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

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BACKGROUND AND OBJECTIVE

Several studies showed the predictor for local control (LC) of lung stereotactic body radiotherapy (SBRT) in patients with primary lung cancer and/or lung metastasis was the prescribed biological equivalent dose with $\alpha/\beta = 10$ (BED10) and concerned SBRT-related complications were radiation pneumonitis (RP), rib fracture, and cardiotoxicity [1-4]. To report LC rate, patterns of failure, toxicity, overall survival (OS) and factors predicting SBRT outcomes, patient with primary or secondary lung tumors in Ramathibodi Hospital were reviewed.

METHODS

A retrospective cohort study was performed. Medical records and SBRT plans of all patients diagnosed early-stage non-small cell lung cancer (NSCLC) or lung metastases treated with SBRT from January 2009 to September 2018 in Ramathibodi Hospital were reviewed. Inclusion criteria were histologically confirmed 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. Dose prescription was prescribed at isodose line covering PTV at PTV D95%. Primary endpoint was 1-year LC rate. Secondary endpoints were patterns of failure, SBRT-related toxicities, OS, factors predicting local failure and SBRT-related complications, using competing risk analysis.

RESULTS AND DISCUSSION

59 patients with 98 lung lesions were eligible. 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). 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%, and adenocarcinoma, 82.7%, respectively. Median maximal tumor diameter was 2.3 cm (0.1-8 cm). Dose prescriptions were various from 25-60 Gy in 1-10 fractions (Table 1). Radiation was delivered by CyberKnife with raytracing, EDGE and RapidArc with Acuros and Analytical Anistropic Algorithm (AAA). 1-year LC was 90.8%, 93.4% in primary NSCLC and 90.1% in lung metastasis, comparable to the previous study [2]. The most common pattern of failure was distant failure, 46.9%. Local and regional failure patterns were 12.2% and 6.1% respectively. Of 9 lung tumors, pulmonary toxicities were observed, grade ≥2 RP found in 8 lesions and one of four patients with ultra- central lesions experienced grade 5 pulmonary hemorrhage which BED3 max at the proximal bronchial tree was 243.9 Gy (high-risk indicator [7]). The multivariate analysis of factors predicting local failure was BED PTV mean. BED PTV mean <100 Gy had more local failure compared to the dose ≥100 Gy, adjusted SHR 5.41 (95% CI 1.14-25.69), p-value = 0.034, and should be one of SBRT planning indexes [5] (Fig 1A). Tumor size >5 cm had higher grade ≥2 RP, adjusted SHR 5.34 (95% CI 1.52-18.69), p=0.009 (Fig 1B). Tumor size may not directly impact symptomatic RP but higher ipsilateral lung doses [6]. 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).

Table 1. Dose regimens

Total dose/ fraction	Primary NSCLC (N=15)	Lung metastasis (N=83)	Total (N=98)
25-60/5	9	55	64 (65.3%)
40-48/4	3	6	9 (9.2%)
42-54/3	2	9	11 (11.2%)
30-36/6	0	6	6 (6.1%)
26-27.5/1	0	5	5 (5.1%)
37-37.5/10	1	2	3 (3.1%)

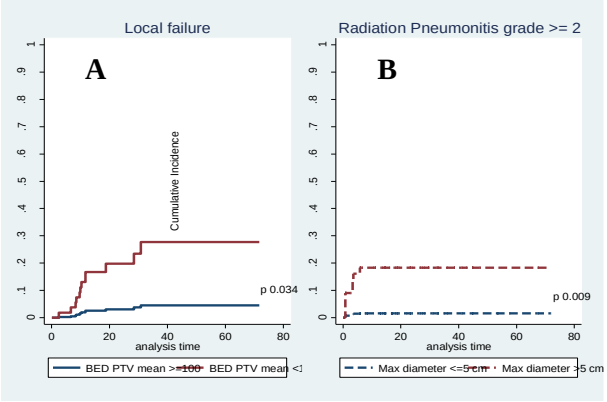

Fig. 1: Cumulative incidence curves of factors predicting local failure **(A)** and grade ≥2 RP **(B)**

CONCLUSION

Local control 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.

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