

Patient Weight Fluctuations During Proton Therapy Treatment: Safety and Financial Implications

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Introduction

During the course of proton therapy, a patient's weight can fluctuate based on side effects of his/her treatment or medication. Weight variances are frequently seen among patients with head and neck cancer, brain cancer, or malignancies necessitating cerebrospinal irradiation (CSI) and can lead to issues with daily proton therapy treatment set-up. A loss of just 5% of body weight during treatment has been attributed to significant set-up displacement (1).

Since the tumor targets are so precise with proton therapy, a shift in patient alignment can lead to the possibility of misadministration of the proton beam. This can cause an increase in unwanted radiation dose to healthy tissues (2). However, ensuring continued proper daily alignment with a patient who is experiencing a weight fluctuation may lead to an increased time in the treatment room due to positioning or set-up issues, or an increase in the number of daily radiographs necessary to attain proper image guided alignment.

Materials and Methods

Case examples of a patient with head and neck cancer, a patient with brain cancer, and a patient needing CSI immobilization were reviewed. All patients experienced fluctuations in their weight during treatment causing issues with daily positioning.

Results

In the presented case examples, an increase in the amount of time needed to set-up and treat each patient was discovered, causing a decrease in room productivity. A patient safety concern was also noted as additional radiographs were required to achieve proper daily patient alignment

Case Example 1: Craniospinal Irradiation

% Weight Change During Treatment	5.4
Mean # of Radiographs Needed for Daily Positioning	9.15
Max # of Radiographs Needed for Daily Positioning	16
Mean Time from First Radiograph to Beam	43.3 minutes
Max Time from First Radiograph to Beam	73 minutes

Case Example 2: Head and Neck

% Weight Change During Treatment	6.8
Mean # of Radiographs Needed for Daily Positioning	3.4
Max # of Radiographs Needed for Daily Positioning	7
Mean Time from First Radiograph to Beam	36.3 minutes
Max Time from First Radiograph to Beam	59.2 minutes

Case Example 3: Brain

% Weight Change During Treatment	22.4
Mean # of Radiographs Needed for Daily Positioning	4.5
Max # of Radiographs Needed for Daily Positioning	7
Mean Time from First Radiograph to Beam	19.7 minutes
Max Time from First Radiograph to Beam	35 minutes

Conclusion

Currently, the standard practice is to evaluate a patient for treatment replanning and daily immobilization modifications if his/her weight changes 10% over baseline. However, this might be too lenient of a threshold for reevaluation and should be reconsidered.

References:

1. Wang, C., F. Chong, J. Wu, M. Lai, and J. Cheng. "Body weight loss associates with set-up error in nasopharyngeal cancer patients undergoing image guided radiotherapy." *International Journal of Radiation Oncology* Biology* Physics* 69, no. 3 (2007): S203.
2. Hong, Theodore S., Wolfgang A. Tomé, Richard J. Chappell, Prakash Chinnaiyan, Minesh P. Mehta, and Paul M. Harari. "The impact of daily setup variations on head-and-neck intensity-modulated radiation therapy." *International Journal of Radiation Oncology* Biology* Physics* 61, no. 3 (2005): 779-788.