

MRI: Pregnancy, & Pediatrics

Tobias Gilk - Sept 27, 2022

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MRI: Pregnancy & Pediatrics

Rules of the Road

- Everything on the screen is for you (you can copy or take photos).
- If you have questions, ask!
- If you disagree, please speak up.

Outline

MRI: Pregnancy & Pediatrics

- Intro
- Pregnancy Risks To MRI Patients
- Pregnancy Risks To Healthcare Workers
- Pediatric Population MRI Risks
- Pediatric Population MRI Safety Advantages
- Q & A

Pregnancy Risks To MRI Patients

Pregnancy Risks To MRI Patients

Non Contrast

MRI is

- Non carcinogenic
- Non mutinogenic
- Produces no lasting physiologic effects of any kind

Pregnancy Risks To MRI Patients

Non Contrast

Patient pregnancies: The vast majority of data today has failed to show that exposure to MR has deleterious effects on the developing fetus. Nevertheless, if pregnancy is established, the decision to proceed with a noncontrast MR study at 1.5 T should be based on the medical benefits weighed against unknown potential risk.

<https://www.acr.org/-/media/ACR/Files/Radiology-Safety/MR-Safety/Manual-on-MR-Safety.pdf>

Pregnancy Risks To MRI Patients

Non Contrast

It's worth noting that ACR Guidance on MRI for pregnant patients...

- **Used to** contain addition concern regarding imaging in 1st trimester
- First trimester concerns were removed from guidance because:
 - Majority of MRI studies of pregnant patients occur in 1st trimester (often before the patient is aware of the pregnancy)
 - No evidence in literature / research of any increased risk in 1st trimester

Pregnancy Risks To MRI Patients

Non Contrast

So if there are no known adverse effects...

- There is no ethical way to perform randomized controlled trials on pregnant patients
- There are small, individualized studies that appear to show small risks, in narrow timeframes within pregnancy... but without confirmed results

Pregnancy Risks To MRI Patients

Non Contrast

So we reduce even *possible* risks...

- Is MRI the best non-ionizing modality to obtain the diagnosis?
- Is the exam timely?
 - Will the clinical information inform care *during* the pregnancy?
- Reduce field strength exposure (if there's not a clear benefit from higher fields).
- Reduce energies (scan in Normal Mode)

Pregnancy Risks To MRI Patients

Non Contrast - Consent?

Do you obtain 'informed consent' to provide MRI for pregnant patients?

Informed Consent

- What are the identified additional / peculiar risks of a study
- What are the alternative options (pros & cons)
- What are the risks of not having the study
- Opportunity to discuss risks : benefits with physician

Pregnancy Risks To Healthcare Workers

Pregnancy Risks To Healthcare Workers

Health care practitioner pregnancies: Pregnant health care practitioners are permitted to work in and around the MR environment throughout all stages of their pregnancy.²⁴ Acceptable activities include, but are not limited to, positioning patients, scanning, archiving, injecting contrast, and entering the MR system room in response to an emergency. Although permitted to work in and around the MR environment, pregnant health care practitioners are requested not to remain within the MR scanner bore or Zone IV during actual data acquisition or scanning. These recommendations are based on the preponderance of data on 3-T magnetic fields. There is a paucity of data available to date regarding human pregnancy exposures to 7-T magnetic fields.

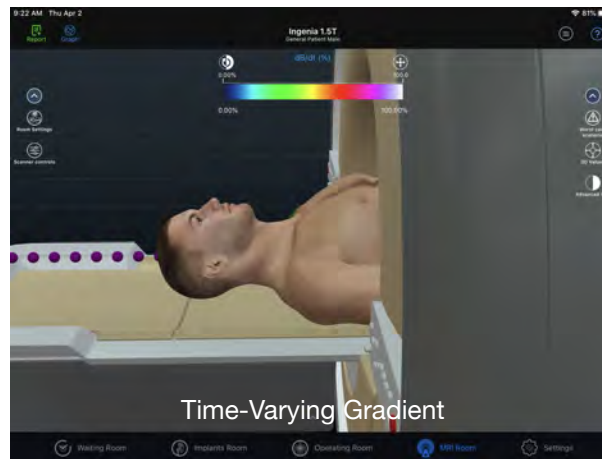
<https://www.acr.org/-/media/ACR/Files/Radiology-Safety/MR-Safety/Manual-on-MR-Safety.pdf>

Pregnancy Risks To Healthcare Workers

Using our 'exposure model' of MRI risk, if the pregnant healthcare worker can be in the MRI scanner room -*except when active imaging*- what field exposures does this guidance feel are not meaningful concerns?

