

Purpose: To evaluate the effect of FDG PET-CT imaging on target volume definition, inter and intra observer perceptions, and on tumor and normal tissue doses.

Methods: The positron emission tomography with fluorine-18-fluorodeoxyglucose (18F-FDG) radiopharmaceutical and computed tomography (CT) combined provide structural and functional information for the definition of tumor and radio-resistant regions that can be treated to high doses. This study uses data from twenty patients who had CT and PET imaging for treatment plan preparation. Treatment plans used non-opposing co-planar beams of four to seven fields. The prescribed dose was 70.2 Gy in 39 fractions. Physicians H and T independently delineated tumor volumes on CT and PET-CT images and treatment plans were generated. Doses to CT contoured structures were obtained from plans that were originally planned based on contoured PET-CT fused images. Tumor volumes of PET-CT and CT were compared by an index of agreement (IA). The intra and inter observer variations on tumor delineation, mean, minimum and maximum tumor doses, and percent differences in uninvolved lung doses were compared.

Results: The mean intra observer IA value was approximately 0.50 for both physicians. The mean inter observer IA value was 0.45 and 0.52 for CT and fused PET-CT tumor outlining respectively. The percent differences in average minimum and mean tumor doses for PET-CT and CT plans were 60.1% and 8.1% respectively for physician H, and 78.4% and 11.7% respectively for physician T. The uninvolved lung mean dose variations for PET-CT and CT plans were 5.6% and 1.9% for physicians H and T respectively, and between both physicians the differences were 9.6% and 12.7% for PET-CT and CT plans respectively.

Conclusions: The volumes created on PET-CT images by two experienced physicians were greatly different compared to volumes created on CT only, resulting in extreme differences in calculated doses.