Interaction between silver nanoparticles of 20 nm (AgNP\textsubscript{20}) and human neutrophils: induction of apoptosis and inhibition of \textit{de novo} protein synthesis by AgNP\textsubscript{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\textsubscript{20}) in human neutrophils. Using dynamic light scattering for the characterization of NPs suspended under identical conditions to those used for \textit{in vitro} experiments, we found that, at 10 \textmu g ml\textsuperscript{-1}, 92\% of AgNP\textsubscript{20} possess a diameter of 17.1 nm but, at 100 \textmu g ml\textsuperscript{-1}, a tri-modal size distribution with large aggregates was observed (> 500 nm). Neutrophil cell size increased when treated with AgNP\textsubscript{20}, and transmission electronic microscopy experiments revealed that AgNP\textsubscript{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 \textmu g ml\textsuperscript{-1} AgNP\textsubscript{20} for 24 h (but not 10 \textmu g ml\textsuperscript{-1}) increased the neutrophil apoptotic rate and inhibited \textit{de novo} protein synthesis. We conclude that AgNP\textsubscript{20} induced apoptosis and can act as potent inhibitors of \textit{de novo} protein synthesis at 100, but not 10 \textmu g ml\textsuperscript{-1} in human neutrophils. Copyright © 2013 John Wiley & Sons, Ltd.

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