MRI Active Gold Nanoshells for MRI Guided Localized Photothermal Therapy

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Overview

The purpose of this research is to develop a nanostucture that can induce localized photothermal therapy (PTT) in solid tumors and guide the therapy under magnetic resonance imaging (MRI), simultaneously. Clinical trial using Gold nanoshells (NSs) have shown promising results in photothermal ablate prostate tumor of 15/16 patients with minimum side effects. This is exciting, however, for better cancer treatment outcome, we need to address the distribution of NSs and the real-time thermal mapping within the ablation zone. To address these concerns and to further extend the functionality of gold NSs within clinic, we have designed MRI-active gold NSs that induce MRI-guided PTT under NIR illumination for better therapy outcome.

Gold-based Nanoparticles for Nano Therapy

GdO₃-Mesoporous Silica Nanoshells (MS NSs) Synthesis

Synthesis step process involving: (1) synthesis of mesoporous silica, (2) synthesis of ultra small GdO₃ nanoparticles, (3) loading the mesoporous silica nanoparticles with the ultra small GdO₃ nanoparticles, (4) growing a thin shell.

STEM-HAADF Energy Dispersive X-ray Mapping

GdO₃-MS NSs were loaded into the interior channels or adsorbed on the surface

MRI Relaxation Process

GdO₃ -MS NS Relaxation Rates (r₁ & r₂)

(100 nm MS core, 22 nm Au shell, (3.3 ± 0.1)×10⁶ Gd₃⁺/NS)

Strong Near-infrared (NIR) Resonance where Tissue has High Transparency

GdO₃-MS NSs Assisting Localized PTT

References


Internship

Partnership for Careers in Cancer Science & Medicine