Cureus

# Combining Biology-Guided Radiotherapy (BgRT) with Stereotactic Body Radiation Therapy (SBRT) for Multiple Target Treatment in a Single Session

**Open Access**
**Abstract**
**Published 03/05/2025**



Chenyang Shen [1], Bin Cai [2], Rameshwar Prasad [1], Thomas Banks [1], Andrew Godley [1], Arnold Pompos [1], Girish Bal [3], Shahed Badiyan [1], Kenneth Westover [4], David Sher [4], Robert Timmerman [5], Tu Dan [6], Aurelie Garant [7]

1. Radiation Oncology, University of Texas Southwestern Medical Center, Dallas, USA 2. Radiation Oncology, University Of Texas Southwestern Medical Center, Dallas, USA 3. Radiation Oncology, RefleXion Medical, Hayward, USA 4. Radiation Oncology, UT Southwestern Medical Center, Dallas, USA 5. Radiation Oncology, University of Texas Southwestern, Dallas, TX, USA 6. Radiation Oncology, UT Southwestern, Dallas , USA 7. Department of Radiation Oncology, The University of Texas, Southwestern Medical Center, Dallas, USA

**Corresponding author:** Chenyang Shen, chenyang.shen@utsouthwestern.edu

**Categories:** Medical Physics, Radiation Oncology
**Keywords:** biology-guided radiotherapy, multiple target treatment, sbrt

**How to cite this abstract**
Shen C, Cai B, Prasad R, et al. (March 05, 2025) Combining Biology-Guided Radiotherapy (BgRT) with Stereotactic Body Radiation Therapy (SBRT) for Multiple Target Treatment in a Single Session. Cureus 17(3): a1394

## Abstract

Objectives:

Patients diagnosed with multiple medically inoperable tumors may benefit from concurrent SBRT treatment of separate targets. Multi-target SBRT is increasingly being used to deliver highly targeted, ablative doses to multiple tumors in fewer fractions and with toxicity comparable to multifractionated IGRT. SCINTIX therapy BgRT also known as SCINTIX therapy is a novel radiotherapy delivery technique which uses positron emission tomography (PET) signals from a tumor to precisely guide the delivery of external beam radiotherapy. In this work we investigate the feasibility of treating multiple PET-avid tumors (using BgRT) and non-PET avid tumors (using SBRT) for oligometastatic and polymetastatic disease in a clinical setting. This is the first time BgRT and SBRT treatments have been delivered in a single clinical session as two separate plans. The goal was to set the stage so that the data can be used to develop and validate multi-target treatment (MTT) planning and delivery when BgRT and SBRT are combined in the same plan.

Methods:

Two patients were treated sequentially by combining BgRT and SBRT in the same session. The first patient had three tumors in the pelvis: a PET-avid tumor located in the right ischium, and two smaller, non-PET-avid tumors located in the right acetabulum and right iliac. A dose of 36 Gy in 3 fractions was prescribed for each target, with the PET-avid tumor treated via BgRT and the others via SBRT. The second patient had two lung tumors separated by roughly 10 cm in the superior-inferior direction: a PET-avid tumor in the right lung and a smaller tumor in the left lung. A dose of 28 Gy in 1 fraction was prescribed for each target, with the PET-avid target treated via BgRT and the other via SBRT. For these two patients, multiple isocenters were used. A planning target volume (PTV) = gross target volume (GTV) + 5mm and a biological tracking zone (BTZ) = PTV + Motion Range + 5 mm were used. The patient was injected with roughly 15 mCi of FDG and the PET prescan started 60 minutes post-injection. The PET prescan was used to check if sufficient PET activity existed in the tumor for an accurate treatment delivery. Two metrics were used to check for sufficient PET activity in the tumors: Activity Concentration (AC), which is the contrast difference between the mean values in the top 80% of the counts in the tumor and the mean activity in a 3 mm shell around the BTZ, and the normalized target signal (NTS), which is AC divided by the standard deviation of the voxels within the background shell. An AC value greater than 5kBq/ml, a NTS $\geqslant$ 2.7 at planning, and a NTS $\geqslant$ 2.0 at prescan are needed to deliver the prescribed dose for the BgRT treatment. For each patient the BgRT treatment was treated first, followed by the SBRT treatment.

Results:

For the first patient the coverage of the BgRT target was 95.05% with a CI of 1.14 and a treatment time of 44 mins. For the two SBRT targets the coverage was 95.29% with a CI of 1.10 and a total treatment time of 30 min. The AC during functional modeling (FM) was 23.24 kBq/ml while during the three fractions it was 20.1 kBq/ml, 16.91 kBq/ml, and 18.57 kBq/ml, respectively. The NTS during FM was 11.44 while during treatment it was 8.89, 9.97, and 9.09, respectively. For the second patient the BgRT target coverage was 95.06% with a CI of 1.10 and a total treatment time of 47 mins. For the SBRT target the coverage was 95.23% with a CI of 1.15 and a treatment time of 24 mins. The patient was injected with roughly 14.45 mCi of FDG during FM

and treatment. The AC during FM was 19.24 kBq/ml while during treatment it was 19.76 kBq/ml. The NTS during FM was 12.62 while during treatment it was 9.42.

Conclusion(s):

Concurrent radiation treatment of multiple targets could be an effective curative option for patients with multiple tumors, particularly those not eligible for surgical resection. This work shows the ability to treat multiple targets using BgRT and SBRT sequentially in the same clinical treatment session using separate plans. As this was the first attempt at such an approach, the data and our workflow served as a guide for other BgRT sites trying to perform MTT using the same plan