

Given the means to detect and quantify internal organ motion during the course of a patient's prostate treatment, it is imperative to consider modification of the planning target volume (PTV). In this study, a systematic model is proposed to generate a confidence-limited PTV (cl-PTV) which compensates for internal target motion in the individual patient. Specifically, the cl-PTV defines a patient-specific volume which ensures that every element of the clinical target volume (CTV) receives no less than a specified percentage of the prescribed dose. First, we hypothesized that clinical target motion in the prostate patient could be confined inside a region generated from a sequence of CTV measurements, obtained from a small number of daily CT scans. To test the hypothesis, we acquired a large number of CT datasets for each patient in the study. The cl-PTV was derived from the convex hull of the union of the first k CTVs, where k is the minimum number needed to ensure that the maximum dose reduction in the clinical target due to internal target motion is less than 5% of the prescribed dose. The confidence of the cl-PTV was tested retrospectively using multiple CT datasets acquired for each of twelve patients. In general, 4 to 5 days of CT measurements within the first week of treatment were needed to achieve this confidence.

Supported in part by NCI-CA71785