

Sommersemester 2019

Titel

Gadolinium MRI Agents: the Good, the Bad, and the Ugly

Vortragender

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Abstract

Of the hundreds of millions of MRI scans in the world about 40% use a contrast agent, almost always containing gadolinium. Although Gd^{3+} provides excellent contrast, its high toxicity necessitates strong coordination by organic chelators. Current clinical agents have slow water exchange rates, fast tumbling times and only 1 coordinated water molecule ($q=1$); consequently their relaxivities are limited to 3 to 5 $mM^{-1}sec^{-1}$.

Relaxivity values up to 350 $mM^{-1} s^{-1}$ are theoretically possible at field strengths between 20-100 MHz

when $q = 3$ and the electronic relaxation parameters are $T_{1e} = 15$ ns and $T_{2e} = 0.3$ ns. These high-relaxivity

values would enable targeted imaging using MRI. We pursued the development of all oxygen donor ligands and these results are summarized in a review¹, which described synthetic strategies for Gd TREN-HOPO (tris-aminoethylamine-hydroxypyridinone) based contrast agents.

However, the recent emergence of toxicity in certain classes of patients has led to a reassessment of the use of these agents and the advantages and disadvantages of the several agents in clinical use.² There has not been a new type of Gd MRI enhancement introduced in the clinic in the last decade.

In 2006, two European groups recognized a relationship between nephrogenic systemic fibrosis (NSF) and gadolinium based enhancement agents in patients with kidney malfunction.

Subsequently it was found that there was residual gadolinium in patients with normal renal function. The linear Gd agents (derivatives of DTPA) have largely been eliminated in the EU and Japan. These issues are still unfolding.

A totally different medical and environmental issue has emerged related to these agents. Since they are unaffected by current sewage treatment processes they end up in the municipal water supplies of regions that use river or well water.

This chemistry and these issues will be discussed.

¹ Ankona Datta and Kenneth N. Raymond, *Accs. Chem. Res.* **2009**, *42*, 938–947.

² Kanal, E., Caravan, P.; *Radiology*, **2015**, *275*, 600-630.



Ort

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Zeit

Montag, 13.05.2019, 17:00 st Uhr

Meet the Prof. für Studierende im Anschluss an den Vortrag

gez. Professor Dr. Daniel Rauh

Gesellschaft Deutscher Chemiker
Ortsverband Dortmund