

AbstractID: 3908 Title: Comparison of a center-of-volume contour-based alignment and a CT image-based automatic alignment of prostate target in CT-guided radiotherapy

Purpose:

Due to organ deformation, the validity of using center-of-volume (COV) for prostate alignment has not been evaluated against other approaches and vice versa. The goal of this study was to compare two methods of prostate target alignment: one used manually delineated contours and the other used a combination of automatic and manual image registration method.

Method and Materials:

In an IRB-approved protocol for repeat CT imaging using a CT-on-rails system, 15 patients received 3 CT scans per week over a period about 8 weeks. For each of the 353 CT images, the prostate was manually contoured by two radiation oncologists and checked by one of them. The center of volume (COV) was computed based on the gravity center of the contour containing the prostate. A CT-Assisted Targeting (CAT) software was also developed in-house for on-line CT image-guided radiotherapy. The registration algorithm consisted of cost functions that were designed to provide accurate, robust and automatic detection of the prostate. The daily position of the prostate was calculated using both the COV method and the CAT software. For the later, the results were also reviewed in every CT images and adjusted when necessary.

Results:

The mean differences ($\pm 1SD$) between COV and CAT alignments were -0.2 ± 0.9 mm, -0.4 ± 1.5 mm, and 0.7 ± 2.4 mm in lateral(RL), anterior-posterior(AP), and superior-inferior(SI) directions, respectively. The results of alignments were highly correlated ($p < 0.0001$) in all directions. Although large differences are few, an outlier analysis showed that large differences were due to (1) inter-observer variation in contouring the reference CT and the daily CT (61%), (2) large deformations of anatomy (65%), and (3) the combination of both (45%).

Conclusion:

We found that both the COV method and the CAT alignment agreed well to within 2mm in RL, 3mm in AP, and 5mm in SI for 95% of alignments.