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Focused ultrasound enhanced delivery in solid tumors

Victor Frenkel
University of Maryland, USA

One of the main impediments to succesful treatment of solid tumors is the inability to obtain sufficient and uniform delivery of therapeutic agents. This is due in part to unique characteristics of the tumor micro-environment, which include abnormalities in the tumor vasculature (such as leaky and tortuous vessels) and a dense and heterogenous extracellular matrix. The presence of these factors can result in deficiencies in transvascular and interstitial transport, respectively, which will ultimately affect the bioavailability and efficacy of administered therapeutics. We have shown how non-invasive and nondestructive, focused ultrasound (FUS) exposures provided in pulsed mode (pFUS) can enhance the delivery of therapeutic agents of various formulations in solid tumor models, including small molecules, antibodies, liposomes, nanoparticles and DNA. Studies were carried out using state of the art, image-guided FUS devices. Enhanced delivery was observed when employing both systemic and local injection, where therapeutic studies demonstrated significant improvements in tumor growth inhibition and survival. Mechanistic studies carried out to support these results showed increase in the effective pore size of the extracellular space, disruption of fibrillar collagen, increased hydraulic conductivity and lower interstitial fluid pressure of the tumor tissue. Preliminary studies were also carried out on the potential of the pFUS exposures on the metastatic process.

Biography

Victor Frenkel completed his PhD in 1999 at the Technion, Israel Institute of Technology. After a Post-doctoral Fellowship at the University of Maryland Biotechnology Istitute, he was a Staff Scientist at the National Institutes of Health Clinical Center, and Associate Professor of Biomedical Engineering at Catholic University in Washington, DC. He is currently working as an Associate Professor and Director of Translational Focused Ultrasound Research at the Department of Diagnostic Radiology and Nuclear Medicine at the University of Maryland School of Medicine. He has published more than 100 peer-reviewed original research articles, invited reviews, editorials, books and book chapters and conference abstracts.

VFrenkel@som.umaryland.edu

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