Super-relaxive Gd Nanoparticle
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Target Audience: Molecular Imaging

Purpose: To identify the mechanism of hyperrelaxivity of nanoparticle presented Gd atoms.

Methods: Novel conjugates containing Gd chelate tethered to polyethylene glycol (PEG)-phospholipid derivatives were synthesized. Two constructs of liposomal-Gd contrast agents were fabricated (figure 1). One of the liposomal construct presented Gd on the surface of the bilayer (SC-Gd). The second liposomal construct presented Gd on the surface of liposome via a flexible polymer tether (SC-PEG-Gd). In order to optimize the nanoparticle contrast agents, in vitro T1 and T2 relaxivities of the two liposomal constructs were investigated as function of field strength, number of Gd atoms per liposome, and liposome size.

Results: The SC-PEG-Gd liposomes showed a significantly higher T1 relaxivity compared to SC-Gd liposomes (figure 2). Differences in relaxivity were observed as a function of field strength and liposome size. Consistent with the Solomon-Bloembergen-Morgan theory, all Gd formulations demonstrated an inverse relationship between T1 relaxivity and field strength.

Conclusion: Surface polymer presentation of Gadolinium chelates resulted in an increase in T1 relaxivity compared to traditional Gd-chelates conjugated directly to the liposome bilayer. The development of a highly sensitive liposomal-based Gadolinium contrast agent could facilitate molecular imaging of small targets with high conspicuity.

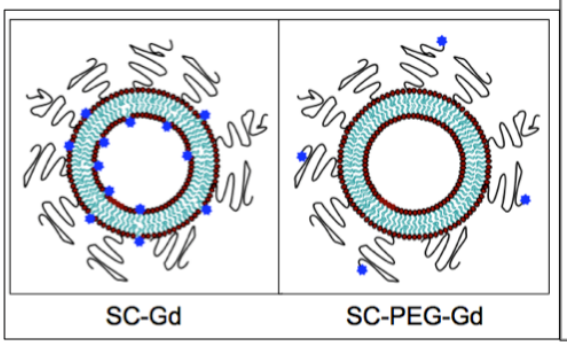

Figure 1. Two different constructs of liposomal-Gd

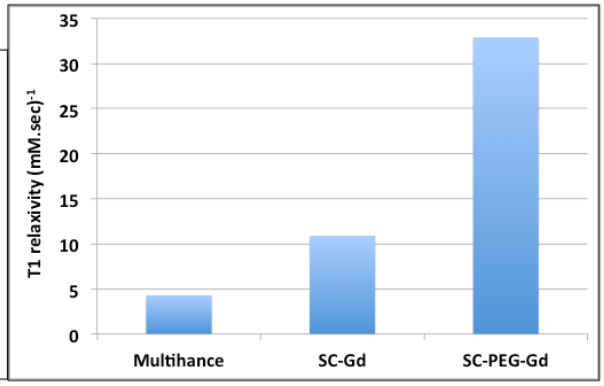

Figure 2. In vitro T1 relaxivity of liposomal-Gd constructs. Measurements were performed in bovine plasma diluted samples at 37 C, 1.5 T field strength. A conventional Gd agent, Multihance, was also considered in the analysis.