

1. Phys Med. 2006 October - December;22(4):119-26.

Dosimetric consequences of breath-hold respiration in conformal radiotherapy of esophageal cancer.

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The objective of this paper is to study the dosimetric impact of respiratory gated radiotherapy in locally advanced esophageal carcinoma and to define the optimal respiratory phase for this treatment. The study included 8 consecutive patients with squamous-cell carcinoma (SCC) or histologically proved adenocarcinoma, for both at least T3-T4 NX or TX N1 M0 stage. Informed consent was obtained before beginning the study. Three spiral scans were performed in breath-hold respiration: one acquisition in end expiration (EBH), one in end inspiration (IBH) and one in deep inspiration breathhold (DIBH); and one acquisition was performed in Free Breathing (FB). A 3 mm-margin was defined as Internal Target Volume (ITV) on FB CT-scan. No ITV was applied on EBH, IBH and DIBH CT-scan. Target volumes were analyzed and we performed dosimetric comparisons on DVH data of each CT-scan for PTV and Organs at Risk (OAR) (Conformity Index, V(dose), D(mean), Equivalent Uniform Dose). DIBH and IBH correlated with a 32% ($p=0.77$) and 20% ($p=0.52$) decrease in lung V(20) respectively as compared to FB (13.5% and 15.6% respectively versus 19.9%). DIBH and IBH correlated with a 25% ($p=0.25$) and 17% ($p=0.39$) decrease in cardiac V(40) respectively, as compared with FB (16.9% and 18.9% respectively versus 22.7%). For spinal cord irradiation, the minimum dose was obtained in IBH (36.5 Gy). Conformal radiotherapy with respiratory gating for esophageal cancer decreases the irradiated dose to OAR. We suggest that DIBH technique should be used when irradiation is performed using the spirometric system. In the Tidal Volume, the inspiration phase is the most favourable and should be chosen for irradiation with a free breathing gating system.