Gadolinium is known to cross the placenta and enter fetal circulation.

Eight publications reported a total of 101 exposures to gadolinium during pregnancy, nearly all of which resulted in term delivery. The median gadolinium administration rate (95% CI: 1.53E-05-8.85E-05) increased risk for stillbirth and neonatal death with gadolinium exposure during pregnancy.

A study of 1.4 million pregnancies in Indiana identified a 9-fold (95% CI: 5.58E-05-8.85E-05) increased risk for stillbirth and neonatal death with gadolinium exposure during pregnancy. This study also identified a 1.36-fold (95% CI: 1.05E-05-1.70E-05) increased risk for rhematological inflammatory or infective skin conditions in the newborn after gadolinium exposure in utero. [Ray JD et al, 2017, PMID: 27599330]

Data Sources: The authors identified 16 data partners within the Sentinel Distributed Database. The study included a utilization study of 4.6 million live births, a prevalence study of non-MRI in pregnant women, and a matched comparator population study.

Women may not deliver a live-born infant during that period.

Table 1. Prevalence of Contrast and Non-Contrast MRI Among Pregnant and Matched Comparator Women

Table 2. Timing of Contrast MRI by Trimester in Pregnant Women

Results:

A utilization study of 4.6 million live births, a prevalence study of non-MRI in pregnant women, and a matched comparator population study.

Methods:

Our study evaluated a large sample of U.S. pregnancies to demonstrate robust inference into gadolinium exposure rates. Assessment of imaging location, trimester, and MRI exposure in a sample of matched comparators was conducted.

We did not have access to information about the underlying diagnoses that prompted the imaging procedure.

Additionally, we are currently unable to link to medical records to assess adverse events in the liveborn infant.

Gadolinium administrations in the first trimester represented 71.6% of all administrations during the hospital admission for delivery and not included in the primary analysis. We could not distinguish whether these MRI occurred prior to delivery to evaluate late-stage pregnancy complications or immediately after delivery to evaluate complications of childbirth.

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Discussion:

We identified 1.2 exposures to gadolinium per 1,000 live birth pregnancies, representing 1 contrast MRI in 860 pregnancies (0.12%).

The most frequent location for contrast MRI among pregnant women was the head (0.7/1,000 pregnancies), and 2.8/1,000 contrast MRI of the head (0.2%) was for imaging of the brain (including brain stem). Abdominal and pelvic imaging locations represented 22.3% (1.56E-05-6.87) of contrast MRI and 39.1% (28.5E-05-78.6E-05) of non-contrast MRI procedures during pregnancy.

Spinal cord and abdominal (0.2/1,000 pregnancies) were the fourth and fifth most common sites in pregnant women comprising 45.1% cervical, 32.6% lumbar, and 22.3% thoracic.

Non-contrast MRI in Pregnancy (Table 2)

- Non-contrast MRI procedures (n=72,862) were 10.6 fold more prevalent during pregnancy than contrast MRI (n=6,879).
- The most common non-contrasted MRI imaging locations were the head (3.6/1,000 pregnancies), the pelvis (2.6/1,000 pregnancies), and the abdomen (2.4/1,000 pregnancies).
- Non-contrast fetal MRI procedures were introduced in October 2015, and this type of MRI was ordered for 0.15% of pregnancies in 2015 and 0.23% of pregnancies in 2017.

MRI Use in Matched Comparator Women (Table 1)

- Matched comparator women (14-22/1,000 controls) were 12.2 fold more likely to receive a contrast MRI than pregnant women (1.1/1,000 pregnancies).
- Non-contrast abdominal and pelvic procedure MRI procedures were 4.7 fold more common among pregnant (5.3/1,000 pregnancies) than non-pregnant women (1.2/1,000 pregnancies).

Discussion:

- A similar depiction of non-contrast MRI by gestational week is provided in Figure 2.
- Decreased use of non-contrast MRI was observed after pregnancy start, which increased as pregnancy progressed.

Conclusions:

Most U.S. radiology facilities have guidelines for use of gadolinium in pregnant women, including protocols to identify pregnant patients. Recommended approaches to avoid inadvertent administration of gadolinium to pregnant women include use of a safety screening form asking about potential for pregnancy, direct questioning of women regarding pregnancy, and prominently displayed signs asking women to notify radiology staff if they may be pregnant.

Use of gadolinium contrast in pregnant women is not recommended because of the benefit to the pregnant woman and fetus outweighing the potential risks. With the 45% prevalence of unintended pregnancies in the United States (PMID: 26926942), implementation of more rigorous safety screening practices (e.g. pregnancy screening and testing) may help reduce inadvertent administration of gadolinium to pregnant women during early pregnancy, particularly when pregnancy status may not be known.

Strengths and Limitations:

- Our study evaluated a large sample of U.S. pregnancies to allow robust inference into gadolinium exposure rates. Assessment of imaging location, trimester, and MRI exposure in a sample of matched comparators was conducted.

- We did not have access to information about the underlying diagnoses that prompted the imaging procedure.

- Additionally, we are currently unable to link to medical records to assess adverse events in the liveborn infant.

Future Research:

- Registries and pharmacovigilance plans could identify pregnant women exposed to contrast and non-contrast MRIs and follow them through delivery, as well as postpartum, to assess adverse events related to gadolinium exposure.

- Additional population based studies of pregnant women exposed to gadolinium and subsequent risk for stillbirth, neonatal death, and other adverse effects in the infant are warranted.

Main Findings:

- We identified 1.2 exposures to gadolinium per 1,000 live birth pregnancies, which correlates to one gadolinium exposure for every 860 pregnancies.

- This rate is approximately 4-fold larger compared to a recent study in Ontario which found 0.3 contrast MRI per 1,000 pregnancies [Roy JD, 2016].

- As additional gadolinium administrations occurred during the hospital admission for delivery and not included in the primary analysis. We could not distinguish whether these MRI occurred prior to delivery to evaluate late-stage pregnancy complications or immediately after delivery to evaluate complications of childbirth.

- Gadolinium administrations in the first trimester represented 71.6% of all exposures in our study, a time when pregnancy may not have been recognized.

- The substantial decrease in gadolinium exposure with pregnancy progression likely represents changing use patterns with knowledge of a patient’s pregnancy status. This is consistent with a survey of 20 academic centers reporting avoidance of gadolinium contrast in pregnancy due to potential risk to the fetus [Sunplem PC, 2011; PMID: 21308238].