Purpose:
To improve target delineation in the radiation therapy planning process by quantitatively registering endoscopic contours traced on endoscopic images to volumetric imaging. This method is especially useful for target delineation in head and neck and esophageal cancers.

Methods:
We have developed technology that registers endoscopic images to CT images by tracking and registering the position and orientation of the endoscope relative to the CT image set using electromagnetic sensors embedded in the endoscope. After 2D to 3D image registration, users can contour regions-of-interest visible in the 2D endoscopic view. A mesh is created on the interior of the ROI and projected onto the 3D image data, registering the ROI with the volumetric image. This 3D ROI can be exported into the treatment planning software (TPS).The technology was tested on an anatomical head phantom based on a subject image with test “lesion” created by soaking a pad with CT contrast agent so that the lesion was visible in the TPS images. The contouring accuracy was tested by comparing the average minimum distance between the endoscopy-derived and TPS contours.

Results:
A CT image of the head phantom was acquired followed by endoscopic imaging. The lesion was contoured in the endoscopic image and the resulting mesh contour imported imported into Pinnacle. The lesion was contoured in Pinacle using CT# threshold. The average minimum distance between the endoscopy and TPS contours was 0.96mm with 93% of all points in the endoscopy ROI within 1.5 mm of any point within the TPS ROI. This accuracy is limited by the CT imaging resolution and the EM sensor accuracy.

Conclusions:
We have demonstrated that lesions can be contoured from 2D endoscopic images and registered to 3D volumetric data sets with an accuracy of ±1 mm.