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MRI Pelvis Without Contrast – Congenital Uterine Anomaly

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Standard uses: Evaluation of congenital uterine anomalies.

Patient prep:

- (1) NPO for at least 4 hours prior to study
- (2) Void before examination.

Field Strength: 1.5T

Coil: Phase array body coil.

Coverage: Superior iliac crest to below the symphysis pubis (i.e. excellent signal from the uterus).

Intravenous contrast: None.

Oral contrast: None.

Anti-peristaltic agent: None.

Note: High quality small FOV T2 TSE/FSE sequences through the plane of the uterus are critical to determine which anomaly is present.

Sequences:

1. Localizer
2. Coronal T2 Ultra fast SE (HASTE, SSFSE, FASE)
 - a. Breath hold, concatenation/multi-breath hold is less desirable than single breath hold
 - b. FOV: Complete front to back coverage (skin to skin)
 - i. CC extent: Must include entire kidney (confirm present, eval for anomaly)
 - c. Goal parameters
 - i. **Large FOV (400-450 mm)**
 - ii. 7 mm thickness, 25% gap (1.5 mm)
3. Axial in and out of phase T1 GRE
 - a. Large FOV = Aortic bifurcation to perineum

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- b. Goal parameters
 - i. Slice thickness 4 mm
 - ii. In plane acquired resolution <1 mm
 - iii. Number of averages ≥ 2
- 4. Axial T1 Ultra fast 3D-GE with fat suppression (VIBE, LAVA, TIGRE)
 - a. Breath hold
 - b. FOV: Superior iliac crest to perineum
 - c. Goal parameters
 - i. Slab slices ≤ 3 mm
- 5. Sagittal T2 fast SE (Turbo SE, Fast SE)
 - a. FOV = Cover all pelvic organs and each pelvic sidewall
 - i. CC: Extend above uterus/sacral promontory to below perineum
 - ii. Trans: At least extending into each femoral head
 - b. Goal parameters
 - i. Slice thickness 3 mm
 - ii. In plane acquired resolution <1 mm
 - iii. Number of averages ≥ 2
- 6. Axial T2 Ultra fast SE (HASTE, SSFSE, FASE)
 - a. Large FOV = Superior iliac crest to perineum
 - b. Goal parameters
 - i. Slice thickness 4-4.5 mm
 - ii. In plane acquired resolution <1 mm
 - iii. Number of averages ≥ 2
- 7. Axial T2 Ultra fast SE (HASTE, SSFSE, FASE) with fat suppression
 - c. Large FOV = Superior iliac crest to perineum
 - d. Goal parameters
 - i. Slice thickness 4-4.5 mm
 - ii. In plane acquired resolution <1 mm
 - iii. Number of averages ≥ 2
- 5. Oblique axial T2 fast SE (Turbo SE, Fast SE) small FOV
 - a. FOV = Cover entire uterus
 - i. CC extent: At least sacral promontory to below perineum
 - ii. PLANE angulation: Thin slice "true" axial to plane of the uterus/endometrial canal (T2 bright stripe) = **short axis of uterus**
 - 1. *Always call radiologist to confirm correct plane. Occasionally a double oblique technique will be needed when there is significant rotation of the uterus. Can call before acquiring any oblique planes if unclear how to angle.*
 - 2. *In some circumstances, the appearance may warrant addition of vaginal gel per radiologist discretion*
 - 3. *See appendix at end*
 - b. Goal parameters
 - i. **FOV approximately 200 mm**
 - ii. Slice thickness 3 mm, 0% gap

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- iii. In plane acquired resolution <1 mm
 - iv. Number of averages ≥ 2
6. Oblique coronal T2 fast SE (Turbo SE, Fast SE)
- a. FOV = cover entire uterus and adjacent structures
 - i. Slices should extend into bladder and sacrum, covering entire region of interest
 - ii. PLANE ANGULATION: Thin slices “true coronal” plane of the uterus/endometrial canal = **long axis of uterus**
 - b. Goal parameters
 - i. Slice thickness 3mm
 - ii. In plane acquired resolution <1 mm
 - iii. Number of averages ≥ 2
 - c. **MOST important sequence in evaluating uterine anomalies**
 - i. **Confirm plane with radiologist**
 - ii. Repeat sequence as necessary
7. 3D T2 fast spin echo (SPACE, CUBE, VISTA, isoFSE, 3D MVOX)
- a. **Perform if available, only available on certain scanners**
 - b. FOV = cover entire uterus including cervix
 - c. Do not need to prospectively send reformats in all planes, as this sequence will be utilized by the radiologist as necessary to create additional oblique planes

