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Beyond this Year's MRI: New Thinking about Gadolinium Exposures and Pregnancy Biomarkers

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Gadolinium-based contrast agents (GBCA) are widely used for high contrast MRIs and are a known source of gadolinium exposure in humans. After injection, gadolinium can dissociate from chelating agents meant to render the normally toxic Gd^{3+} inert and bioaccumulate within tissues, such as bone and skin. While GBCA use during pregnancy has been extensively studied, less is known about how legacy exposures may manifest during pregnancy.

Here we present data on fifteen pregnancies with a history of exposure to GBCA prior to pregnancy, in some cases many years prior. Maternal blood, cord blood, placentae and breast milk all had elevated gadolinium concentrations, indicating these tissues and fluids track Gd exposure and may serve as biomarkers of past exposure. Collection and analysis of these kinds of samples is also less invasive than other potential biomarkers, such as bones. In addition to evidence in animal models that gadolinium incorporation from GBCA is actually lessened during pregnancy, this study emphasizes the need to better understand gadolinium exposures throughout life as well as its incorporation into the human body.

To this end, we also present gadolinium concentration data from Ohio and New York surface water and tap water that has been impacted by anthropogenic Gadolinium. GBCA are eliminated via urine from the human body principally as chelated gadolinium after hospital administration, and introduced into the environment through wastewater treatment facilities, which do not typically remove it during treatment. Measured river water samples from the Scioto River drainage basin were found to have significantly elevated gadolinium concentrations which increased significantly between locations measured north and south of the Columbus, Ohio wastewater treatment facilities, suggesting anthropogenic sourcing. The calculated anthropogenic gadolinium concentrations were determined to be between 0.008 and 0.07 ppb. We propose that studying the potential chronic exposure to elevated environmental Gd concentrations though the use of biomarkers, such a bone or placenta, could improve understanding of the implications of such exposures for human health.