

Treatment outcomes of stereotactic body radiotherapy for early stage non-small-cell lung cancer and lung metastasis

Introduction

Stereotactic body radiotherapy (SBRT) is a highly precise local treatment with high dose per fraction. Local control rate in lung tumors treated with SBRT is high, 85-95%. Several studies showed the predictor for local control

of lung SBRT in patients with primary lung cancer and/or lung metastasis was the prescribed biological equivalent

dose with $\alpha/\beta = 10$ (BED10) and common SBRT-related complications were radiation pneumonitis (RP), rib fracture,

and cardiotoxicity. For central/ultracentral lung tumors, the fatal complications, such as pulmonary hemorrhage, were

reported.

Despite increasing use of SBRT, there are still unclear predicting factors about its outcomes. Therefore, patients with lung tumors treated with SBRT in Ramathibodi Hospital were reviewed.

Materials and methods

A retrospective cohort study was performed in therapeutic and prognostic type and received ethics approval from the Institutional Review Board. Medical records and SBRT plans of all patients diagnosed early stage non-small cell lung cancer or lung metastases treated with SBRT from January 2009 to September 2018 in Ramathibodi Hospital

were reviewed. Inclusion criteria were histologically confirmed early stage NSCLC (T1-2N0M0), lung metastasis with

known primary malignancy and good performance status (ECOG ≤ 2). Exclusion criteria were missing data and reirradiation to in-field region.

We delineated additional interesting volumes such as a 3-cm shell outside the planning target volume (PTV), left atrium, superior vena cava, and ribs. Dose prescription was prescribed at isodose line covering PTV at PTV

D95%. There was no clinical target volume (CTV) and gross target volume (GTV) was expanded 3- to 5-mm margin

to be PTV. Radiation was delivered by three linear accelerators as follows, with ray tracing, Acuros and Analytical

Anisotropic Algorithm (AAA).

Imaging studies and SBRT plans were reviewed by either a thoracic radiation oncologist or a thoracic radiologist in order to identify local recurrence or post-radiation change.

Results

59 patients with 98 lung lesions were eligible which primary NSCLC and lung metastasis were 15.3% and 84.7%, respectively. Median follow-up time was 16.8 months (0.1-71.7 months). There were variations in patient

demographics between two types of lung tumors. Primary NSCLC patients were older, more comorbidities and poorer

performance status compared to the other. Majority of tumor origin and histopathology were primary lung cancer, 49%

2

and adenocarcinoma, 82.7%. Median maximal diameter of the tumor was 2.3 cm (0.1-8 cm). Dose prescriptions were

various from 25-60 Gy in 1-10 fractions.

As competing risk analysis, overall 1-year local control rate was 90.8%, 93.4% found in primary lung cancer and 90.1% in lung metastasis. The most common pattern of failure was distant failure, 46.9%. The follows were local

and regional failure patterns, 12.2% and 6.1% respectively. Of 9 (9.2%) lung tumors, pulmonary toxicities were observed which radiation pneumonitis grade ≥ 2 found in 8 (8.2%) lesions and one of four patients with ultra-

central lesions experienced grade 5 pulmonary hemorrhage. The multivariate analysis of factors predicting local failure was mean BED of the PTV. Mean BED of the PTV <100 Gy had more 1-year local failure compared to the dose ≥ 100 Gy, 15.5% versus 3%, adjusted SHR 5.41 (95% CI 1.14-25.69), p-value = 0.034. The maximal diameter of the tumor >5 cm had higher grade ≥ 2 pneumonitis, 18% versus 3.3%, adjusted SHR 5.34 (95% CI 1.52-18.69), p=0.009. 1-year overall survival was 80% in primary NSCLC and 72% in lung metastasis. Median overall survival was 16.8 months (0.1-71.7 months).

Conclusion

Local control rate of lung SBRT was high with acceptable toxicity. BED PTV mean was the predictive factor for local tumor control. The tumor maximal diameter >5 cm might correlate with radiation pneumonitis grade ≥ 2 .

Lung SBRT might not suitable for ultra-central lung tumors.

Figure 1. Cumulative incidence curves of factors predicting local failure and radiation pneumonitis grade ≥ 2

Country or Int. Organization

Thailand

Affiliation

Ramathibodi Hospital, Mahidol University

Primary author: Dr NANNA, Thongtra (Division of Radiation Oncology, Department of Diagnostic and Therapeutic Radiology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University)

Co-authors: Dr BOONYAWAN, Keeratikarn (Division of Radiation Oncology, Department of Diagnostic and Therapeutic Radiology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University); Dr PUATAWEEPONG, Putipun (Division of Radiation Oncology, Department of Diagnostic and Therapeutic Radiology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University); Dr SUWATANAPONGCHED, Thitiporn (Division of Diagnostic Radiology, Department of Diagnostic and Therapeutic Radiology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University); Dr WATTAKIYANON, Nattinee (Division of Radiation Oncology, Department of Diagnostic and Therapeutic Radiology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University); Dr RUANGKANCHANASETR, Rawee (Division of Radiation Oncology, Department of Diagnostic and Therapeutic Radiology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University); Dr SWANGSILPA, Thiti (Division of Radiation Oncology, Department of Diagnostic and Therapeutic Radiology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University)

Presenter: Dr NANNA, Thongtra (Division of Radiation Oncology, Department of Diagnostic and Therapeutic Radiology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University)

Session Classification: Paper Session 2: Implementation of New Technologies