In Vivo Biodistribution and Pharmacokinetics of Optimized Magnetic Particle Imaging Tracers

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Magnetic particle imaging (MPI) is an emerging magnetic nanoparticle detection technique that has great potential as a novel biomedical imaging procedure. Particularly, MPI offers a safer real-time option over conventional x-ray angiography procedures since it uses safe magnetic fields (no ionizing radiation) and biocompatible superparamagnetic magnetite (Fe_3O_4) nanoparticle tracers, which are the source of the signal and play a significant role in spatial resolution. Current tracer formulations such as Resovist® offer poor spatial resolution, and thus, inadequate performance for high-quality angiographies. Alternatively, our superparamagnetic magnetite (SuperMag) tracers show 30% improvement in spatial resolution compared to Resovist®. However, an ideal MPI tracer consists of a balance between an optimized magnetic core and a biocompatible shell that enhances circulation times combined with appropriate functionalization necessary to enhance the tracer's bioavailability. For angiographies, tracer availability in the vasculature is of utmost importance to determine the most effective method of administration and ensure sufficient time for the imaging procedure. In this preliminary study we report pharmacokinetics and biodistribution characteristics of SuperMag tracers in an animal model. SuperMag tracers were formulated with variations in the polymeric shell and subsequently tested in CD-1 mice. Dose-dependent biodistribution was studied using MR-imaging and post-mortem histology analysis. Implications of *in vivo* circulation characteristics on MPI angiography procedures are discussed.

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