TRA Medical Imaging
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# Uterine or Endometrial Mass and Fibroids

## MRI Pelvis Without and With Contrast

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**Standard uses:** Evaluate uterine mass (leiomyomas/fibroids, leioyomyosarcoma, etc.) or endometrial mass.

> **NOTE:** For indications of "endometriosis", please refer to the Ovary/Adnexa MR pelvis protocol.

**Patient prep:**
(1) NPO for at least 4 hours prior to study
(2) Void before examination.

**Oral contrast:** None.

**Coil:** Phase array body coil.

**Coverage:** Position the coil such that there is good coverage and signal from the ovaries and uterus. Increase FOV as needed for very large masses to ensure entire mass is imaged.

**Intravenous contrast:** Single dose gadolinium @ 2 cc / sec (Gadavist, MultiHance if Gadavist unavailable).

**Anti-peristaltic agent:** None.

**NOTE #1:** Small FOV T2 plane through the uterus is VERY important. Majority of dynamic contrast-enhanced images obtained in the **SAGITTAL** plane.

**NOTE #2:** Unless otherwise noted, planes are *orthogonal* (to the magnet) axial, coronal, sagittal (i.e., not specifically oriented to an organ).

**SUMMARY:**

1. Localizer
2. Coronal T2 Ultra fast SE non-FS
3. Axial in/out T1 GRE
4. Sag T2 fast SE non-FS
5. Axial T2 Ultra fast SE non-FS
6. Axial T2 Ultra fast SE FS
7. Oblique Axial T2 fast SE
8. Oblique Coronal T2 fast SE

9. + 10. Oblique Axial + Sagittal T1 pre-contrast FS

11 + 12. + 13. +14. Oblique Axial + Oblique Coronal + Sagittal + Large FOV True Axial post-contrast FS

15. Axial DWI/ADC
16. Subtraction series (4 total – 3 sagittal, 1 oblique axial)

**Sequences:**

1. Localizer
    a. Breath hold

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: Include lower poles of kidneys if possible
    c. Goal parameters
        **i. Large FOV (400-450 mm)**
        ii. 7 mm thickness, 25% gap (1.5mm)

3. Axial in and out of phase T1 GRE
    a. FOV = Superior iliac crest to perineum
    b. Goal parameters
        i. Slice thickness 4 mm
        ii. In plane acquired resolution <1 mm
        iii. Number of averages >= 2

4. 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

5. 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

6. 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

7. 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 **= short axis to the uterus**
            1. *Call radiologist if you have difficulty, occasionally a double oblique technique will be needed when there is significant rotation of the uterus*
            2. *See appendix at end*
    b. Goal parameters
        **i. FOV approximately 200 mm**
        ii. Slice thickness 3 mm, 0% gap
        iii. In plane acquired resolution <1 mm
        iv. Number of averages >= 2

8. 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 to the uterus**
    b. Goal parameters
        i. Slice thickness 3mm
        ii. In plane acquired resolution <1 mm
        iii. Number of averages >= 2

9. & 10. Oblique Axial + Sagittal
PRECONTRAST Ultra fast 3D-GE with fat suppression (VIBE, LAVA, TIGRE) – **2 PLANES**
    a. Breath holds
    b. Planes
        i. Obl Axial: As #7
        ii. Sagittal: Cover pelvic organs, extending into each femoral head
    c. Goal parameters
        i. Slab slices <= 3 mm

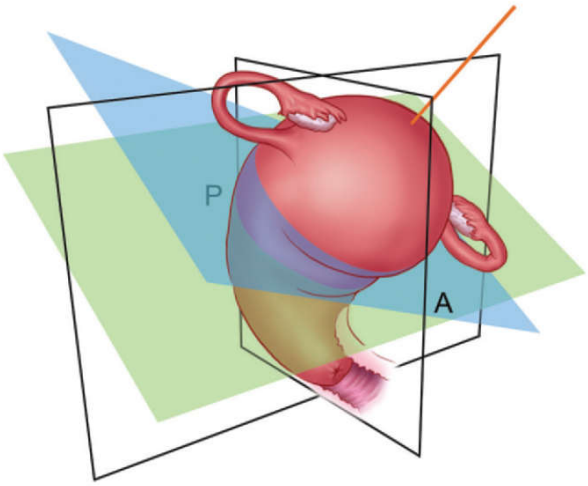
11. & 12. & 13. & 14. Oblique Axial + Oblique Coronal + Sagittal + Large FOV True Axial POSTCONTRAST Dynamic 3D-GE with fat suppression (VIBE, LAVA, TIGRE) **– 4 PLANES**
    a. Breath holds
    b. Planes
        i. Obl Axial: As #7
        ii. Obl Coronal: As #8
            a) Cover front to back (skin to skin), including at least from uterus/sacral promontory to perineum (*higher coverage and/or added sequences if mass extends outside of the pelvis*)
        iii. Sagittal: Cover pelvic organs, extending into each femoral head
        iv. Large FOV True Axial: Superior iliac crests to below pubic symphysis (skin to skin, front to back, and side to side)
    c. Goal parameters
        i. Slab slices <= 3 mm
        ii. TIMING = Fixed scan delay (time from beginning of injection until center of k-space)
        1. Sagittal: 35 s, 1 min, 4 min
        2. Obl Axial: 2 min
        3. Obl Coronal: 3 min
        4. Large FOV True Axial: 5 min

15. Axial DWI/ADC
    a. Free breathing
    b. FOV: Superior iliac crest to perineum
    c. Goal parameters = 50/400/800 and ADC map

16. Subtraction series (4 total – 3 sagittal, 1 oblique axial)

**Radiologist's perspective:**
MRI offers superior soft tissue contrast resolution compared to CT and US, making it an ideal modality for imaging the female pelvis. MRI is typically reserved for difficult cases that are unable to be answered by ultrasound. Leiomyomas/fibroids (particularly large ones), adenomyosis, endometrial masses, etc. make up the bulk of the indications for this exam. The relationship of these masses with the endometrium, junctional zone, and myometrium is important for deciding management by referring physicians, which is why small FOV planes are obtained through the planes of the uterus and most dynamic images are obtained in the sagittal plane (through the axis of the endometrium).
Subtraction sequences are important to better delineate true enhancement from intrinsic T1 hyperintensity (i.e., hemorrhage, fat).

