

X-ray MRI and ultrasound safety during pregnancy



The central principle: image when the result matters

Pregnancy does not make diagnostic uncertainty harmless. A missed diagnosis in the pregnant patient can threaten maternal oxygenation, circulation, infection control, surgery timing, or medication decisions, and maternal wellbeing is closely linked to fetal wellbeing. For this reason, expert guidance emphasizes that imaging should be performed when it is expected to change management, clarify a serious diagnosis, or guide urgent treatment.

The practical approach is not simply "avoid radiation." Instead, clinicians weigh several factors: the suspected condition, gestational age, whether the uterus is in or near the imaging field, whether a non-ionizing alternative can answer the question, and how quickly a result is needed. In many cases, ultrasound or MRI can provide the needed information. In others, an X-ray or CT scan may be the most accurate and fastest test, and using it is appropriate when clinically justified.

Understanding radiation and fetal risk

X-rays and CT scans use ionizing radiation, which has enough energy to affect atoms and molecules. At high doses, ionizing radiation can increase risks to

developing tissues. The type of risk depends on dose and gestational age. Very high fetal exposures have been associated with pregnancy loss, congenital malformations, impaired growth, or neurodevelopmental effects, especially during sensitive windows of organ development. Diagnostic imaging, however, usually involves much lower doses than those associated with these deterministic effects.

For most plain radiographs, such as dental, chest, extremity, or many spine images, fetal exposure is very low, particularly when the uterus is outside the primary beam. Even some CT examinations may deliver fetal doses below thresholds associated with malformations, though dose varies widely depending on the body area scanned and the protocol. The care team should use pregnancy-appropriate protocols, avoid repeat imaging unless needed, and limit the scanned region to the clinical question.

There is also a theoretical stochastic risk, meaning a small possible increase in childhood cancer risk with radiation exposure, without a strict safe threshold. This is why clinicians do not order X-ray-based imaging casually. Still, when the maternal condition is significant, the potential benefit of diagnosis often outweighs the small theoretical radiation risk.

Ultrasound: first-line for many pregnancy-related questions

Ultrasound uses high-frequency sound waves, not ionizing radiation. It is widely used to assess fetal growth, anatomy, placental location, amniotic fluid, cervical length, and many maternal conditions such as gallbladder disease or kidney obstruction. Diagnostic ultrasound has no documented adverse fetal effects when used prudently by trained professionals.

"Prudently" matters. Ultrasound should be performed for a medical indication, using appropriate settings and reasonable examination time. Doppler ultrasound, which can involve higher acoustic energy than standard grayscale imaging, is used when clinically indicated, such as evaluating blood flow, fetal wellbeing, or suspected vascular problems. Non-medical keepsake scans should be approached cautiously because they may increase exposure time without medical benefit.

Ultrasound has limitations. Image quality can be affected by fetal position, bowel gas, maternal anatomy, gestational age, and the organ being examined.

Some conditions, such as appendicitis in later pregnancy or complex neurologic problems, may require MRI or another modality if ultrasound cannot answer the question.

MRI: powerful imaging without ionizing radiation

MRI uses a strong magnetic field and radiofrequency pulses to generate detailed images. It does not use ionizing radiation, which makes it valuable in pregnancy when ultrasound is nondiagnostic or when detailed soft-tissue evaluation is needed. MRI may be used to evaluate suspected appendicitis, pelvic masses, placental disorders, neurologic symptoms, spinal disease, or complex fetal anomalies when additional information will influence care.

Available evidence has not shown actual fetal harm from MRI performed during pregnancy. Many guidelines consider MRI acceptable when it is expected to provide clinically important information that cannot be obtained adequately by ultrasound or when MRI is preferable to a radiation-based test. As with any medical test, it should be ordered for a clear reason rather than for reassurance alone.

Some MRI examinations feel challenging because the patient may need to lie still in a narrow scanner, and the machine is loud. Pregnant patients should tell the MRI team about gestational age, discomfort lying flat, shortness of breath, claustrophobia, implanted devices, or prior metal exposure. The radiology team can adjust positioning, provide hearing protection, and screen for device safety.

MRI contrast: why gadolinium is treated differently

Gadolinium-based contrast agents can improve MRI detail, especially for inflammation, tumors, vascular abnormalities, or certain neurologic questions. During pregnancy, gadolinium crosses the placenta. Because long-term fetal effects are not fully defined, it is generally avoided unless the expected diagnostic benefit is substantial and the information cannot be obtained without it.

If contrast MRI is being considered, the decision should involve a careful discussion among the ordering clinician, radiologist, and patient. Key

questions include whether the contrast-enhanced result would change management, whether a non-contrast MRI or ultrasound could answer the question, and whether postponing contrast until after delivery is safe. This is not a situation for automatic refusal or automatic use; it is a risk-benefit decision.

X-rays and CT scans: sometimes the right test

Plain X-rays remain appropriate in pregnancy when needed, for example after trauma, suspected pneumonia, dental infection, bone injury, or certain chest symptoms. If the fetus is not in the direct beam, exposure is typically very low. Shielding practices have evolved, and some radiology departments no longer use routine abdominal shielding because it can interfere with automatic exposure controls or obscure anatomy; however, the team should always optimize the exam to minimize unnecessary exposure.

CT scans use X-rays and usually involve higher radiation doses than plain radiographs, but they can be lifesaving. CT may be appropriate for serious trauma, suspected pulmonary embolism, stroke evaluation, complicated infection, bowel obstruction, kidney stones in selected situations, or when other tests are inconclusive. The uterus may receive little exposure in head or chest CT compared with abdominal or pelvic CT, although protocols vary.

If CT is recommended, ask whether ultrasound or MRI could answer the question with similar reliability and speed. If not, ask whether the CT protocol can be optimized for pregnancy. In urgent conditions, the priority is accurate diagnosis and timely treatment.

Iodinated contrast for CT and X-ray procedures

Iodinated contrast is used in many CT angiography studies and some fluoroscopic or X-ray procedures. It can cross the placenta, but when it is clinically necessary, it may be used because the diagnostic value can be significant. One common reason is suspected pulmonary embolism, where contrast-enhanced imaging may be needed to evaluate maternal pulmonary arteries.

The care team should consider kidney function, allergy history, the urgency of the diagnosis, and whether alternative imaging is adequate. Concerns about fetal thyroid exposure have been discussed in medical literature, but

clinically necessary contrast should not be withheld solely because of pregnancy when the result is important for maternal care. Follow local obstetric and pediatric guidance regarding newborn thyroid screening, which is routine in many settings.

How to prepare for imaging while pregnant

Before any imaging test, tell the scheduler, technologist, and radiologist that you are pregnant or may be pregnant, and share your estimated gestational age. Bring the clinical question if you know it: for example, "rule out appendicitis" or "evaluate shortness of breath and possible pulmonary embolism." The more specific the question, the better the protocol can be tailored.

Ask what diagnosis the test is meant to confirm or exclude.

Ask whether ultrasound or MRI could answer the question instead of an X-ray-based test.

Ask whether contrast is required and how it would change management.

Ask whether the imaging field includes the uterus and what dose-reduction steps are used.

Do not cancel urgent imaging without speaking to the clinician who ordered it.

It is reasonable to ask questions, but you should not have to carry the burden alone. Obstetric clinicians, emergency physicians, radiologists, and technologists are trained to balance diagnostic benefit and fetal safety.