

Dosimetric comparison of Acuros and AAA algorithms in Spine Stereotactic Body Radio Surgery (SBRT)

Raheel Mukhtar, Sana Mazhar, Khalid Iqbal, Khurram Khan,
Mahnaz Qamar, Tabinda Sadaf
Medical Physics Department, Shaukat Khanum Memorial Cancer Hospital and Research Centre, Lahore, Pakistan

OBJECTIVE

Compare AAA and Acuros calculations for target dose coverage, homogeneity and dose falloff in single-fraction spine SBRT.

METHODS

We compared 21 matched AAA–Acuros plan pairs. All plans were made using Eclipse/ARIA version 18.0.1, with two full arcs per plan and a prescription of 18 Gy in 1 fraction.

All plans passed EPID QA using portal dosimetry at gamma criteria of 1%/1 mm.

We calculated means $\pm$ sample SD and paired differences. Two-sided Wilcoxon tests compared eight dose/HI endpoints, with Holm correction for multiple comparisons.

Mean $\pm$ SD.
*CI/GI provisional (20 pairs).

TREATMENT

Eclipse/ARIA version 18.0.1

TrueBeam linear accelerator

10 MV FFF photons

Reported dose rate: 2400 cGy/min. Confirm machine setting as 2400 MU/min.

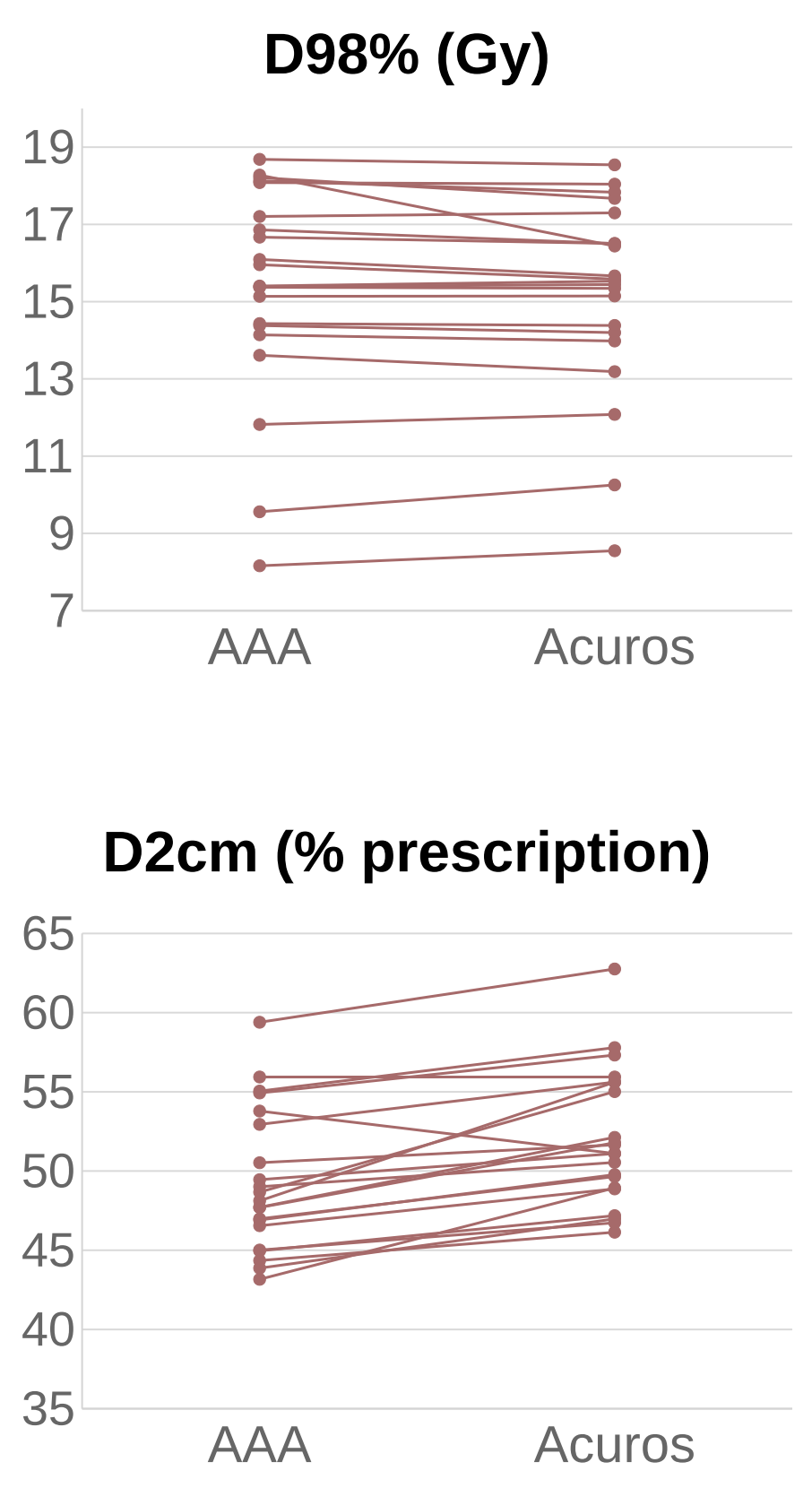
DOSIMETRIC PARAMETERS		
Metric	AAA	Acuros
D2% (Gy)	22.02 $\pm$ 1.15	21.85 $\pm$ 0.82
D98% (Gy)	15.31 $\pm$ 2.79	15.15 $\pm$ 2.53
D50% (Gy)	19.91 $\pm$ 0.52	19.92 $\pm$ 0.57
D95% (Gy)	17.13 $\pm$ 1.85	16.95 $\pm$ 1.79
HI	0.336 $\pm$ 0.161	0.336 $\pm$ 0.142
D2cm (%)	49.29 $\pm$ 4.47	52.03 $\pm$ 4.32
RTOG CI*	0.934 $\pm$ 0.054	0.920 $\pm$ 0.078
GI*	4.097 $\pm$ 0.525	4.191 $\pm$ 0.725

RESULTS

Acuros increased D2cm by 2.74 percentage points (Holm $p = 0.004$).

Mean D95% decreased by 0.18 Gy, but did not reach corrected significance ($p = 0.067$).

D2%, D98%, D50%, D99%, D100% and HI also showed no significant difference after correction.



CONCLUSION

Acuros XB is preferred for spine SBRT because its transport-based modelling more accurately represents material composition and radiation transport at bone–soft tissue interfaces. Published phantom and Monte Carlo validation support superior accuracy over AAA in heterogeneous media [1,2].

We recommend Acuros XB for final dose calculation after local commissioning. This study demonstrates algorithm-dependent dose differences. The accuracy recommendation rests on published validation.

EPID QA

All plans passed at 1%/1 mm (department-reported). Recorded gamma passing rates: 99.0–100.0%, mean 99.88% (38 arcs from 19 paired plans).

[1] J Radiat Res. 2024;65:109–118. [2] Med Phys. 2011;38:2208–2221.