Body MR Protocols

Abdomen focus protocols
A 1: Pre- and post-contrast abdomen MRI
A 1L: Abdomen MRI without contrast
A 1P: Pre- and post-contrast abdomen MRI (pancreas protocol)
A 1R: Pre- and post-contrast abdomen and pelvis MRI (renal protocol)
A 2: Pre- and post-contrast abdomen MRI (uncooperative patient)
A 3: MR cholangiopancreatogram (MRCP)
A 4: Abdomen MRI without contrast (adrenal protocol)
A 5: Pre- and post-contrast abdomen and pelvis MRI (bowel protocol)
A 6: Chest, abdomen, or pelvis MRI with OR without contrast (superficial mass protocol)

Pelvic focus protocols
P 1: Pre- and post-contrast pelvis MRI (gynecologic protocol)
P 2: Pre- and post-contrast pelvis MRI (non-gynecologic protocol)
P 2R: Pre- and post-contrast pelvis MRI (rectal cancer protocol)
P 2P: Pre- and post-contrast pelvis MRI (prostate protocol)
P 2K: Non-contrast pelvis MRI (prostate radiation planning protocol)
P 2JB: Non-contrast pelvis MRI (prostate radiation implant protocol)
P 3: Pelvis MRI without contrast (appendicitis protocol)
P 4: Pre- and post-contrast pelvis MRI (urethral and perineal protocol)
P 5: Pelvis MRI with OR without contrast (scrotal protocol)
P 6: Pre- and post-contrast pelvis MRI with MR angiography (uterine fibroid embolization protocol)
P 7: Pelvis MRI without contrast (placenta accreta protocol)
P 8: Pelvis MRI without contrast (pelvic floor protocol)
P 9: Pelvis MRI with and without contrast (anal fistula protocol)
**A 1: Pre- and post-contrast abdomen MRI**

**Indications:** abdomen pain, liver lesion workup

**Sequences:** patient supine (preferred) or prone if poor breath-holder.
- Coronal HASTE: all sequences from hepatic dome to iliac crests.
- Axial 2-D FLASH in- and out-of-phase.
- Axial breath-hold T2 FSE: TE >150 msec.
- Axial dynamic VIBE: pre-contrast, arterial, portal venous phases.
- Post-Gd coronal 2-D FLASH or VIBE with fat saturation
- Delayed post-Gd axial VIBE
- *Opt:* Axial DWI and ADC

**Comments:**
- Axial 2-D FLASH: in-phase, out-of-phase images acquired as a double echo. T1-weighted images will generally not help much in lesion detection, but will address issues of focal hepatic fat and incidental adrenal masses.
- Axial T2 FSE: hemangiomas should approach the signal intensity of simple cysts given the prolonged TE. May perform post-Gd for more efficient use of time.
- Suggested VIBE timing formula: Delay = ½ injection time + arrival time – ½ acquisition time + fudge factor (4 sec). Arrival time = time to peak signal in abdominal aorta.
- Perform post-Gd 2-D FLASH out-of-phase to enhance fat saturation.
- Diffusion: use b=0, b=150, b=500. Send to PACS b0 and b500 images only, along with ADC.
- Eovist contrast: 20-minute delays for final axial VIBE.
A 1L: Abdomen MRI without contrast

Indications: abdomen pain not further specified.

Sequences: patient supine (preferred) or prone if poor breath-holder.
- Coronal HASTE: all sequences from hepatic dome to iliac crests.
- Axial 2-D FLASH in-phase
- Axial 2-D FLASH out-of-phase
- Axial breath-hold T2 FSE: TE >150 msec.
- Opt: Axial DWI and ADC.

Comments:
- Limited non-contrast abdomen MRI protocol. Avoid using unless requisition and patient’s symptoms are truly vague.
- Axial 2-D FLASH: in-phase, out-of-phase images acquired as a double echo. T1-weighted images will generally not help much in lesion detection, but will address issues of focal hepatic fat and incidental adrenal masses.
- Axial T2 FSE: hemangiomas should approach the signal intensity of simple cysts given the prolonged TE.
- Diffusion: use b=0, b=150, b=500. Send to PACS b0 and b500 images only, along with ADC.
A 1P: Pre- and post-contrast abdomen MRI (MRCP/pancreas protocol)

Indications: pancreatic lesion workup; malignant biliary stricture.

