Generation of Consensus Contour Atlas for Esophageal Cancer IMRT

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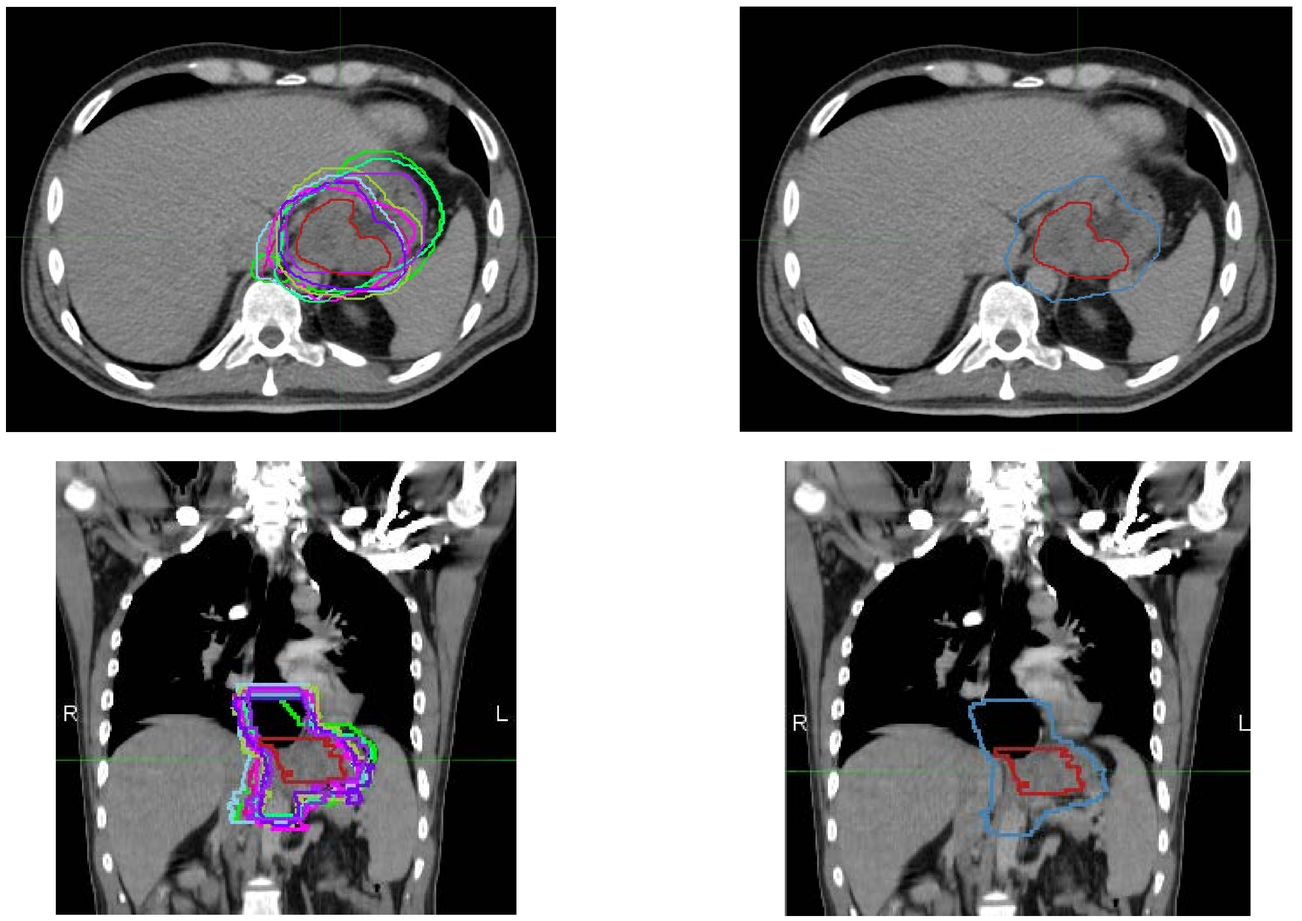
Purpose

Intensity-modulated radiation therapy (IMRT) is increasingly used for esophageal cancer; however, no reference atlas exists to guide GTV and CTV contouring. Current clinical trial contouring guidelines are derived from traditional radiotherapy (RT) field borders. The specific aim was generation of a consensus contouring atlas and guidelines for CT-based contouring of esophageal cancer.

