treatment size. For 7/15 patients the esophageal expansion was larger than 1.3. The average relative expansion of the esophagus was 1.30±0.19 (range: 1.04 - 1.67). We will present dose-response curves calculated from the weekly 4DCTs.

Conclusions: The esophagus expands in response to radiation, reaching approximately a 30% increase in cross-sectional area during the final week of a 50.4Gy treatment, although there is much variability between patients.