AbstractID: 8713 Title: Detailed Radiobiological Analysis Does Not Distinguish Between Biochemical Failures in a Case Control Study of Permanent Prostate Brachytherapy Patients

Purpose: To determine dosimetric and radiobiological predictors of biochemical control after recalculation of prostate implant dosimetry using updated AAPM Task Group 43 (TG-43) parameters and the radiobiological parameters recommended by TG-137.

Materials & Methods: All biochemical failures among patients implanted with ^{125}I or ^{103}Pd sources between 1994 and January 2006 were matched 2:1 with non-failure controls. The individual matching was by risk group, radionuclide, prescribed dose, and time of implant (one match before and one after the failed patient). Complete dose volume histogram (DVH) data was recalculated for all 55 cases and 110 controls after updating the original source strength by the retrospectively determined ratios of TG-43. Differential DVH data was acquired in 179 increments of prostate volume versus percent-prescribed dose. At each dose level, the biologically equivalent dose, BED_i, equivalent uniform dose, EUD_i, and tumor control probability, TCP_i were calculated from the implant dose along with any external beam delivered to the patient.

Results: There was no significant difference between failures and controls in terms of total BED (143 vs. 142 Gy), EUD (95 vs. 94 Gy), or TCP (0.87 vs. 0.89). Conditional logistic regression analysis factored out the matching variables and stratified the cohort into each case and his controls, but no radiobiological parameter was predictive of biochemical failure. However, there was a significant difference between radiobiological parameters of ^{125}I and ^{103}Pd due to less complete coverage of the target volume by the former isotope. The implant D_{90} dose was highly correlated with BED, EUD, TCP and natural prescription dose.

Conclusion: In this case-control study of prostate brachytherapy biochemical failures and non-failures, there were no radiobiological parameters derived from detailed DVH based analysis that predicted for biochemical control. This may indicate that the implant dosimetry in this study is at or near the limits of dose escalation.