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



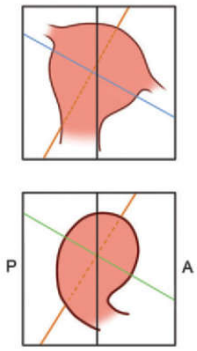






**Figure 2.** The double oblique technique. Illustration shows a uterus that is anteriorly rotated in the sagittal plane (anteverted) and laterally tilted to the left in the coronal plane. The double oblique sequence is performed by angling images anteriorly in the sagittal plane (green line) and laterally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

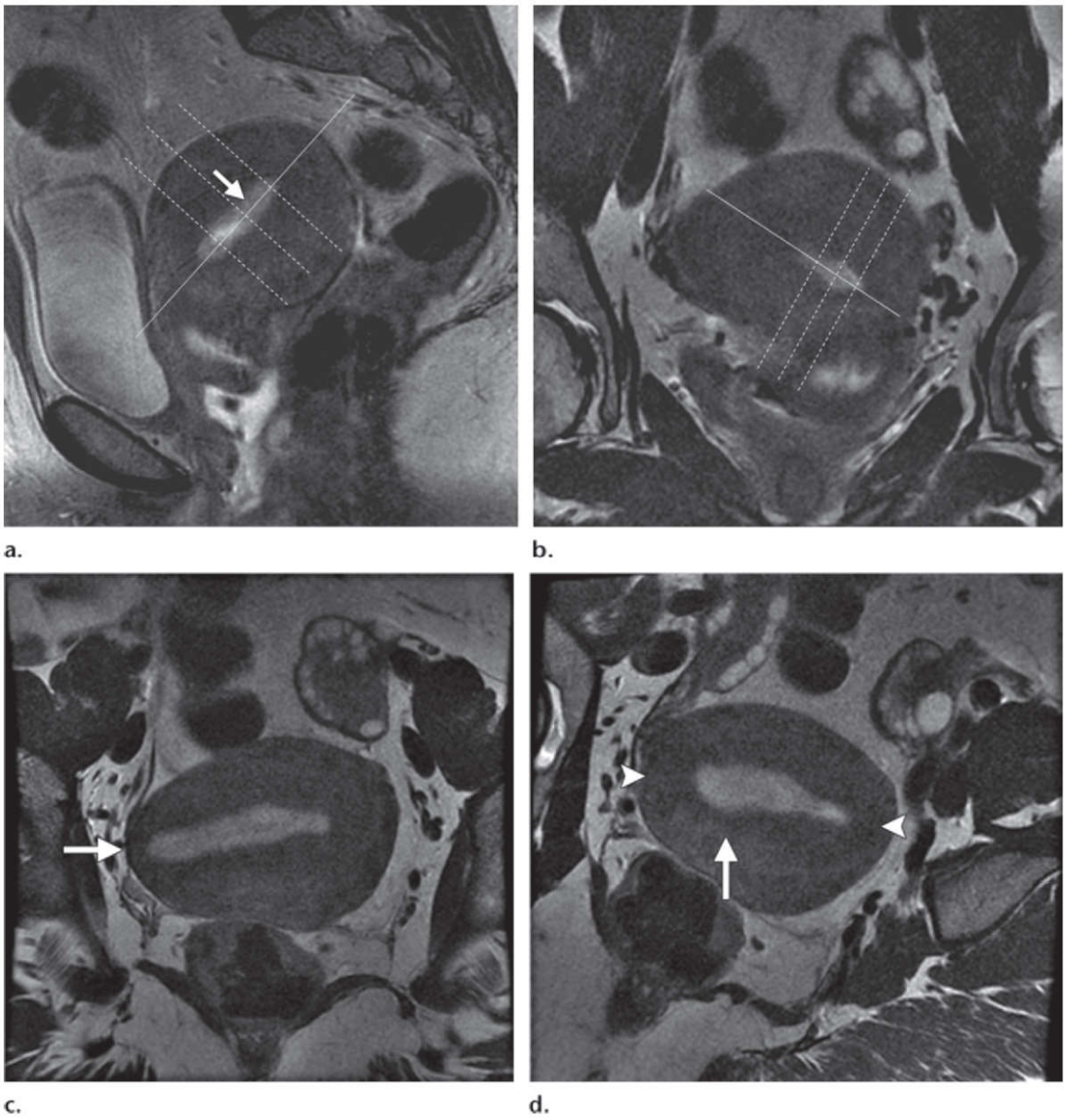



**Figure 3.** Double oblique technique in a patient with endometrial cancer. **(a)** High-resolution sagittal T2-weighted FRFSE MR image shows the correct plane for prescribing the orthogonal axial images perpendicular to the endometrial cavity in patients with endometrial carcinoma. Solid line and arrow = 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.

**References**

1. Rauch, G. M. et al. Optimization of MR Imaging for Pretreatment Evaluation of Patients with Endometrial and Cervical Cancer. RadioGraphics 34, 1082–1098 (2014).