AbstractID: 12781 Title: Benefits of Radiotherapy added Nanoparticle assessed by a Quantitative Analysis of Dose-Gradient: an Evaluation in Soft and Lung Tissues by Monte Carlo

Purpose: Evaluate the volume fraction enclosed by maximum isodose ($isodose_{max}$) within a structure as a quantitative criterion for assessing the benefits of using nanoparticles in Radiotherapy. **Material and Methods:** Dose enhancement can be evaluated in a volume with and without nanoparticles by the ratio between mean doses, defining an average-dose-enhancement-factor (DEF). Decompounding DEF in multiplicative terms is possible to define a maximum-dose-enhancement-factor(DEFmax) and a dose-gradient-factor(GF). GF express what fraction of volume is enclosed by the $isodose_{max}$ present in the analyzed structure. GF close to 1 express that the $isodose_{max}$ present in the analyzed volume increase its value. GF close to 0 indicates that the $isodose_{max}$ decrease its value. Soft and lung targets with 3x3x1cm³ containing and not containing 0.11mM concentration of gold nanoparticles (AuNP) were considered to Monte Carlo simulations, performed with PENELOPE-2008. Adjacent-volumes were delimited as tissues 1cm far from the target in all directions. A 120kV x-ray beam was considered to simulate Intra-Operative-Radiotherapy situations. **Results:** Dose distributions visually revels changes in dose-gradient and depth dose curves presents it quantitatively. In target soft tissue: $DEF_{soft-tissue}^{target} = 2.44$ and $DEF\max_{soft-tissue}^{target} = 2.40$; To adjacent-volume $DEF_{soft-tissue}^{adjacent\ volume} = 1.14$ and $DEF\max_{soft-tissue}^{adjacent volume} = 2.44$. It indicates that in target $isodose_{max}$ changes not so much, presenting almost the same values in situations with and without AuNP; However in adjacent-volume $isodose_{max}$ had its value increased. In target lung tissue: $DEF_{lung-tissue}^{target} = 2.43$; $DEF\max_{lung-tissue}^{target} = 2.49$; $DEF_{lung-tissue}^{adjacent\ volume} = 0.92$; $DEF\max_{lung-tissue}^{adjacent volume} = 2.30$. These parameters indicate that the $isodose_{max}$ changes its value not so much in lung-target but radically in lung-adjacent-tissue. This behavior is expressed in each corresponding GF of these structures: $GF_{soft-tissue}^{target} = 1.02$; $GF_{soft-tissue}^{adjacent volume} = 0.47$; $GF_{lung-tissue}^{target} = 0.97$; $GF_{lung-tissue}^{adjacent volume} = 0.39$. **Conclusions:** AuNP increase the mean dose in target and decrease radically the maximum isodose in adjacent tissues. The GF express quantitatively how attenuation and dose-contribution effects are balanced providing information to guide clinical cases of nanoparticle added to Radiotherapy.