Multifunctional Nanoparticles for Cancer Theranostics

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Gliomas display a poor disease prognosis causing death within 15 months after diagnosis. Chemotherapy has offered some hope to target this, however, it is majorly ineffective due to the low therapeutic window, poor efficacy and high cytotoxicity. To overcome these challenges, we conjugated Angiopep-2, a cell penetrating peptide (CPP) to Iron Gold (Fe-Au) alloy nanoparticles and investigated the ability of Ang-Fe-Au Nps conjugate to limit glioma growth via magnetic field induced hyperthermia. Our results show that 6.44nm sized conjugated Fe-Au Nps were superparamagnetic, enhanced negative Glioma image contrast and displayed a 12°C temperature elevation when magnetically stimulated, indicating applications in medical imaging and hyperthermia-based therapy. Angiopep-2 conjugation resulted in 1.5-fold higher ingestion by C6 glioma cells than L929 fibroblasts, indicating specific glioma targeting and resulting in 90% decrement in cell viability due to magnetic field induced hyperthermia. Immunohistochemical analysis showed an enhanced coagulative necrosis, glial fibrillary acidic protein (GFAP) expression and decreased Ki67 labelling index in rat treated with Ang-Fe-Au Nps which translated to a 5-fold decrement in tumor volume, consequently resulting in an increased survival time by 7 days. The dual application of this platform opens new doors towards cancer theranostics with minimal invasiveness.

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