AbstractID: 2845 Title: External Beam Radiotherapy Boosts to Reduce the Impacts Caused by Edema in Prostate Permanent Seed Implants

Purpose: In prostate permanent seed implants, it has been shown that edema caused by the surgical procedure decreases dose coverage and hence may reduce treatment efficacy. External beam boosts can be utilized to neutralize the negative impact of edema so that originally desired treatment efficacy can be achieved. This study is to investigate the number of fractions needed in these external beam boosts.

Method and Materials: The reduction in treatment efficacy can be characterized with an increase in tumor cell survivals and biomathematical models have been developed to calculate the tumor cell survival increases in seed implanted prostates of different edema sizes and durations. A linear quadratic radiobiological model was used to derive the number of fractions needed in the external beam boosts with which the tumor cell survival fractions will be reduced to the desired levels. Prostate edema of different durations and sizes was taken into consideration in tumor cell survival fraction calculations.

Results: As edema duration and size increased, the fraction number needed in the external beam boosts increased for both ^{125}I and ^{103}Pd seed implants. For edema of same duration and size, the needed number of fractions was higher in ^{103}Pd implants than in ^{125}I implants. External beam boost is needed for all the edemas investigated in ^{103}Pd implants while in ^{125}I implants the boost can be avoided for edemas of relatively short duration (3 days) and sizes (less than 20%).

Conclusion: In conclusion, fractionation sizes have been determined for the external beam boosts that are needed to neutralize the negative impacts caused by edema in both ^{125}I and ^{103}Pd prostate seed implants. The number of fractions needed is larger in ^{103}Pd implants than in ^{125}I implants. The fractionation sizes are also influenced by various radiobiological parameters, and these influences increase as edema size increases.