THE IMPACT OF REACTIVE OXYGEN SPECIES ON THE BIOLOGICAL ACTIVITY OF SURFACE-MODIFIED MAGNETITE NANOPARTICLES

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Abstract

Reactive oxygen species (ROS) have been proposed as the underlying mechanism involved in the adverse biological effects of iron oxide nanoparticles. The data published to date are, however, inconsistent, and the mechanism underlying ROS formation has not been completely elucidated. Here, we investigated the capacity of several surface-modified magnetite nanoparticles (MNPs) to generate ROS in human lung cancer (A549) and diploid (HEL 12469) cells. All MNPs were characterized in-depth by different physico-chemical methods. Particle size distribution, colloidal stability and zeta potentials in culture media were determined by dynamic laser light scattering, and the amount of internalized MNPs was quantified by atomic absorption spectrometry. Although all MNPs induced certain levels of ROS in both A549 and HEL 12469 cells, none of them produced any significant increase in oxidative damage to DNA in either of these cell lines. Indeed, no changes in the total antioxidant capacity and intracellular glutathione levels were observed in MNPs-treated human lung cell lines regardless of surface coating. In line with this, no increase in activities of GPx in A549 cells and of SOD in HEL 12469 cells were detected. Despite this, only discreet changes in the GPx and SOD activities were observed in HEL 12469 and A549 cells, respectively. In conclusion, our data indicate that oxidative stress plays, at most, only a marginal role in the biological activity of surface-modified MNPs in human lung cells.

Keywords: Magnetite nanoparticles, ROS, oxidative DNA damage

ACKNOWLEDGEMENTS

This study was supported by the VEGA grants 2/0051/09, 2/0143/13 and 2/0163/12, APVV-0658-11 grant, and by the grant through the EEA FM and the NFM (project SK0020).

Author did not supply full text of the paper/poster.