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Non-invasive delivery of magnetic drug nanocarrier to the brain

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Advancements in nanobiotechnology revolutionized health care management via investigating nanomedicine and delivery for targeted diseases. Due to easy tunable performance features these systems serves in a controlled manner and significantly useful for personalized health care. Keeping this in view, magnetically-guided brain delivery of magneto-electro nanoparticles (MENPs±25 nm), a drug nanocarriers capable to exhibit AC magnetic field stimuli responsive on-demand drug release, in C57Bl/J mice has been demonstrated. Our findings confirm uniform distribution of MENPs in the brain of mice without causing clinical toxicity and altering neurologic behavior. However, the translation of this brain delivery method for humans is not yet developed due to a mismatch of available static magnet dimension in relation to the human brain size and shape. Aiming to develop personalized nanomedicine to eradicate neuro-HIV/AIDS, we demonstrated magnetically-guided brain delivery of MENPs to the brain of an adult female baboon (*Papio hamadryas*) using Magnetic Resonance Imaging (MRI) as a navigation tool. An optimized dose of MENP (22 mg/13 kg) suspended in 100 ml PBS was injected into the baboon vasculature via the saphenous vein with a flow rate of 220 ml/hr. After injection, the baboon was placed under static MRI magnetic exposure for 3 hours to achieve magnetically-guided brain delivery. MRI image analysis confirmed MENPs distribution within the brain regions such as basal ganglia, hemisphere and vertex. The results of histopathology and blood toxicity profile studies confirmed that injected MENPs did not cause any toxicity or metabolic abnormalities. We propose utilizing MRI as a potential navigation tool for the brain delivery of magnetic therapeutic formulations to treat brain diseases for personalized health care.

Biography

Ajeet Kumar Kaushik is an Assistant Professor at the Centre of Personalized Nanomedicine, Institute of NeuroImmune Pharmacology, Department of Immunology of Florida International University, USA. He is the recipient of various reputed awards and exploring smart electrochemical sensing systems for rapid diagnostics and nanocarriers for on-demand site-specific delivery/release of therapeutics to prevent CNS diseases. His research interest is developing nanomedicine along with exploring novel methods of brain delivery and wearable sensors for personalized health care. He has received his PhD in Chemistry and Biosensors in collaboration with the National Physical Laboratory and Jamia Milia Islamia, New Delhi, India.

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