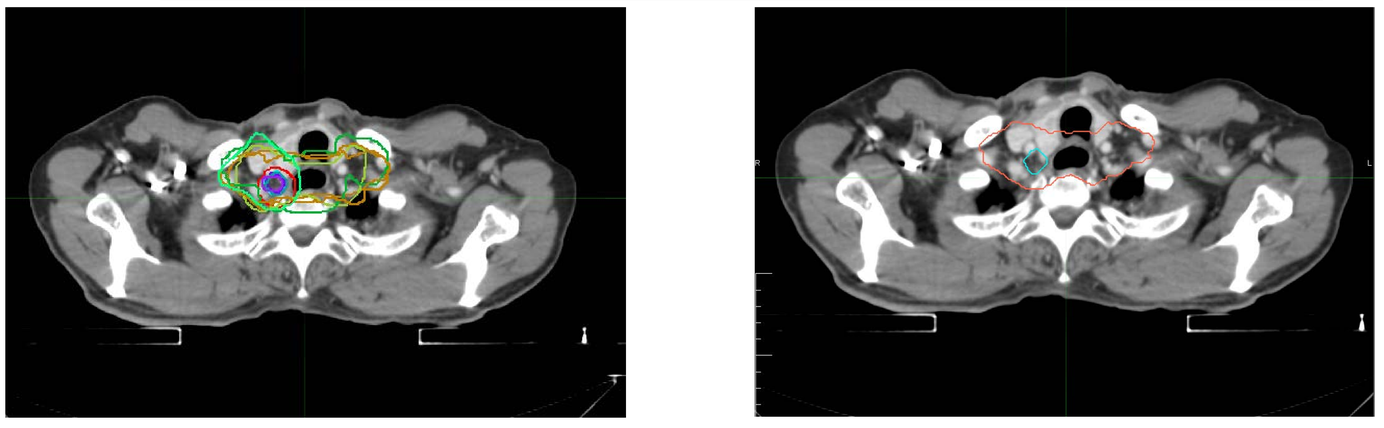
Methods

- Distributed CT sim datasets from three test cases to an expert GI radiation oncology panel .
- Clinical info and diagnostic PET-CT provided
- Test cases consisted of a GE junction, distal esophageal, and mid/upper esophageal cancer.
- Instructed panelists to generate GTV contours based on this information.
- Then, using a reference GTV, panelists generated CTV contours according to CALGB 80803 trial guidelines.
- Imported contours into the Computational Environment for Radiotherapy Research (CERR) for quantitative analysis.
- Calculated Simultaneous Truth and Performance Level Estimation (STAPLE) to generate consensus contours.
- Calculated kappa statistics to characterize level of agreement between panelists.

GE junction test case *(GTV in maroon, STAPLE contour in blue)*



Mid-upper esophagus test case *(GTV in turquoise, STAPLE contour in red)*



Characteristics of panelists' contours

	GE junction CTV	Distal esoph CTV	Mid esoph CTV	GE junction GTV	Distal esoph GTV	Mid esoph GTV
Min. Vol.	397.9	364.7	265.3	36.9	42.0	14.5
Max Vol.	563.2	712.1	496.7	106.2	68.3	67.2
Mean Vol.	467.7	489.9	384.2	73.5	54.1	53.2
Vol. Std. Dev.	65.0	112.7	92.3	21.6	8.2	18.5
Intersect. Vol.	219.2	178.5	110.5	27.1	34.1	12.1
Union Vol.	790.0	979.8	835.5	133.2	88.2	102.9
STAPLE Vol.	477.5	569.1	441.8	74.3	55.9	68.8
Kappa	**0.68**	**0.66**	**0.61**	**0.65**	**0.79**	**0.62**

Results

- GTV and CTV contours successfully obtained from eight panelists.
- **Kappa statistics indicated substantial agreement between panelists for each of the respective GTVs and CTVs** (see table; kappa values between 0.61 and 0.80 represent substantial agreement.)
- Standardized STAPLE contours permitted creation of a preliminary consensus atlas for esophageal IMRT.

Reference: Allozi R, Li XA, White J, et al. Tools for consensus analysis of experts' contours for radiotherapy structure definitions. *Radiother Oncol* 2010: 97:572-578

Conclusions

This panel of expert GI radiation oncologists achieved substantial agreement on IMRT contours for three esophageal cancer cases, each representing a typical anatomic presentation of this disease. A preliminary consensus contouring atlas was generated which will serve as the basis for a forthcoming reference atlas and consensus contouring guidelines.

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