AbstractID: 2837 Title: What does the dosimetric errors encountered in prostate brachytherapy tell us about the alpha/beta ratio

Purpose: Use the linear quadratic model to evaluate the α/β ratio for prostate cancer taking into account the dosimetric errors resulting from seed displacements in prostate permanent implant brachytherapy with ^{125}I and ^{103}Pd. The study tests the sensitivity of the α/β ratio for different values of the prescribed external radiation dose, different published values of the Relative Biological effectiveness (RBE) for both ^{125}I and ^{103}Pd and different prescribed implanted dose.

Method and Material: The biological effective dose (BED) for prostate implant brachytherapy is equated to the external radiation therapy dose to derive an equation for α/β ratio. α/β ratio is then determined for different values of the implanted ^{125}I or ^{103}Pd dose and for different published values of the RBEs. The analysis took into account dosimetric errors resulting from inaccurate placement of seeds or seed movements after placement. The dosimetric uncertainties were previously determined from Monte Carlo simulation model which accounted for the seed positioning errors.

Results: The results showed that the α/β ratio for prostate cancer varies between 1.0 and 4.5 for an RBE of 1.0 for an external prescribed dose of 78.0 Gy. When published values of RBEs are incorporated into the analysis, the α/β ratio varies between 0.37 and 4.4. For RBE values ranging from 1.0 to 2.0, α/β ratio decreases from 1.55 to 0.55 for an implanted dose of 145 Gy and an external beam dose of 78 Gy. The α/β ratio changed by 30% when the external beam radiation dose was increased from 72 Gy to 80 Gy.

Conclusions The α/β ratio for prostate cancer is uncertain and could be as low as 0.37 and as high as 7 depending on which factors have been incorporated into the analysis. Taking an average reduction in implanted dose of 10-20%, realistic values of α/β ratio for prostate tumor lies between 0.7 and 3.0