AbstractID: 7252 Title: Enhancement of cell killing by x-ray irradiation in the presence of gold nanoparticles

Purpose: This investigation was initiated to determine the radiobiologic enhancement for x-ray irradiation of cells in the presence of citrate-stabilized gold nanoparticles.

Method and materials: Citrate-stabilized gold nanoparticles were added to a strain of lymphoma cells in suspension at a concentration of 0.017 mg of gold per ml. Cell suspensions prepared included a two sham controls, and two samples with gold nanoparticles. One sham and one gold nanoparticle based sample were irradiated with x-ray photons from a clinical x-ray device (120 kVp, 6.67 mm Al equivalent beam). A total dose of 0.91 Gy was delivered in two approximately equal parts (24 hour separation). The non-irradiated cell suspensions were treated identically. Cell survival for non-irradiated cell suspensions and irradiated cell suspensions were determined over 72 hours using methylene blue dye exclusion.

Results: The ratio of live:dead cells for all cell suspensions was 7.5:1 at the start of the experiment. After 72 hours, the irradiated cells exhibited a ratio approximately 50% lower than the non-irradiated cells. The irradiated cell suspension with gold nanoparticles showed enhanced cell killing.

Conclusions: Even at the low gold concentration and low x-ray energy, gold nanoparticles exhibit some enhancement of cell killing. Further studies are ongoing using increasing gold concentrations and varying radiation doses. It is likely that the presence of higher Z materials contributes to secondary electron dose in a way that may be described only through microdosimetry methods.
Gold nanoparticle-enhanced radiation therapy is a possible outcome of this work. Additional effort is directed toward functionalized gold nanoparticles using targeting moieties for specific cancers. This work contributes toward an understanding of the therapeutic enhancement that may be expected with specific concentrations of gold nanoparticles.
Supported by: NIH R01 CA119412-01