Journal of Cardiovascular Magnetic Resonance

Poster presentation

Open Access

19F MRS assessment of siRNA delivery to vascular cells via perfluorocarbon nanoparticles

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from 13th Annual SCMR Scientific Sessions
Phoenix, AZ, USA. 21-24 January 2010

Published: 21 January 2010

Journal of Cardiovascular Magnetic Resonance 2010, **12**(Suppl 1):P103 doi:10.1186/1532-429X-12-S1-P103

This abstract is available from: http://jcmr-online.com/content/12/S1/P103

Introduction

RNA interference mediated by the introduction of exogenous siRNAs has been a powerful tool for the modulation of gene expression. The ability to track siRNA delivery would be advantageous for future *in vivo* studies.

Methods

To design a synthetic vehicle to serve as both an siRNA delivery agent and an imaging agent, perfluorocarbon nanoparticles (PFC-NP) were loaded with the cationic lipid 1, 2-Dioleoyl-3-Trimethylammonium-Propane (DOTAP) in the lipid monolayer to form transfection complexes with siRNA to the VCAM-1 gene. siRNA loading onto nanoparticles was measured via PAGE gel. Mouse 2F2B endothelial cells were incubated with transfection complexes (PFC-NP/siRNA) for 4 h. ^{19}F MR spectroscopy was performed at 11.7 T to determine the number of NP bound to each cell. mRNA levels were measured 48 h after transfection to determine knockdown.

Results

The loading conditions used in this experiment resulted in 645 siRNA molecules per nanoparticle. Incubation with 2F2B cells led to a roughly linear increase in bound nanoparticles over the range of concentrations tested. In one condition which resulted in a 72% reduction in VCAM-1 mRNA levels, ^{19}F spectroscopy data reported 5563 particles per cell.

Conclusion

For future *in vivo* studies, a trackable delivery agent would aid in the determination of localization of siRNA delivery to specific tissues. To this end, we have developed a nanoparticle which is able to deliver siRNA to mouse endothelial cells and whose signal can be detected by ^{19}F MR spectroscopy and imaging.