Purpose

Utility of MR Imaging in the Pregnant Patient with Non-obstetric Abdominal Pain

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Imaging Safety

CT:

- Deterministic effects of radiation are not typically of primary concern after a diagnostic abdomen/pelvis CT during pregnancy since the dose from a single exam is below the determined threshold dose (100mGy). Doses above the threshold have been shown to cause varying effects based on gestational age. Radiation above threshold during pregonagiosis (0-2 weeks post conception) increases risk of spontaneous abortion; however, surviving gestations develop without continued risk. Greatest risk of organ malformation and generalized growth retardation occurs at 2-8 weeks post conception. Minimal risk of teratogenesis to the developing fetus is present after 25 weeks, unless an exceptionally high dose is used.

- Carcinogenesis is the primary concern after obtaining a diagnostic abdomen/pelvis CT, regardless of the dose. A relative risk of 2 for fatal childhood cancer has been approximated after exposure to abdomen/pelvis CT, regardless of the dose. A relative risk of 2 for fatal childhood cancer has been approximated after exposure to abdomen/pelvis CT, regardless of the dose.

MRI:

- Adverse fetal outcomes have not been detected with the use of MRI in pregnancy; however, adequate and well controlled studies involving MRI safety in pregnant humans have not been performed.
- Possible means of adverse effects involve heating from MR gradient changes and direct interaction of the electromagnetic field with biological structures. However, tissue heating is greatest at the maternal body surface with negligible effects near the body center, limiting the risk of damage to the fetus. Estimated fetal temperature increase with MRI has been predicted to be below the expected teratogenic level.
- MRI remains preferable to an imaging study with ionizing radiation but should be performed only when deemed medically necessary.

CONTRAST

- Neonatal hypothyroidism has occurred after amniocentesis with iodinated contrast but not following intravenous administration. No adverse effects during pregnancy with IV iodinated contrast have been reported. However, contrast should be administered only when absolutely necessary to avoid potential harm to the fetus.
- Gadolinium crosses the placental barrier and can accumulate in the amniotic fluid, placing the fetus at risk for NSF. Gadolinium is therefore contraindicated during pregnancy and classified as category C by the FDA.

MRI Case Review

- Ultrasound is the mainstay of imaging in pregnancy; however, adequate evaluation of the abdominal viscera frequently is unobtainable. Cross sectional imaging is often necessary, especially since delayed diagnosis is a significant cause of morbidity/mortality to the developing fetus. The following cases demonstrate how MRI (especially, T2 sequences) can be utilized to avoid ionizing radiation and assist with diagnosis and preoperative planning for common causes of acute non-obstetric abdominal pain.

Uterine Leiomyoma

FINDINGS:

- Axial T2 FASE and Sagittal T2 FASE images demonstrate a 6.4 x 5.6 cm subserosal degenerating fibroid in the anterior uterine body.

CASE DETAILS:

- Patient is a 35 year old female who presented at 33 weeks gestation with preterm contractions and abdominal pain. She had a history of uterine fibroids and initial ultrasound was inconclusive. MRI was performed for further evaluation and demonstrated multiple uterine fibroids, some of which were degenerating. MR images demonstrate a 6.4 x 5.6 cm subserosal degenerating fibroid involving the anterior uterine body.
- Uterine fibroids are a common finding with increased risk of degeneration and acute abdominal pain during pregnancy due to loss of blood supply from uterine enlargement.
- On MRI, degenerating fibroids will contain internal edema/necrosis appearing with increased signal intensity on T2 weighted images with heterogeneous signal intensity on T1 weighted imaging.

Ovarian Torsion

FINDINGS:

- Axial and Coronal T2 images demonstrate an enlarged left ovary which has lost its normal internal architecture.

