in vivo and real-time pharmacokinetic profile of magnetic nanoparticles by AC Biosusceptometry images

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The AC Biosusceptometry (ACB) is a consolidated biomagnetic technique that provides in vivo detection and monitoring of magnetic nanoparticles (MNPs). This study describes the employment of a multi-channel ACB system to assess accumulation patterns of magnetic nanoparticles using real-time images acquired in vivo and a pharmacokinetic model to describe the biological process. The ACB System employed here is a multi-channel instrument, in which 10 detection coils are positioned in the center of a larger excitation coil. The signal intensity registered is stored in a matrix and cubic spline interpolation was applied. By acquiring sequential images, we were able to have a video, illustrating the accumulation of nanoparticles in organs of interest and its circulation in the bloodstream in real time. The nanoparticles used were manganese ferrite with 13 nm of diameter, 58 emu/g of magnetization and concentration of $1.7 \times 10^5$ particles/ml. After positioning the ACB sensor, the animal was anesthetized by urethane (1.5 mg/kg). The ACB system showed remarkable temporal resolution to monitor the MNP in vivo and in real time. The images allowed us to choose regions of interest (ROI) over specific regions to acquire a temporal profile of ACB intensity that could be further associated with the nanoparticles concentration and feeds the mathematical model which describes the transfer constants between the bloodstream and the organs of interest.