

By parametrizing the dose fall-off from a radioactive seed as a single inverse power function of distance ($D(r) \propto r^{-2.4}$ for ^{125}I and $\propto r^{-2.8}$ for ^{103}Pd), a rigorous solution of the dosimetric effects of edema on a permanent prostate seed implant has been derived. The solution provided an explicit proof that the relative dosimetric effects of edema, as found in the previous numerical studies by Yue et. al. [1], are independent of the size of implant volume, the number of seeds used, and the seeding configuration for a given edema. It showed that the size of relative dosimetric effects caused by an edema is also independent of the dose evaluation point within the target volume. The analytic solution was found in good quantitative agreement with those obtained from the direct numerical simulation [1], which enables a complete tabulation of the relative dosimetric effects of edema as a function of the edema magnitude and edema half-life for both iodine-125 and palladium-103 permanent implants. These tables make it easy to assess the impact of edema in preplanning a prostate seed implant and in evaluating the accuracy of conventional post implant dosimetry.

[1] Yue et al, Int. J. Radiat. Oncol. Biol. Phys. 43, 447-454, 1999.