- Static Magnetic Fields
- Time-Varying Gradients
- RF Fields

Pregnancy Risks To Healthcare Workers



Pregnancy Risks To Healthcare Workers

Survey of reproductive health among female MR workers

Epidemiologic data were obtained to evaluate potential risks from exposure to the static and time-varying magnetic fields used in magnetic resonance (MR) imaging. A questionnaire sent to women workers in more than 90% of clinical MR facilities in the United States addressed menstrual-reproductive experiences, work activities, and potential confounders (eg, age, smoking, alcohol use). In 1,915 completed questionnaires, 1,421 pregnancies were reported: 280 occurred in an MR worker (technologist or nurse), 894 in an employee in another job, 54 in a student, and 193 in homemakers. Comparing MR-worker pregnancies with those occurring in employees at other jobs, a relative risk ratio of 1.27 (95% confidence interval [CI], 0.92-1.77) was found for spontaneous abortions; for conception taking more than 12 months, 0.90 (CI, 0.54-1.51); for delivery before 39 weeks, 1.19 (CI, 0.76-1.88); for birth weight below 5.5 lb (2.5 kg), 1.01 (CI, 0.50-2.04); and for male gender of the offspring, 0.99 (CI, 0.80-1.22). Adjustment for maternal age, smoking, and alcohol use also failed to markedly change any of the associations. These results suggest that there is **not a substantial increase in these common adverse reproductive outcomes.**

<https://pubs.rsna.org/doi/10.1148/radiology.187.2.8475280>

Pediatric Population MRI Risks

Pediatric Population MRI Risks

Pediatric MR Safety Concerns

Sedation and monitoring issues: Children form the largest group requiring sedation for MRI. Sedation may not always be required: for example, if an ultrafast MR examination may be diagnostic. When necessary, sedation protocols may vary from institution to institution according to procedures performed (diagnostic vs interventional), the complexity of the patient population (healthy preschoolers vs premature infants), the method of sedation (mild sedation vs general anesthesia), and the qualifications of the sedation provider.

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Pediatric Population MRI Risks

Sedation / Anesthesia Guidance

PRACTICE PARAMETERS

Practice Advisory on Anesthetic Care for Magnetic Resonance Imaging

An Updated Report by the American Society of Anesthesiologists Task Force on Anesthetic Care for Magnetic Resonance Imaging

<http://www.asahq.org/~media/sites/asahq/files/public/resources/standards-guidelines/practice-advisory-on-anesthetic-care-for-magnetic-resonance-imaging.pdf>

Pediatric Population MRI Risks

Sedation / Anesthesia Guidance

Do you feel that anesthesia (or other allied clinical services) are among the biggest risks in your MRI suites?

Pediatric Population MRI Risks

For the neonatal and the young pediatric population, special attention is needed in monitoring body temperature for both hypo- and hyperthermia, in addition to other vital signs. Temperature monitoring equipment that is approved for use in the MR suite is readily available. Commercially available, neonatal isolation transport units and other warming devices intended to be used in the MR environment are also available.

<https://www.acr.org/-/media/ACR/Files/Radiology-Safety/MR-Safety/Manual-on-MR-Safety.pdf>

Pediatric Population MRI Risks

Screening Issues

Pediatric/minor patients: Children may not be reliable historians and, especially for older children and teenagers, should be questioned twice by Level 2 Personnel: once in the presence of parents or guardians and once separately to maximize the possibility that all potential dangers are disclosed. Therefore, it is recommended that they be gowned before entering Zone IV to help ensure that no metallic objects, toys, or other unacceptable items inadvertently find their way into Zone IV. Pillows, stuffed animals, and other comfort items brought from home represent potential risks and should be discouraged from entering Zone IV.

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Pediatric Population MRI Risks

Screening Issues

Companions in Zones III or IV: Those deemed appropriate to accompany or remain with the patient should be screened using the same criteria as anyone else entering Zone IV.

In general, it would be prudent to limit accompanying companions to a single individual. Only a qualified, responsible Level 2 MR Physician should make screening criteria exceptions.

Hearing protection and MR Safe/MR Conditional seating are recommended for accompanying companions within the MR scan room.

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Pediatric Population MRI Risks

Pediatric - Specific Implants / Devices



PRECISE Telescoping Intramedullary Rod System



MAGEC Telescoping Spinal Implant

Pediatric Population MRI Safety Advantages

Pediatric Population MRI Safety Advantages

Smaller habitus

- Likely naturally further away from both RF and gradient transmitters
- Smaller mass means less total absorbed energies

Pediatric Population MRI Safety Benefits

- TEXT
- TEXT

Pediatric Population MRI Safety Advantages

Newborns / Neonates

- Can't vaso-constrict
- Shed heat, uncontrollably
- Less likely to have 'overheating' concerns

Pediatric Population MRI Safety Benefits

- TEXT
- TEXT

Q&A

Thank You

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