

AbstractID: 5026 Title: Proton Treatment Planning Strategies Based on the 4D CT information

Purpose:

Particularly in the case of thoracic radiation therapy, there are substantial inter- and intra-fractional variations in shape, volume and position of treatment targets and the intervening and surrounding normal tissues. The purpose of this work is to develop proton treatment planning strategies for mobile tumors with and without mobile intervening structures based on 4D CT, and to assess the planning strategies using 4D CT data and daily in-room CT information.

Method and Materials:

Five treatment planning strategies were evaluated based on (1) free breathing CT with small smearing, (2) free breathing CT with large smearing, (3) average CT with small smearing, (4) average CT with CT numbers inside the tumor volume replaced by higher CT numbers, and (5) maximum intensity projection CT. For a lung patient with large, 1.6 cm, tumor motion and immobile surrounding tissues, treatment plans were designed using strategies 1, 2 and 4. Each treatment plan was recalculated on five daily CT images using bony structure alignment. For an esophagus patient with 3.5 cm tumor motion and large cardiac, liver and spleen motion, treatment plans were designed using strategies 1, 2, 3 and 5. Each treatment plan was recalculated in all 10 phases of the 4D CT.

Results:

For the lung patient, the tumor coverage evaluated using the five daily CT's is superior when using strategies 2 and 4 as compared to strategy 1. However, the lung sparing is superior using strategy 4 compared to strategy 2. For the esophagus patient, the treatment plans using strategy 2 and 5 covered the targets for each 4D CT phase while the plan using strategy 1 and 3 caused significant under-dosing.

Conclusion:

With the strategies developed using 4D CT data, good tumor coverage was achieved for the thoracic patients with large tumor and surrounding tissue motion using proton therapy.