

Analysis of inter-fraction setup error of nasopharyngeal carcinoma treated with tomotherapy with megavolt computed tomography

Wang Fangzheng^{1, 2}, Ye Zhimin^{1, 2}, Jiang Chuner³, Fu Zhenfu^{1, 2}, Hu Fujun^{1, 2}, Wang Lei^{1, 2}, Yang Shuangyan⁴, Yu Huanhuan⁴, Shi Jianfang⁴

¹Department of Radiation Oncology, Zhejiang Cancer Hospital, Zhejiang Hangzhou, 310022

² Key Laboratory of Radiation Oncology of Zhejiang Province, Zhejiang Hangzhou, 310022

³Department of Breast Surgery, Zhejiang Cancer Hospital, Zhejiang Hangzhou, 310022

⁴Department of Physics, Zhejiang Cancer Hospital, Zhejiang Hangzhou, 310022

Abstract

Objective: To evaluate the inter-fraction setup error during the treatment with MVCT and provide theoretical basis for clinical target volume-planning target volume(CTV-PTV) margins for nasopharyngeal carcinoma patients treated with tomotherapy.

Methods: Thirty-seven consecutive NPC patients treated with tomotherapy were prospectively enrolled for the study between February 2015 and September 2015. For each patient, one MVCT scan was obtained after conventional positioning, online correction and tomotherapy delivery daily, and the scan was registered to the planning CT to

determine inter-fraction setup error. The M_{PTV} was calculated with the recipe: $M_{PTV} = 2.5\sigma + 0.76\delta$ (σ : systematic error; δ : random error). Results: The average absolute errors of the inter-fraction were – 1.945 ± 0.047 mm, 0.024 ± 0.0562 mm and 0.0303 ± 0.0504 mm in the three dimensions. Gradual increases in both inter-fraction three-dimensional displacement were observed with time and treatment ($P < 0.05$). The total M_{PTV} accounting for inter-error were 3.913mm, 0.0873mm and 0.0959mm mm.

Conclusions: Tomotherapy irradiation technology personalized MPTV should be adopted for the design of tomotherapy plan. Displacement increased as a function of time.

Key words: Mugavolt computed tomography; setup error; planning target volume; nasopharyngeal carcinoma; tomotherapy