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Assessing the magnetic resonance imaging performance of Gadolinium-Hyaluronic Acid polymer as a contrast agent in Phosphate Buffered Saline

The aim was to investigate HA as a potential contrast agent for first-pass myocardial perfusion imaging*, and to assess the imaging performance of gadolinium-hyaluronic acid (HA) polymer complexes from HA-ligand constructs by determining the proton longitudinal relaxivities and accurate relaxation rates in saline solutions at 10.72 MHz. Imaging of same solutions in well defined dialysis tubing at 3T using a constructed phantom was then used to measure the rate of diffusion to determine if the Gd-complex polymer conjugate would have a sufficiently large hydrodynamic size to prevent immediate perfusion through vascular wall-like conditions to account for leaks from the intravascular to interstitial space.

Samples denoted as HW02-18 Sample A and HW02-18 Sample B were successfully prepared by coupling an amine functionalized DTPA with HA via EDC/NHS coupling methods. These produced the highest relaxation rates and relaxivities at 10.72 MHz compared to the other preparation methods. Twenty four hours post-injection, Gadodiamide showed a signal to noise ratio of unity, while HW-147 continued to retain some degree of contrast relative to the background. The slope of the logarithmic fit corresponding to HW01-147 was estimated at -0.006 compared to -0.01 of Gadodiamide, a much steeper drop indicating smaller molecular size and faster perfusion rate across the dialysis membranes. This is demonstrative of the Gd ion's relative freedom to influence the R1 of extracellular water molecules, while the molecular size of the Gd-polymer complex has a molecular radius that is sufficiently large to prevent vascular-like perfusion. This is a necessary prerequisite for HA bound Gd as a contrast agent for first-pass myocardial perfusion imaging.
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