Dosimetric impact of using Acuros algorithm for stereotactic lung and spine treatments

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Introduction

The main aim was to assess the dosimetric impact of calculating with the Acuros (AXB) algorithm instead of Anisotropic Analytical Algorithm (AAA) for stereotactic (SBRT) lung and spine cancer treatments.

Material and methods

- Eclipse (Varian Medical Systems) version 11: AAA and AXB
- True beam STx with HD MLC 120: 6FF and 6FFF
- Ten SBRT lung patients (6FFF)
  - Dynamic conformal arc with a prescription of 50 to 55 Gy in 3 or 5 fractions to the 80% isodose (4 patients: 5 x 10 Gy, 2 patients: 5 x 11 Gy and 4 patients: 3 x 18 Gy)
- Ten SBRT spine patients (6FF)
  - Rapid Arc plans with a prescription of 27 Gy in 3 fractions to the PTV median dose (3 x 9 Gy)
- Same beam settings and monitor units used with the AXB algorithm as with the AAA
  - Evaluation of the two dose reporting modes of AXB: dose to medium (Dm) and dose to water (Dw)
- Relative dose differences (%) between algorithms $\frac{AXB-AAA}{AAA} \times 100$ were calculated for
  - PTV, ITV: D98%, D95%, D50% and D2%
- Organs at risk:
  - Mean dose to the ipsilateral lung (lung SBRT)
  - D2% and mean dose to the spinal cord or to the cauda equina (spine SBRT)

Results

- SBRT in lung patients
  - PTV
    - $D_{95\%}$: -0.69 ± 0.21 (-2.76 ± 0.87)
    - $D_{99\%}$: 0.23 ± 0.02 (-2.17 ± 0.84)
    - $D_{50\%}$: 0.39 ± 0.24 (-0.79 ± 1.18)
    - $D_{2\%}$: 0.05 ± 0.39 (-2.64 ± 2.13)
  - ITV
    - $D_{95\%}$: 0.98 ± 0.02 (-3.75 ± 1.68)
    - $D_{99\%}$: 0.24 ± 0.14 (-2.15 ± 1.72)
    - $D_{50\%}$: 0.27 ± 0.37 (-0.58 ± 1.46)
    - $D_{2\%}$: -0.89 ± 1.12 (-2.47 ± 1.78)

- SBRT in spine patients
  - PTV
    - For D98%, D95%, D50% and D2%, AAA estimates in general higher doses than AXB for D98% and D95% for PTV lung
    - Small difference (<2%) between AAA and AXB for D50% for PTV lung
    - Less difference (<3%) between AAA and AXB for ITV than for PTV
    - AXB Dm very similar to AXB Dw

- Ipsilateral lung
  - Mean dose AxB: 0.12 ± 0.07 (AxB-AAA) (%)
  - Mean dose AxB: 0.44 ± 0.07 (AxB-AAA) (%)

- For D98%, D95%, D50% and D2%, AAA estimates higher doses than AXB Dm and lower doses than AXB Dw
- Large difference between AXB Dm and AXB Dw
- PRV spinal cord or cauda equina

- Large difference between AAA and AXB
- Higher difference in mean dose than in D2%

Conclusion

For SBRT spine patients, the discrepancies between AAA, AXB Dw and AXB Dm calculations can be important and the choice of the dose reporting mode has to be carefully evaluated. For SBRT lung patients, less discrepancies were found in the studied cases, nevertheless, special care on low density lung and small field has to be paid.