

AbstractID: 7217 Title: Determination of Feasibility and Prescribed Dose for ¹⁴²Pr Glass Seeds for Prostate Cancer Brachytherapy

Purpose: A ¹⁴²Pr glass seed is proposed for brachytherapy treatment of prostate cancer. A prescribed dose for ¹⁴²Pr was derived and case study performed to assess the feasibility of the ¹⁴²Pr seed.

Method and Materials: Sensitivity studies using the linear-quadratic model and biological parameters were conducted to find the prescribed dose for ¹⁴²Pr. A case study was performed to assess the feasibility of the ¹⁴²Pr seed and modeled using the VariSeed™ program. The main work was the description of the seed, optimized planning, and comparison with conventional seeds.

Results: 90 Gy from ¹⁴²Pr can give the equivalent biological effective dose (BED) of 144 Gy from ¹²⁵I and 125 Gy from ¹⁰³Pd using reasonable assumptions. As the α/β ratio decreases, the BED for ¹⁴²Pr increases exponentially. The BED of ¹⁴²Pr was insensitive to the tumor repopulation factor. Therefore, ¹⁴²Pr is acceptable for treating tumors with high tumor repopulation factor and low α/β ratio. Based on the dose-optimization planning, the best arrangement of seeds, dose coverage, and isodose contours were found using ¹⁴²Pr glass seeds with the initial activity of 6 mCi. Fifty ¹⁴²Pr seeds can deliver the prescribed dose to about 90% of the prostate volume satisfying the dose constraints rules which were set to give lower dose to adjacent organs. From the comparisons, the coverage of ¹⁴²Pr glass seeds was higher than that of typical ¹²⁵I seeds. The surface area of the rectal wall exposed by ¹⁴²Pr glass seeds was less than that by ¹²⁵I seeds.

Conclusion: A prescribed dose of 90 Gy is suggested for ¹⁴²Pr. ¹⁴²Pr glass seeds can deliver the prescribed dose to a larger volume of the prostate and the undesired doses to adjacent organs were less than seeds using low energy photons.