Mechanism of ultrasmall superparamagnetic iron oxide nanoparticles-induced glioblastoma multiforme cytotoxicity: Effects on mitochondrial function

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This study investigated the in vitro cytotoxic effects of Ultrasmall Superparamagnetic Iron Oxide Nanoparticles (USPIONs) uptake on GBM function. USPIONs with a mean core diameter between 10–15 nm were loaded to CNS-1 cells cultures at different concentration (10-200 µg/mL) and its cytotoxic effects were assessed in different time-point (2-24 hr). Rat CNS-1 was chosen as our GBM model in this study because it was developed to obtain a histocompatible astrocytoma cell line with infiltrative and growth pattern similar to human gliomas. The uptake of USPIONs was analysed using the JEOL1011 transmission electron microscope (TEM) and the iron quantification was assessed using Graphite Furnace Atomic Absorption Spectrometry (GFAAS). The cell viability and the mitopotential were measured using the MUSE Count & Viability Kit and the MUSE Mitopotential Assay Kit. Bioenergetics was examined using Seahorse Mito Stress Test. TEM showed that USPIONs entered CNS-1 via clatherin coated pits which were then internalized in vacuoles. The biological effects of USPIONs on CNS-1 cell viability and mitopotential were dose and time-dependent. USPIONs at 5-200 µg/mL decreased the cell viability of CNS-1 cells at 12 hr (Control: 100%±0, USPIONs: 74.62%±2.11, P<0.05). USPIONs at 10-200 µg/mL increased the percentage of total depolarized cells at 12 hr (Control: 0.03±0.01, USPIONs: 0.37±0.12, P<0.05). Through these studies, it deepened our understanding of the cytotoxic effects of USPIONs on GBM function.

Fingerprinting heterogeneity of glioma using PET/MRI information

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This project is proposing a novel machine learning algorithm based on Generative Method to characterize intra-tumor heterogeneity of glioma. The algorithm was applied on dynamic [18F] FET-PET, [18F] Fmiso PET, rOEF, MRI T1, T2, T1W, T2W, FLAIR, DCE MRI and so on. This probabilistic model allows for different tumor boundaries in each channel, reflecting difference in tumor appearance across modalities. Classification result shows partly distributed feature maps in order to be able to select relevant features amongst wide patient data. The identified parts with different malignancy were discussed and validated according to first, the manual segmentations by clinical experts to investigate the performance on the tumor borders and second, graph maps to investigate the performance on the intra tumor regions. The main aim of the project is focused on the extraction of the additive information from PET and combining it with the MRI images information for each patient and relating them to the grade of malignancy.