

AbstractID: 9035 Title: Pitfalls of the ITV and PTV dose in thoracic anatomy and composite 4D dose calculation

Propose: To point out conceptual errors in the ITV and PTV dose of thoracic anatomy with composite 4D dose calculation.

Methods and materials: Organs in the thorax and upper abdomen are susceptible to respiration induced internal organ motion. Due to organ motion, the dose delivered to tissues may differ from the planned dose. Four-dimensional CT imaging and elastic image registration of the 4DCT images can be used in the delivered dose estimation. First, a treatment plan was generated on one of the CT image sets in the 4DCT. The plan parameters were copied to the remaining 3DCT images and the dose was recalculated on each individual image; next, the recalculated doses were warped to the reference CT to form a composite 4D dose using transformation fields obtained from elastic image registration of the 4DCT. The composite 4D dose was treated as an accurate estimation of the dose delivered to the patient. In the literature, variation of the ITV and PTV doses corresponding to the different respiratory phases has been reported. In this study, using a stereotactic body radiation therapy of lung tumor as an example, we point out conceptual errors in the delivered dose estimation.

Result: It was shown that the ITV-based SBRT plans can delivery the prescribed dose to the tumor (GTV). However, the tissues constituting the ITV, and hence the PTV, in the context of mobile anatomy depend on the particular phase of the respiration cycle.

Conclusion: The comparison of the ITV and PTV dose at different respiratory phases is erroneous. Its usage can easily lead to the incorrect calculations of the delivered dose to the patient. We therefore believe that while the ITV and PTV can be used to guide the addition of treatment margins, 4D dose calculations are only relevant to the GTV.