Cureus

Stereotactic Radiation Therapy Boost for Patients with Breast Cancer in the Prone Position using a Novel Fast Ring-Gantry Radiotherapy System: A Treatment Planning Study

Open Access
Abstract
Published 04/02/2023

Oluwaseyi M. Oderinde [1] , Karine Al Feghali [1] , Arjun Maniyedath [2] , Shervin Shirvani [2]

1. Radiation Oncology, RefleXion Medical, Hayward, USA 2. Clinical Sciences, RefleXion Medical, Hayward, USA

Corresponding author: Oluwaseyi M. Oderinde, ooderinde@reflexion.com

Categories: Medical Physics, Radiation Oncology
Keywords: radiotherapy treatment planning, prone positioning, breast cancer, stereotactic radiotherapy (srt)

How to cite this abstract
Oderinde O M, Al Feghali K, Maniyedath A, et al. (April 02, 2023) Stereotactic Radiation Therapy Boost for Patients with Breast Cancer in the Prone Position using a Novel Fast Ring-Gantry Radiotherapy System: A Treatment Planning Study. Cureus 15(4): a930

Abstract

Objectives:

Earlier studies have looked at the feasibility of definitive radiation therapy for patients with breast cancer who are medically inoperable or refuse surgery. One of these studies delivered conventional whole-breast irradiation followed by a boost using stereotactic body radiotherapy (SBRT) to the primary tumor only or intensity-modulated radiotherapy to the tumor plus axillary nodes. The current study assesses the use of a novel fast ring-gantry radiotherapy system for breast SBRT boost for patients in a prone position.

Methods:

From a cancer imaging archive (*QIN-breast) 3 breast cancer patients with 18-fluorodeoxyglucose (FDG) PET/CT images were selected based on tumor size (≤5 cm). The PET/CT imaging was used to delineate gross tumor volume (GTV), and the clinical target volume (CTV) and planning target volume (PTV) was defined with a 15 mm margin around the GTV and 3 mm margin around the CTV, respectively (ROCK Trial, NCT03520894). In addition, 5 mm from the skin surface, thoracic wall, and pectoral muscles were excluded from the CTV and PTV. The treatment plans were created with a prescription dose of 21Gy in 3 fractions to the PTV using a research version of the RefleXion® treatment planning system (X1-TPS). The X1-TPS uses a fast iterative shrinkage-thresholding algorithm (FISTA) for fluence map optimization and collapsed cone convolution/superposition for dose calculation. The dose distribution to the heart, ipsilateral and contralateral lungs, and contralateral breast were analyzed.

Results:

The gross tumor sizes were 2.6, 3.1, and 4.8 cm. The planning tumor volume (PTV) coverage (D95%) was 97.6, 98.2, and 98.8%, respectively. The mean lung dose was 1.44, 1.02, and 1.04 Gy for ipsilateral lung, and 0.55, 0.74, and 0.74 Gy for contralateral lungs, respectively for the 3 patients. In addition, the maximum dose to the heart was 5.20, 5.91, and 4.73 Gy, while the mean dose to the heart was 0.92, 1.73, and 1.91 Gy for the three patients. The maximum dose to the contralateral breast was 5.06, 4.93, and 5.45 Gy, respectively, for the 3 patients.

Conclusion(s):

This study demonstrated the treatment planning feasibility of using a novel fast ring-gantry radiotherapy system for breast SBRT boost for patients who refuse surgery or are deemed medically inoperable. Further clinical studies are needed to confirm these findings and assess the oncologic and cosmetic outcomes of using this approach.