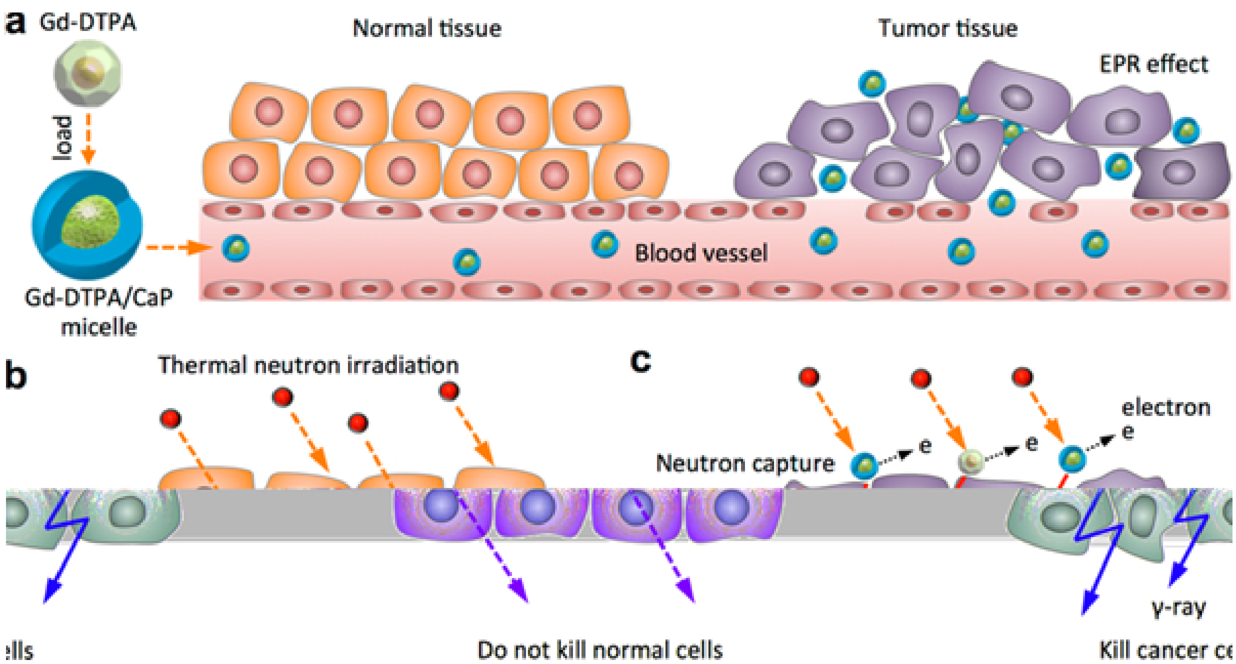
Gadolinium-based particles show and treat tumours

October 27 2015



Scheme of Gd-DTPA/CaP hybrid micelles targeting tumours for gadolinium neutron capture therapy (GdNCT). (a) The accumulation of Gd-DTPA delivered by Gd-DTPA/CaP in tumours due to the enhanced permeation and retention effect. (b) Low energy thermal neutron irradiation does not kill normal cells without NCT agents. (c) Thermal neutron irradiation could kill or cause hazardous damage to cancer cells by the gamma rays emitted from the Gd nuclides after nuclear reaction with captured thermal neutrons. Credit: 2015 The American Chemical Society

Neutron-capture therapy (NCT) provides an effective localised treatment for irradiating cancer tumours. However to ensure only cancerous cells are destroyed it is helpful to see where NCT drugs have accumulated in order to target their activation only in tumours.

Now a collaboration led by researchers at the Kawasaki Institute of Industry Promotion in Japan has demonstrated cancer imaging and treatment using gadolinium-based nanoparticles in living mice.

Absorption of harmless low-energy thermal neutrons can trigger fission in stable elements including lithium, boron, gadolinium and uranium, releasing high-energy particles and gamma radiation that destroy nearby cells. Therefore, NCT has the potential advantage of attacking cells across a whole tumour. Among those elements, gadolinium is useful, because is used for MRI imaging.

Dr. Kazunori Kataoka and colleagues at Kawasaki Institute of Industry Promotion, Tokyo Institute of Technology, The University of Tokyo, National Institute of Radiological Sciences and Kyoto University in Japan delivered a gadolinium-based clinical MRI contrast agent - Gd-DTPA - to tumour cells. They encased the drug in CaP micelles that ensured preferential uptake by tumour tissue and stayed intact while in the blood only disintegrating to release the gadolinium compounds once in tumour cells in response to the change in pH.

"The Gd-DTPA/CaP showed a dramatically increased accumulation of Gd-DTPA in tumours, leading to the selective contrast enhancement of tumour tissues for precise tumor location by MRI," state the researchers in their report. "The enhanced tumour-to-blood distribution ratio of Gd-DTPA/CaP resulted in the effective suppression of tumour growth without loss of body weight, indicating the potential of Gd-DTPA/CaP for safe cancer treatment."

More information: Peng Mi et al. Hybrid Calcium Phosphate-Polymeric Micelles Incorporating Gadolinium Chelates for Imaging-Guided Gadolinium Neutron Capture Tumor Therapy, *ACS Nano* (2015). DOI: 10.1021/acsnano.5b00532

Provided by Kawasaki Innovation Gateway Skyfront