Abstract ID: 7523 Title: The impact of procedure-induced edema on cell survival and tumor control probability in permanent prostate brachytherapy using 131Cs radioactive source

**Purpose:** Procedure-induced prostate edema can cause significant changes to the dose delivered by a permanent prostate brachytherapy. The aim of this work was to examine systematically the impact of procedure-induced edema on the effectiveness of cell kill in permanent prostate brachytherapy using 131Cs radioactive sources.

**Method and Materials:** The concept of biologically effective dose (BED) was used to quantify the impact of prostate edema on the radiation-induced cell kill in 131Cs permanent prostate brachytherapy. The repopulation of surviving cells and the repair of sub-lethally damaged cells during the protracted dose delivery was modeled by the cell potential doubling time and a repair half-time, respectively. The procedure-induced prostate edema and its resolution dynamics was described by a quantitative model reported by Waterman et. el. (Int. J. Radiat. Oncol. Biol. Phys. 41, 1069-1077, 1998). The surviving fraction of cancer cells and the potential tumor control probability was examined over a range of edema magnitudes and resolution half-lives observed in real patients.

**Results:** When edema was neglected in pre-implant treatment planning, the BED of an actual implant was found to depend strongly on the edema magnitude, its resolution half-life, and tumor potential doubling time. For a typical edema with magnitude of 50% and half-life of 10 days, the edema-induced reduction in BED was greater than 15% resulting in an increase of cell-survival by more than one order of magnitude. For larger edemas with magnitude of 90% and half-life of 20 days, the edema-induced increase in cell survival was more than two orders of magnitude.

**Conclusions:** Procedure-induced edema can cause significant reduction in BED and increase in cell survival in 131Cs permanent prostate brachytherapy. Depending on the initial tumor burden, the increase in cell survival could lead to significant reduction in tumor control probability for patients having moderate and large edemas.