



Nanomedicine- Are There Safety Concerns?

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Abstract

Nanotechnology has made significant contributions to medical diagnostics and therapeutics. In fact, there has been much progress seen in the field of cancer nanomedicine. However, there are still challenges to be dealt with, such as an incomplete understanding of nano-bio interactions and concerns related to nanosafety. One example of nanoparticles that have emerging oncological applications as prospective theranostic agents is gold nanoparticles (AuNPs). However, AuNPs are known to have potential adverse effects that may give rise to health risks. We show that 20 nM size AuNPs can be internalized by lung fibroblasts and small airway epithelial cells as evidenced by conventional transmission electron microscopy coupled with energy dispersion X-ray microscopy for elemental profiling and advanced microscopy techniques. Intracellular uptake of AuNPs was also observed to be associated with the production of reactive oxygen species giving rise to oxidative stress and a host of undesirable biological effects such as DNA damage and cytotoxicity, as well as altered gene and protein profiles affecting many cellular and functional processes. Using an *in vivo* model system, intravenous administration of AuNPs in Wistar rats revealed the presence of inflammatory changes in the lungs. The studies have highlighted the toxicity of AuNPs in *in vitro* and *in vivo* experimental systems, clearly demonstrating that AuNPs can induce unwanted and detrimental effects in normal lung cells. Hence, the importance of risk assessments and safety measures that have to be in place, when AuNPs, and other types of nano-platforms are used in nanomedicine.

Keywords: *Nanomedicine, Nanosafety, Gold nanoparticles, Cytotoxicity, Altered gene and protein profiles, inflammatory changes in lungs*
