2010

**Dosimetric Evaluation of Tumor Tracking in 4D Radiotherapy**

I. Buzurovic  
*Thomas Jefferson University Hospitals*

M. Werner-Wasik  
*Thomas Jefferson University Hospitals*

T. Biswas  
*Thomas Jefferson University Hospitals*

J. Galvin  
*Thomas Jefferson University Hospitals*

A. Dicker  
*Thomas Jefferson University Hospitals*

See next page for additional authors

Follow this and additional works at: https://jdc.jefferson.edu/bodinejournal

Part of the Oncology Commons

Let us know how access to this document benefits you

**Recommended Citation**

DOI: https://doi.org/10.29046/TBJ.003.1.023  
Available at: https://jdc.jefferson.edu/bodinejournal/vol3/iss1/24

This Article is brought to you for free and open access by the Jefferson Digital Commons. The Jefferson Digital Commons is a service of Thomas Jefferson University's Center for Teaching and Learning (CTL). The Commons is a showcase for Jefferson books and journals, peer-reviewed scholarly publications, unique historical collections from the University archives, and teaching tools. The Jefferson Digital Commons allows researchers and interested readers anywhere in the world to learn about and keep up to date with Jefferson scholarship. This article has been accepted for inclusion in Bodine Journal by an authorized administrator of the Jefferson Digital Commons. For more information, please contact: JeffersonDigitalCommons@jefferson.edu.
Dosimetric Evaluation of Tumor Tracking in 4D Radiotherapy

Authors
I. Buzurovic, M. Werner-Wasik, T. Biswas, J. Galvin, A. Dicker, Y. Yu, and T. Podder

This accepted abstract is available in Bodine Journal: https://jdc.jefferson.edu/bodinejournal/vol3/iss1/24
Dosimetric Evaluation of Tumor Tracking in 4D Radiotherapy

Buzurovic, I., Werner-Wasik, M., Biswas, T., Galvin, J., Dicker, A., Yu, Y., Podder, T.
Department of Radiation Oncology, Thomas Jefferson University Hospitals, Philadelphia, PA

Purpose
In some patients the tumors in lung, pancreas, liver, breast, and other organs move significantly during cardiac and breathing cycles. In this study we have investigated the dosimetric benefits of real-time tumor tracking for patients who were diagnosed with lung cancer.

Materials and Methods
The study includes the evaluation of dosimetric advantages of tumor motion tracking and the irradiation of normal lung and spinal cord. The dosimetric evaluation of tumor tracking was carried out on ten randomly selected patients who were scanned using 4D-CT technique. The 4D-CT phase reconstruction was performed using GE Advantage Workstation software, version AW 4.3_07. The 3D-CRT plans were generated using CMS-XiO4.4. Tissue heterogeneity was corrected for all plans. For each patient, eleven dosimetric plans were generated: ten plans for the target volumes contoured at ten breathing phases and one plan for the internal target volume (ITV) generated on average intensity projection (AvIP) studyset. The ITV was defined as a spatial sum of the gross target volumes (GTV) for each phase. The phasewise plans were compared to the clinically used ITV-AvIP plans in order to assess dosimetric effects of tumor tracking. The planning target volumes (PTV) were generated by adding 10mm margin around GTVs and ITV for both phase-wise plans and ITV-AvIP plans. To analyze data obtained from the dosimetric plans we compared dosimetric parameters including coverage of PTV (D99, D95, D50) volumes of normal lung receiving 5Gy, 13Gy, 20Gy, 30Gy dose (V5, V13, V20, V30) and D5 of spinal cord for AvIP-based plans with phase-wise tracked plans.

Results
Average PTV coverages for all plans were 91.6% of the prescribed dose (PD) for D99, 96.7% for D95 and 104.3% for D50. The average maximum dose was 110% of PD and the mean dose was 103.6% of PD. The 3D tumor motions for all investigated patients were more than 10mm. It was observed that average V5, V13, V20 and V30 with tracking technique were about 17.4%, 19.3%, 18.3% and 22.7% lower than the Vxs without tracking, respectively. Approximately 20% of healthy lung received 4-8Gy less dose when the tumor tracking technique was used; wide variations were observed due to differences in prescribed dose, tumor location and size.

Conclusion
Implementation of the active tracking and dynamic dose delivery techniques can potentially improve dose distribution of the tumor-volumes. This, in turn, will potentially improve the quality of patient treatment by minimizing irradiation to the healthy tissues, sparing critical organs and lowering the toxicities.