Sequences: patient supine (preferred) or prone if poor breath-holder.
- Coronal HASTE: hepatic dome to iliac crests.
- Axial 2-D FLASH in- and out-of-phase.
- Axial breath-hold T2 FSE with fat saturation or SPAIR
- Oblique coronal thin-slice HASTE through pancreas and CBD.
- Radial 40 mm thick HASTE (MRCP) around the common bile duct
- 3D MRCP with SPACE (available on Avantos only)
- Axial dynamic VIBE: pre-contrast, arterial, portal venous phases.
- Post-Gd coronal 2-D FLASH or VIBE with fat saturation
- Delayed post-Gd axial VIBE
- Opt: Axial DWI and ADC.

Comments:
- Coronal HASTE: survey sequence with heavy T2 weighting.
  Suggested parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- Axial 2-D FLASH: in-phase, out-of-phase images acquired as a double echo. T1-weighted images will generally not help much in lesion detection, but will address issues of focal hepatic fat and incidental adrenal masses.
- Axial T2 FSE: added fat saturation should increase conspicuity of peripancreatic infiltrative processes.
- Suggested VIBE timing formula: Delay = ½ injection time + arrival time – ½ acquisition time + fudge factor (4 sec). Arrival time = time to peak signal in abdominal aorta.
- Perform post-Gd 2-D FLASH out-of-phase to enhance fat saturation.
- Diffusion: use b=0, b=150, b=500. Send to PACS b0 and b500 images only, along with ADC.
A 1R: Pre- and post-contrast abdomen and pelvis MRI (renal protocol)

Indications: renal mass and hydronephrosis workup

Sequences: patient supine (preferred) or prone if poor breath-holder. All axial sequences span from hepatic dome through bottom of kidneys. Coronal sequences span from hepatic dome to bladder base.
- Coronal HASTE
- Axial 2-D FLASH in- and out-of-phase
- Axial 2-D FLASH in- and out-of-phase with fat saturation
- Axial breath-hold T2 FSE
- MR urogram: coronal 60 mm thick slab HASTE/SPACE.
- Coronal dynamic VIBE: pre-contrast, corticomedullary, nephrographic, and 5-minute delayed/ureteral phases.
- Post-Gd axial VIBE or 2-D FLASH with fat saturation.
- Opt: Axial DWI and ADC.

Comments:
- Pre-exam hydration: 1000 cc of water OR 250 cc IV NS (preferred).
- Axial 2D FLASH with fat saturation: T1-weighted sequence should address issue of angiomyolipomas.
- MR urogram details: acquire 10-15 times, each spaced 5-10 seconds apart. Display all images in one series.
- Suggested VIBE timing formula: \( \text{Delay} = \frac{1}{2} \text{injection time} + \text{arrival time} - \frac{1}{2} \text{acquisition time} + \text{fudge factor} \) (4 sec). Arrival time = time to peak signal in abdominal aorta.
- Perform post-Gd 2-D FLASH out-of-phase to enhance fat saturation.
- Diffusion: use \( b=0 \), \( b=150 \), \( b=500 \). Send to PACS \( b0 \) and \( b500 \) images only, along with ADC.
A 2: Pre- and post-contrast abdomen MRI (uncooperative patient)

Indications: patients with limited mobility, decreased mental status, and poor breath-holding capability.

Sequences: patient supine.

- Coronal HASTE (preferred) or tru-FISP: liver to iliac crests.
- Axial turbo FLASH: liver dome to iliac crests.
- Axial HASTE (preferred) or tru-FISP: liver dome to iliac crests.
- Dynamic axial VIBE or turbo FLASH with fat saturation: pre-contrast, arterial, and portal venous phases.
- Post-Gd coronal turbo FLASH with fat saturation: liver to iliac crests.

Comments:

- Should ideally be limited to inpatients when other imaging modalities have been exhausted.
- HASTE: can increase slice thickness and inter-slice gaps to decrease patient breath-hold times. Suggested baseline parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
A 3: MR cholangiopancreatogram (MRCP)

**Indications:** assess for biliary obstructions and strictures. Optional Secretin MRCP to assess pancreatic duct and exocrine pancreatic function.