Radiologists perspective:

MRI is the gold standard in the evaluation of congenital uterine anomalies. The alignment to the uterus is *critical* to distinguish between the different congenital anomalies, which may have important treatment and reproductive implications. This means that true coronal imaging to the plane of the uterus must be acquired with great care and repeat sequences performed if necessary.

Contrast is not necessary to evaluate uterine anomalies.

Please direct any questions or concerns to any of the body radiologists.

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Appendix

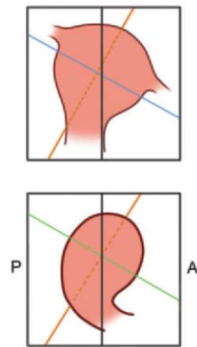
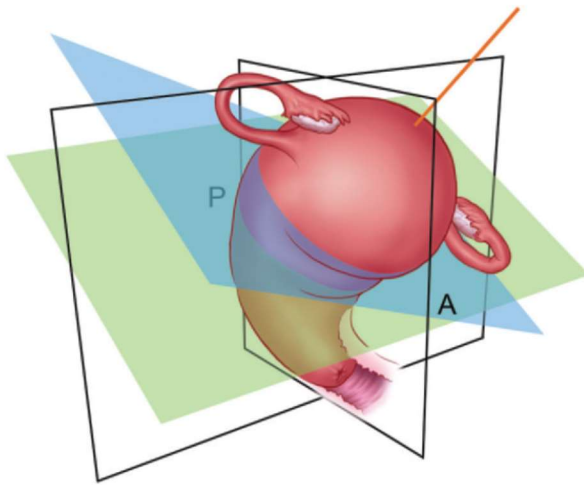


Figure 2. The double oblique technique. Illustration shows a uterus that is anteriorly rotated in the sagittal plane (anteverted) and laterally tilted to the left in the coronal plane. The double oblique sequence is performed by angling images anteriorly in the sagittal plane (green line) and laterally in the coronal plane (blue line), which creates true oblique images along the true axis of the uterus (orange line). *A* = anterior, *P* = posterior.

