Study of the radiosensitizing properties induced by PEGylated magnetic nanoparticles.

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In the field of radiosensitizing compounds, high-Z nanoparticles (NPs) have received growing interest. Up to now, reports have highlighted the ability of such nanoparticles to increase tumor cell death upon irradiation, improving thus, the radiation treatment efficiency. Despite some extensive studies led in the field (especially focused on golds NPs (GNPs)), the mechanism(s) responsible for the radiosensitization effect of GNPs remains poorly understood, and mainly focused on physical effects (i.e. dose increase due to secondary particle emission after collision between the NPs and the ionizing radiations). Interestingly, recent studies suggest the central role of some biochemical mechanisms on the observed radiosensitizing effect [1]. A significant correlation has been made between the inhibition of the detoxification enzyme in GNP-treated cells and the magnitude of radiosensitizing effect [2]. These enzymes play a key role in the detoxification system of cells by catalyzing the transformation of reactive oxygen species into stable oxygen compounds such as O_2 and H_2O.
In view of these elements, we were interested to study if such inhibition behavior may be evidenced for other kind of NPs. Owing to their biocompatibility and superparamagnetic properties, iron oxide nanoparticles (SPION) were selected. Stable SPION were obtained by coprecipitation, followed by a surface treatment using a carboxylated-silane (i.e. TEPSA). PEG chains were further introduced by a subsequent coupling reaction [3]. The size, magnetic properties, surface modification were characterized using respectively transmission electron microscopy (TEM), NMRD profile, dynamic light scattering. In addition, a feasibility study was first approached by biocompatibility study and the cellular uptake evaluation. Irradiation of a lung carcinoma cell line incubated with iron oxide nanoparticles evidenced a potent radiosensitizing effect, which suggests the use of our nano-objects as a theranostic platform.

References

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