Analysis of cell cycle, apoptosis rate and DNA damage in neuronal cells exposed to differently charged gold nanoparticles

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Gold nanoparticles (AuNP) are widely used for numerous applications in different fields, and in the last years they have gained significant attention in biomedicine. Due to their small size and particular physical-chemical properties, AuNP stand out for their potential application in neurological disorders, since they can cross the blood-brain barrier. In this context, it is relevant to discard any possible adverse effects on nervous system cells once they are introduced into the body. On this basis, the main objective of this work was to assess the potential cytotoxic and genotoxic effects of differently charged AuNP (i.e. anionic, cationic and neutral) at biologically relevant concentrations on human neuronal cells (SH-SY5Y) treated for 3 and 24 h. Potential alterations of cell cycle as well as apoptosis induction were assessed by flow cytometry as indicative of cytotoxicity, whereas genotoxicity was analyzed by comet assay and γH2AX analysis. Slight cell cycle alterations were observed for all AuNP whereas increased percentage of apoptosis cells were found just for neutral AuNP after 24 h of treatment. Furthermore, the three tested AuNP showed a low genotoxic potential, inducing very slight primary DNA damage in comet assay and low, although significant, increases of double strand breaks evaluated by γH2AX assay. These results provide a better understanding of AuNP biological behaviour and are satisfactory for their possible use in nervous system-targeted applications.

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