AbstractID: 13222 Title: Dosimetric comparison of anisotropic analytical and pencil beam convolution algorithms in breast cancer radiation treatment planning

Purpose: The anisotropic analytical algorithm (AAA) has been shown to provide more accurate dose calculation due to 3D scatter and inhomogeneity corrections than the pencil beam convolution algorithm (PBC) for inhomogeneous anatomical regions such as lung based on Monte Carol simulation and measurements. This study aimed to investigate whether the same level of dosimetric plan quality was achievable using AAA compared to PBC in breast cancer radiation treatment planning.

Materials and Methods: This study included 10 lumpectomy (group I) and 10 mastectomy (group II) cases. All plans used for actual patient treatment were initially calculated using PBC algorithm (V8.2.23) and subsequently re-planned using the AAA (V8.6.15) in the same Eclipse treatment planning system. Re-planning involved changes in wedges, subfields and beam weightings as needed. AAA plans were normalized to achieve the same V100% (volume receiving 100% prescription dose) to the breast or chest-wall volume as the original PBC plans. The dose to ipsi-lateral breast (group I) or chest-wall (group II) and the dose to ipsi-lateral lung were compared.

Results:

For both groups, the ipsi-lateral lung in plans using AAA showed higher dose than PBC (group I D_{Mean}=9.1Gy vs 7.7Gy, p=0.002; V_{5Gy}=37.8% vs 22.8%, p=0.002) and (group II D_{Mean}=8.9Gy vs 7.6Gy, p=0.002; V_{5Gy}=33.6% vs 21.2%, p=0.002). Dosimetric differences between AAA and PBC plans were marginal either in the breast or chest-wall region while the differences between AAA and PBC plans for V90% of breast and chest-wall were statistically significant (the difference was only ~1%). For chest-wall (group II), AAA plans showed larger high-dose volumes (V105%=24.1% vs 19.5%, p=0.037; V110%=2.8% vs 1.5%, p=0.027) whereas group I showed no statistical significance.

Conclusions:

Plans using AAA calculation could achieve the similar level of dose coverage as PBC calculation for target volume. However, the lung volume receiving low dose is larger with AAA dose calculations.