Acquisition Techniques for MR of the Uterus and Adnexa
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I do not have any relevant financial relationships with any commercial interests
MR Protocol: Uterus and Adnexa

- T1-w: with and without fat sat
- T2-w: multiple planes
- T1-w + fat sat post Gd
MRI Female Pelvis: Protocol (U of M)

- **Localizer** (T2-w SSFSE or HASTE): Cor
- **T1-w** (GRE in-phase/opposed-phase): ax
- **T2-w** (FSE): Sag, short axis, long axis
- **T1-w + fat sat** (GRE): ax
  - Pre gad
  - Multiphasic post gad
- **Smooth muscle relaxant IM**: Glucagon
## MRI Female Pelvis: Protocol (WBH)

<table>
<thead>
<tr>
<th>Sequence Name</th>
<th>Slice Thick mm</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Localizer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non BH TSE T2 Sagittal</td>
<td>3-4</td>
<td>To cover uterus</td>
</tr>
<tr>
<td>Non BH TSE T2 FS Axial</td>
<td>3-4</td>
<td>True axial – to cover uterus</td>
</tr>
<tr>
<td>Non BH TSE T2 Coronal</td>
<td>3-4</td>
<td>True coronal – to cover uterus</td>
</tr>
<tr>
<td>Non BH TSE T1 Axial</td>
<td>5</td>
<td><strong>Cover entire pelvis from iliac crests to ischial tuberosities</strong></td>
</tr>
<tr>
<td>Non BH TSE T1 FS Axial – Pre gad</td>
<td>4</td>
<td>To cover entire pelvic cavity - include all of uterus &amp; ovaries</td>
</tr>
<tr>
<td>Non BH TSE T1 FS Axial – Post gad</td>
<td>4</td>
<td>To cover entire pelvic cavity - include all of uterus &amp; ovaries</td>
</tr>
<tr>
<td>Non BH TSE T1 FS Sagittal – Post gad</td>
<td>4</td>
<td>To cover entire pelvic cavity - include all of uterus &amp; ovaries</td>
</tr>
</tbody>
</table>

Optional

**For congenital uterine anomalies**
- Non BH TSE T2                        | 3-4            | Parallel to long axis of uterus – to cover uterus      |
- BH Coronal True FISP                 | 5              | Cover posterior abdomen - to evaluate kidneys.         |

**For endometrial cancer or cervical cancer**
- VIBE FS Axial – Pre gad              | 3-4            | To cover uterus or cervix                              |
- VIBE FS Axial – Post gad             | 3-4            | Dynamic post gad – 30 sec, 60 sec, 90 sec post injection. |

- Many sequences have parallel sat bands. Do not remove.
- Many sequences have iPat Grappa Factor of 2 or 3 and spatial resolution interpolation of 512. Do not remove.
- Place oblique coronal anterior sat band to cover abdominal fat
- Cover pelvis from iliac crests to ischial tuberosities on axial images.
MRI Protocol: Uterus and Adnexa

- T1-w: with and without fat sat
- T2-w: multiple planes
- T1-w Gadolinium enhanced imaging
High T1-w Signal Ovarian Mass

Differential diagnoses: (Blood, fat, mucin containing masses)
- a. Endometrioma
- b. Hemorrhagic cyst
- c. Dermoid cyst
- d. Ovarian mucinous cystadenoma
High SI on T1-w, Fat or Hemorrhage?

Dermoid

Endometrioma

T1-w without and with fat suppression
T1-w GRE OP/ IP
MRI Protocol: Uterus and Adnexa

- T1-w: with and without fat sat
- T2-w: multiple planes
- T1-w Gadolinium enhanced imaging
Sagittal T2-w FSE

MRI Female Pelvis: Uterus

- outer myometrium
- cervix
- endometrium
- vagina

JZ
MRI Female Pelvis: Ovaries

Axial T2-w FSE
Endometrial CA with myometrium invasion
Adenomyosis

• Endometrial stroma & glands in myometrium > myometrial hyperplasia
• Junctional zone focally or diffusely thickened ≥12 mm (normal < 8 mm)
Long uterine axis T2-w FSE

(assessment of outer fundal contour)
Congenital Uterine Anomalies

- Outer fundal contour distinguishes septate from bicornuate and didelphys
- Septate: fundal contour is flat or minimally concave (indentation <1 cm)
Congenital Uterine Anomaly

Septate Uterus
Congenital Uterine Anomalies

- Didelphys & bicornuate: deep fundal cleft

Didelphys

Bicornuate bicollis
Short uterine axis T2-w FSE
(assessment of myometrial abnormalities)
<table>
<thead>
<tr>
<th>Adenomyosis</th>
<th>Leiomyoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elliptical, ill defined</td>
<td>Round, well demarcated</td>
</tr>
<tr>
<td>Contiguous with JZ</td>
<td>Separate, may compress JZ</td>
</tr>
<tr>
<td>Minimal mass effect</td>
<td>Mass effect</td>
</tr>
<tr>
<td>Punctate high T1 &amp; T2 signal</td>
<td>Variable T1 &amp; T2 signal (degeneration)</td>
</tr>
<tr>
<td>Medical or hysterectomy</td>
<td>Embolization or surgical</td>
</tr>
</tbody>
</table>
Short cervical axis T2-w FSE
(assessment of cervical abnormalities)
Cervical CA
confined to cervix

Normal cervix
Cervical CA
confined to cervix
Cervical CA with parametrial extension
MR Protocol: Uterus and Adnexa

- T1-w: with and without fat sat
- T2-w: multiple planes
- T1-w fat sat: Gadolinium enhanced imaging
High T1-w Signal Ovarian Mass

- Administer Gd to exclude malignancy
- Assess enhancement: subtraction
  (post contrast – pre contrast)

Hemorrhagic cyst
Complex ovarian mass

Cystadenocarcinoma
• Other available sequences but not routinely performed
  – MRA
  – 3D T2-w
  – Diffusion
Figure 26a. (a) **MR angiogram** before uterine fibroid embolization nicely depicts trifurcation of the right internal iliac artery and a kink at the origin of the uterine artery (UA). (b) Digital subtraction angiogram obtained with selective injection via the right internal iliac artery in the same patient demonstrates good correlation between MR angiography and digital subtraction angiography. 

Preliminary Clinical Experience at 3 T With a 3D T2-Weighted Sequence Compared With Multiplanar 2D for Evaluation of the Female Pelvis
Hecht et al. AJR 2011; 197:W346–W352

Compare 3D T2-weighted sampling perfection with application-optimized contrast with different flip-angle evolutions (SPACE) with three-plane 2D turbo-spin echo (TSE) sequences for female pelvic imaging at 3T

**CONCLUSION.** At 3 T, 3D SPACE has similar image quality and diagnostic quality with shorter scan time when compared with 2D TSE but with reduced contrast between fat and fluid.
Results:
Mean myometrial SNR was higher on 3D than 2D images. Mean SI difference ratios between cervical or endometrial carcinomas and gluteal muscle were higher on 3D images, but those between leiomyoma and myometrium were lower than those on 2D images. Image quality and carcinoma conspicuity were superior with the 3D T2-weighted TSE sequence. No significant differences between 3D and 2D T2-weighted TSE imaging in accuracy of staging for cervical or endometrial carcinoma.
Conclusion: The 3D T2-weighted TSE sequence showed certain advantages over the 2D T2-weighted TSE sequence, and it has the potential to improve the performance of MR imaging for the evaluation of uterine carcinoma.
THE END