Purpose: To investigate the tumor geometric relationship to the dose variations of Anisotropic Analytical Algorithm (AAA), pencil beam convolution algorithm with/without modified Bath Power Law (PBMPPL)/PB in stereotactic body radiation therapy (SBRT) treatment plans of patients presenting with a solitary primary lung cancer.

Materials/Methods

Treatment plans of 14 patients (7 upper lobe, 7 lower lobe) were used for this study. The planning target volume (PTV) size ranges from 3.9c.c. to 156.7c.c. The SBRT treatment plans were composed of 10-12 non-coplanar photon beams as per RTOG guidelines. The prescription dose for this study were (i) 4x12Gy, (ii) 5x10Gy, and (iii) 5x11Gy.

The Varian Eclipse treatment planning system Eclipse v. 8.9 (Palo Alto, CA) was used for this study. Four-dimensional CT (4D CT) data were used to define the integral target volume (ITV) on maximum intensity projection. An 5mm circumferential margin was used to create PTV from ITV. Plans were generated with three algorithms.

Results

a). For small lesions (PTV occupy less than 1% of the ipsilateral lung volume), the PBMPL plans had overestimated the dose by average 10 % compared to AAA. But the PB without any heterogeneity correction agrees well with AAA.

b). For big lesions (PTV occupy more than 1% of the ipsilateral lung volume), the PBMPL plans had agreed well with AAA. But the PB without any heterogeneity correction underestimate the dose by average 15% compared to AAA.

c). The tumor location (Group1: within 1cm from the lung wall; Group2: 2cm away from the lung wall Group3: in between zone of 1 and 2cm from the lung wall; Group 4: Spread from the lung wall to the 2cm away zone ) seems to relate with dose calculation variations among different algorithms.

Conclusions:

Prescription adjustment is not necessary for PTV less than 1% of ipsilateral lung volume as the recent suggestion by the quality assurance working group of phase III Rosel study of prescription dose reduction of 10% from 60Gy to 54Gy when utilizing AAA instead of PBC.