Research Article

Journal of Applied Toxicology

Received: 16 July 2013, Revised: 9 September 2013, Accepted: 26 September 2013 Published online in Wiley Online Library: 15 November 2013

(wileyonlinelibrary.com) DOI 10.1002/jat.2956

Interaction between silver nanoparticles of 20 nm ($AgNP_{20}$) and human neutrophils: induction of apoptosis and inhibition of *de novo* protein synthesis by $AgNP_{20}$ aggregates

Michelle Poirier, Jean-Christophe Simard, Francis Antoine and Denis Girard*

ABSTRACT: Cytotoxic and proinflammatory properties of silver nanoparticles (AgNPs) have been reported in few studies but the direct interaction between AgNPs and neutrophils, which play a key role in inflammation, has never been documented. Here, we examined the role of AgNPs with a starting size of 20 nm ($AgNP_{20}$) in human neutrophils. Using dynamic light scattering for the characterization of NPs suspended under identical conditions to those used for *in vitro* experiments, we found that, at 10 μg ml^{-1}, 92% of $AgNP_{20}$ possess a diameter of 17.1 nm but, at 100 μg ml^{-1}, a tri-modal size distribution with large aggregates was observed (> 500 nm). Neutrophil cell size increased when treated with $AgNP_{20}$ and transmission electronic microscopy experiments revealed that $AgNP_{20}$ can rapidly interact with the cell membrane, penetrate neutrophils, localize in vacuole-like structures, and be randomly distributed in the cytosol after 24 h. Treatment with 100 μg ml^{-1} $AgNP_{20}$ for 24 h (but not 10 μg ml^{-1}) increased the neutrophil apoptotic rate and inhibited *de novo* protein synthesis. We conclude that $AgNP_{20}$ induced apoptosis and can act as potent inhibitors of *de novo* protein synthesis at 100, but not 10 μg ml^{-1} in human neutrophils.

Keywords: silver nanoparticles; inflammation; neutrophils; apoptosis; protein synthesis