AbstractID: 7152 Title: An automatic method to delineate 18F-FDG PET tumor volumes for radiation treatment planning.

Purpose: To develop and evaluate an automatic method of segmenting biological tumor volumes in ^{18}F-FDG-PET images for radiation treatment planning.

Method and Materials: We developed a method of correcting errors in biologic tumor volume due to the finite spatial resolution in ^{18}F-FDG PET images. The PET image is acquired, then used to generate a "spillover image" *S*, defined as the difference between an iteratively deconvolved image and the original PET image. The biologic tumor boundary was defined along the contour where the spillover image *S* changes sign. This algorithm was validated with tumors simulated with various sizes (11-28 mm) and background levels, and also with PET/CT images from 10 patients having FDG-avid head/neck tumors having anatomical boundaries clearly defined with CT. PET-derived biologic tumor volumes were compared against the CT-derived anatomic tumor volumes and against the volumes extracted by applying a simple threshold to the PET image.

Results: The biologic tumor volumes derived with the proposed method matched the CT-derived anatomic tumor volumes for all tumor sizes having background activities from 0 to 33% of the tumor activity in the simulated data, and agreed to within 90% for all tumors evaluated in the patient data. For all tumor sizes, the PET volumes derived from this algorithm matched more closely with the CT-derived volumes than those obtained with a fixed threshold applied to the PET images.

Conclusion: The proposed algorithm incorporates the spatial resolution of the imaging system to automatically segment biologic tumor volumes. The algorithm automatically compensates for differences in tumor size and tumor:background contrast, and does not require a fixed threshold to be applied to the PET image. Such a scheme will be useful for defining biologic tumor volumes with ^{18}F-FDG PET for radiation treatment planning.

Research sponsored by Siemens Oncology Care.