AbstractID: 7490 Title: Multiple-radionuclide brachytherapy sources: Dosimetry characteristics, prescription dose and DVH

Purpose: To study the potentiality of brachytherapy seeds loaded with two radionuclides from a dosimetric point of view and from a Dose-Volume Histogram point of view.
Method and Materials: First the AAPM TG43U1 dosimetry formalism has been adapted in order to implement multiple radionuclide brachytherapy sources in present Treatment Planning System. Monte Carlo simulations have been performed to derive the dosimetric characteristics of a source based on a mixture of ^{103}Pd with ^{125}I and ^{103}Pd with ^{131}Cs. The linear quadratic model has then been used to derive the prescribed dose for such bi-radionuclide sources, using the ^{103}Pd, ^{125}I or ^{131}Cs brachytherapy experience as benchmarks. The prescribed dose has been determined for different biological parameter (α, β, T_{rep}, T_{pot}) and edema characteristics (resolving rate, magnitude). Dose-volume histograms of virtual patients implanted with bi-radionuclide seeds have been computed using commercialized Treatment Planning Systems.
Results: The derived prescription dose is similar if ^{103}Pd or ^{125}I are use as benchmarks but differs by about 30 Gy if ^{131}Cs brachytherapy is used as a reference. Dose-volume histograms show that these bi-radionuclide sources decrease the dose and dose rate to the surrounding organs at risk and reduce also the number of cold spots caused by dose inhomogeneity.
Conclusions: We present how we adapted the AAPM TG43U1 dosimetry formalism to make the use of multiple radionuclide brachytherapy sources compatible with current treatment planning. We also describe the method used to derive the prescription dose for such sources. Finally, the effect on the DVH is highlighted.