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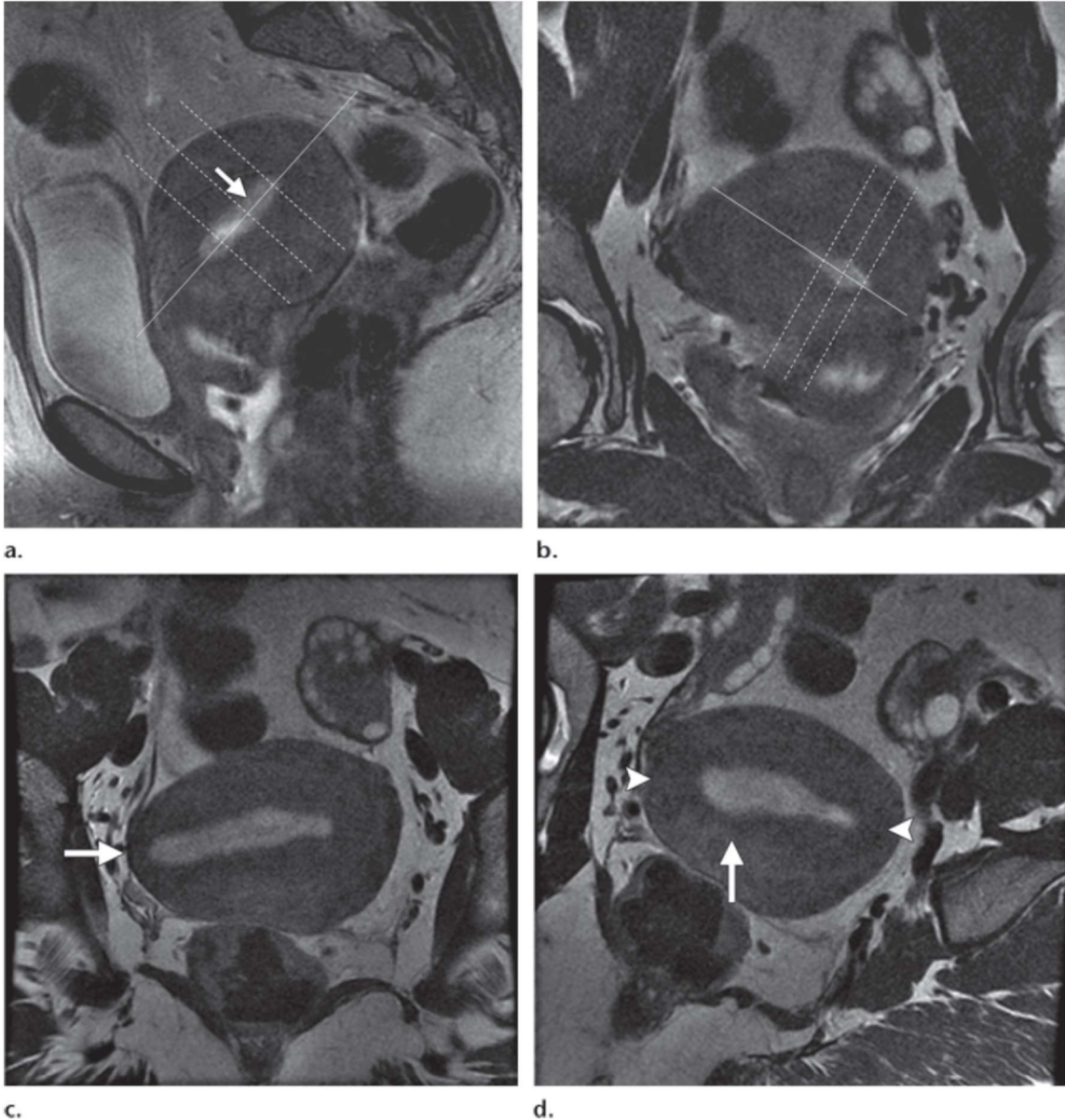


Figure 3. Double oblique technique in a patient with endometrial cancer. **(a)** High-resolution sagittal T2-weighted FRFSE MR image shows the correct plane for prescribing the orthogonal axial images perpendicular to the endometrial cavity in patients with endometrial carcinoma. Solid line and arrow = long axis of the uterus, dashed lines = plane of acquisition for routine axial oblique sections. **(b)** Coronal high-resolution FRFSE T2-weighted MR image shows that the body of the uterus is deviated to the right. The second oblique plane is prescribed perpendicular to the axis of the uterus in the coronal plane. The axis of the endometrial cavity in the coronal plane (solid line) and the acquisition plane of the oblique axial images (dashed lines) are seen. The combination of both acquisitions prescribed along the long axis of the uterus in the sagittal and coronal planes forms the double oblique axial image. **(c)** Axial oblique high-resolution T2-weighted FRFSE MR image shows apparent thinning of the right myometrium (arrow), which may be mistaken for myometrial invasion. **(d)** Double oblique high-resolution T2-weighted FRFSE MR image prescribed with both the sagittal and coronal planes is more appropriately angled along the true axis of the uterus and shows the thickness of the myometrium to be symmetric (arrowheads). Subtle superficial invasion of the inner myometrium is seen along the anterior wall (arrow). High-resolution double oblique images are particularly useful when lateral deviation of the uterus is seen in the coronal plane and minimize problems with volume averaging that result from the position of the uterus within the pelvis, which may lead to erroneous interpretations of myometrial invasion.

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References

1. Behr SC, et al. Imaging of Mullerian Duct Anomalies. Radiographics. 2012; 32:233-250.