

AbstractID: 12850 Title: The Effect of Uterine Motion and Margins on Doses in Intensity Modulated Radiation Therapy of Cervical Cancer

Purpose: In cervical cancer, uterine motion can be large relative to cervix motion. Target vs normal tissue (NT) dose tradeoffs are quantified using published motion estimates and margins derived from standard formulas.

Methods: 10 anonymized cervical cancer patients had prescription dose of 48.75Gy over 25 fractions. Plans were created with a uniform 1cm margin (PTV_A), and a margin tapering from 2.4cm at the uterine fundus to 1cm at the cervix (PTV_B). These were combined with motion model 1 (MM1) in which all structures moved normally with 3mm standard deviation (SD), and motion model 2 (MM2) in which the motion SD increased from 3mm at the cervix to 7.5mm at the fundus. 3mm SDs (1cm margins) are consistent with measured cervix motion, usually extrapolated to the entire PTV (upper vagina+cervix+uterus). 7.5mm SDs (2.4cm margins) are consistent with more recent uterine motion estimates. Plan evaluation utilized dose volume histograms (DVHs).

Results: For MM2, PTV_A gives inadequate dose to the fundus and CTV. The 95th percentile of fundus D₉₈ dose, denoted D_{98,95}, drops from 49.8Gy in MM1 to 44.5Gy in MM2. Target dose is restored by using PTV_B. However, NT volumes receiving doses of 30-50Gy increase by up to 11%. Half the increase can be attributed to the normal tissues' own motion moving them into the radiation field, the other half to the expanded margin in PTV_B.

Conclusions: For a uniform 1cm margin, larger uterine motion reduces fundus dose by about 5Gy and increases NT volumes receiving 30-50Gy by ~5%, relative to plans where the uterus has cervix-like motion. Use of a tapered margin (PTV_B) can restore fundus and CTV dose, but will increase NT volumes receiving 30-50Gy by a further ~5%. Use of percentile doses and DVHs is a useful method of evaluating the dosimetric effect of different motion scenarios.