AbstractID: 9655 Title: On the clinical implementation of gold nanoparticle-aided radiation therapy (GNRT)

Purpose: To present possible strategies for the clinical implementation of *gold nanoparticle-aided radiation therapy (GNRT).* **Method and Materials:** *GNRT* is an emerging treatment modality currently under development. *GNRT* would provide a way to substantially escalate the tumor dose far beyond the current limit while maintaining the normal tissue dose at the levels comparable to conventional radiation therapy. The current study investigated possible strategies for clinical implementation of *GNRT* by surveying existing *in-vivo* data and performing Monte Carlo (MC) calculations for the cases mimicking typical clinical situations. The cases included in this study were a brachytherapy case using Yb-169 source and an external beam radiation therapy (EBRT) case using low energy-enhanced megavoltage photon beams (e.g., 4 MV and 2 MV) that can be generated by a slight modification of a conventional design of linear accelerators. **Results:** The MC calculations suggest the macroscopic dose enhancement factor (MDEF) within the tumor region could be 42 and 200%, for the gold concentration levels of 7 and 18 mg Au/ g tumor, respectively, with Yb-169 source. The current results also suggest the macroscopic dose enhancement ranging 10 to 40% could be achievable across the tumor volume with low energy-enhanced megavoltage photon beams at a realistic tumor gold concentration (e.g., between 7 and 30 mg Au/g tumor). Besides, the current investigation indicates the dose distributions due to low energy-enhanced megavoltage photon beams could be created comparable to those due to conventional megavoltage beams, while producing the suggested level of tumor dose enhancement. **Conclusion:** According to the current study, *GNRT* appears to be very feasible via a brachytherapy apparoch using Yb-169 source. *GNRT* also appears to be feasible for EBRT with low energy-enhanced megavoltage photon beams. The tumor dose under these implementation scenarios may be enhanced further with an active targeting of tumor cells with gold nanoparticles.