AbstractID: 12823 Title: Silver Nanoparticle added to Nuclear Medicine: a Preliminary Evaluation of Dose Increase in Iodine Therapy assessed by Monte Carlo

Purpose: Investigate physical aspects of silver nanoparticle (AgNp) application in iodine therapy aiming increase dose conformality in Nuclear Medicine treatments of thyroid disease. **Material and Methods:** AgNp (2-3nm size) were considered uniformly embedded in thyroid tissue in 1% mass concentration. PENELOPE-2008 Monte Carlo code was used to perform the simulations. A faithful neck geometry was described in PENGEOM-2008 code, considering air cavity, spinal cord and all relevant tissues present in clinical cases. Iodine-131 radioactive events inside thyroid volume were simulated considering beta and photon energy spectrums. Monte Carlo spectrometry was applied inside thyroid volume to identify components with high probability of interaction with silver atoms that increase dose locally due to AgNP presence. Dose increase in thyroid volume was calculated as the ratio between total dose deposited with and without AgNp $\left(DEF = \overline{D}_{without\ AgNp} / \overline{D}_{with\ AgNp}\right)$ and comparing total doses deposited in studied volumes. Dose conformality increase was evaluated from changes in dose-profiles and isodose curves inside the neck. **Results:** The DEF was 1.19 to thyroid volume (target) and 0.40, 0.56, 0.77 and 0.63 to spinal cord, spinal bone, parotids and sublingual base, respectively. In non-target regions, DEF lower than 1 indicate that the dose decrease, resultant from high absorptions of fluency that occurs locally in target volume. Total dose in thyroid volume increases from 32.43Gy to 38.40Gy due to AgNp presence, representing 18.4%. In axial and longitudinal profiles is possible to observe that the doses not only increase in target region, but also decrease in healthy volumes, contributing to more conformal treatment. **Conclusions:** Silver nanoparticle added to Iodine therapy can contribute to dose increase changing dose conformality in benefic therapeutic levels. Monte Carlo simulation is a powerful tool to investigate metal nanoparticle applications in Nuclear Medicine cases. Future investigations will asses nanoparticle atomic number and concentration variations.