CASE DETAILS:

- Patient is a 28 year old female who presented at 22 weeks gestation with vague abdominal pain for the past 2 days with acute increase in severity prior to presentation. Ultrasound was unable to visualize the ovaries secondary to displacement by the enlarged uterus. MRI demonstrated an enlarged left ovary which had lost its normal architectural architecture, as well as a small amount of free fluid in the left lower abdominal quadrant.
- Ovarian torsion affects approximately 7% of known ovarian masses during pregnancy, with a prevalence of 1/1800 during pregnancy. The clinical presentation of ovarian torsion may be similar to that of appendicitis (pelvic pain, nausea and vomiting). Ovarian torsion occurs most commonly during the first trimester when the uterus is enlarging rapidly and may be more common in pregnant patients due to ligamentous laxity.

Choledocholithiasis

FINDINGS:

- Axial and Coronal T2 FASE images demonstrate numerous gallstones within the gallbladder and two 4 mm gallstones within the common bile duct.

CASE DETAILS:

- Patient is a 44 year old female who presented at 17 weeks gestation with right upper quadrant pain and intermittent nausea. Ultrasound was initially performed and demonstrated a distended gallbladder containing innumerable gallstones. MRCP was then performed and demonstrated innumerable gallstones, dilatation of the common bile duct up to 1 cm, and two 4 mm gallstones within the distal common bile duct.
- Cholelithiasis is a common finding in pregnant patients with abdominal pain. Pregnancy is a known risk factor for cholelithiasis and may be complicated by acute cholecystitis. On MRI, gallstones appear as T2 signal voids within the gallbladder.
- Cholelithiasis is best seen on T2 weighted sequences as a dependent signal void within the common bile duct.

Acute Appendicitis

FINDINGS:

- Axial and Coronal T2 FASE images demonstrate a fluid filled appendix measuring 8 mm in maximum diameter.

CASE DETAILS:

- Patient is a 26 year old female who presented at 18 weeks gestation with 10 hours of stabbing abdominal pain, chills, nausea, vomiting, anorexia and an increased WBC count. MRI was performed for suspected appendicitis and demonstrated a fluid filled tubular structure in the right upper abdomen extending from the cecum measuring 8 mm in maximum diameter with minimal diffusion restriction at the base. Findings consistent with acute appendicitis.
- Appendicitis is the most common presenting illness requiring emergent surgical intervention in pregnant patients. Localization of the appendix on MRI during pregnancy can be difficult due to changes in position of the appendix and cecum (which may be displaced into the right upper abdominal quadrant near the liver).
- MRI findings of appendicitis include:
  - Appendiceal diameter of > 7 mm, appendiceal wall thickness > 2 mm, high T2 signal intraluminal contents due to fluid or edema, and periappendiceal fat stranding or fluid.

Appendiceal Mucocele

FINDINGS:

- Axial and Coronal T2 FASE images demonstrate a 2.4 x 2.9 x 8.0 cm T2 hypointense tubular structure in the right lower quadrant.

CASE DETAILS:

- Patient is a 28 year old female who presented at 22 weeks gestation with excruciating abdominal pain. She reported a history of a “10 cm ovarian cyst” which had been previously diagnosed by ultrasound at an outside hospital.
- Ultrasound was initially performed and demonstrated a large cystic lesion in the right pelvis without a definite association with the right ovary or cecum. MRI was then performed and demonstrated a 2.4 x 2.9 x 8.0 cm T2 hypointense, T1 hypointense tubular structure anterior to the cecum and ascending colon which did not demonstrate any relationship to the right ovary or uterus. Surgery was performed two weeks later and the pathology revealed a low grade appendiceal mucinous neoplasm with rupture.

Ovarian Cyst

FINDINGS:

- Axial and Coronal T2 FASE images demonstrate a 15.2 x 11.8 x 24.0 cm right ovarian cyst.

CASE DETAILS:

- Patient is a 17 year old female who presented at 30 weeks gestation with right upper quadrant pain, fever, maternal and fetal tachycardia and an elevated WBC count. MRI demonstrated a 15.2 x 11.8 x 24.0 cm right ovarian cyst.
- Benign ovarian cysts are the most common ovarian masses encountered during pregnancy and are usually asymptomatic on T2 weighted imaging and low to intermediate signal intensity on T1 weighted imaging.

References


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