

Purpose: Magnetic nanoparticles (MNP) may serve as a carrier for targeting therapeutics. In such application, it is crucial to achieve effective local retention of MNP under magnetic guidance. A micro CT imaging system of high spatial resolution was used to determine the volumetric retention of MNP subjected to magnetic guidance.

Methods: Male Sprague Dawley rats were anesthetized to expose the bifurcation of abdominal aorta and iliac arteries. MNP (Chemicell) were injected intravenously while an NdFeB magnet (4.9 kG) was placed by the left iliac artery. Arteries were then ligated to preserve blood inside, removed, and fixed in paraformaldehyde solution prior to micro CT scanning. Micro CT was used to image the samples for evaluation of MNP retention in the artery.

Results: Strong MNP attenuation was shown in the reconstructed images of micro CT from the experimental left-iliac artery under magnetic influence; whereas the right arteries and aortas show little x-ray attenuation. We further calculated the ratios of MNP volume over total sample volume to quantify the impact of external magnetic field on the MNP retention. The results show that the volume ratio of the left-iliac artery group was much higher than that of the aorta/right artery groups.

Conclusions: Our results suggest that local retention of MNP in the artery may be achieved with intravenous administration of MNP in vivo. In addition, micro CT analysis may be used for magnetic field optimization to improve local retention/distribution of MNP.