**Sequences:** patient supine (preferred); prone if poor breath-holder.
- Coronal HASTE: hepatic dome to iliac crests.
- Axial 2-D FLASH in- and out-of-phase.
- Axial breath-hold T2 FSE with fat saturation or SPAIR
- Oblique coronal thin-slice HASTE through biliary system
- Oblique axial thin-slice HASTE through biliary system
- Radial 40 mm thick HASTE (MRCP) around the common bile duct
- 3D MRCP with SPACE (available on Avantos only)

**Optional: additional secretin MRCP sequences: 60mm thick slabs.**
- Coronal oblique HASTE immediately after injection.
- Coronal oblique HASTE every 30 seconds for up to 5 minutes, then every 60 seconds up to 10 minutes.

**Comments:**
- Coronal HASTE parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- Thin-slice HASTE parameters: TR 1100/TE 85; BW 195; ST/gap of 4/0, 218 x 256, FOV 30-40, NEX 0.5, coronals interleaved.
- Axial T2 FSE can be limited from top of gallbladder to bottom of pancreas. Fat saturation increases conspicuity of any infiltrative processes around the pancreas.
- Axial 2-D FLASH also does not need to cover entire liver. Provides T1-weighting, and also increases conspicuity of surgical clips.
- Oblique coronal and axial HASTE images oriented with respect to the extra-hepatic bile duct direction.

**Secretin MRCP details:**
- Patient preparation: fasting for 4 hours prior to exam.
- Negative oral contrast agent to reduce signal from overlying stomach, taken a few minutes before exam: 300 mL GastroMark, pineapple or blueberry juice.
- Secretin dose: 16 µg in adults, 0.2 µg/kg in pediatric patients. Administer slowly over 1 minute, NOT as bolus, to minimize patient discomfort.
A 4: Abdomen MRI without contrast (adrenal protocol)

**Indications:** adrenal adenomas versus malignancy.

**Sequences:** patient supine.
- Coronal HASTE: hepatic dome to iliac crests.
- Axial 2-D FLASH in-phase
- Axial 2-D FLASH out-of-phase
- Axial 2-D FLASH subtraction images.

**Comments:**
- Coronal HASTE: survey sequence with heavy T2 weighting.
  Suggested parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- Axial 2-D FLASH: in-phase, out-of-phase images acquired as a double echo to minimize misregistration for the subtraction images.
  Acquire from hepatic dome to bottom of kidneys.
- If other abdominal findings (ie., liver lesions) also need to be worked up concomitantly, perform abdomen survey instead, as adrenal workup sequences are incorporated into that protocol.
- Subtraction images: the order of sequence subtraction is critical.
  Correct way: In-phase images MINUS out-of-phase images. Hint: sequence with the higher TE, MINUS sequence with the lower TE.
A 5: Pre- and post-contrast abdomen and pelvis MRI (bowel protocol)

Indications: Crohn’s disease, bowel wall lesion characterization.

Sequences: patient prone (preferred) or supine.
- Coronal HASTE: top of kidneys to symphysis; 2 acquisitions if nec.
- Axial HASTE (non-interleaved): liver dome to symphysis; multiple acquisitions as necessary.
- Coronal 2-D FLASH in- and out-of-phase: top of liver to iliac crests.
- Post-Gd coronal VIBE or 2-D FLASH with fat saturation: top of kidneys to symphysis.
- Post-Gd axial VIBE or 2-D FLASH with fat saturation: liver dome to iliac crests.
- Opt: Axial DWI and ADC.

Comments:
- Suggested HASTE parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- 5-10 minutes before, administer 0.25 mg Levsin sublingually. Contraindications: glaucoma, bowel distention, myasthenia gravis, urinary obstruction, unstable heart disease.
- Oral contrast: two 450 cc bottles of Readi-Cat Barium contrast the night before, and 2 more bottles 1 hour before scan.
- Prone positioning will spread out bowel loops and decrease number of coronal slices needed for adequate coverage.
- Axial HASTE: typically 4 sets of images will be needed for adequate coverage.
- Post-Gd images done after a 60-80 second delay. Acquire images out-of-phase to enhance fat saturation.
- Diffusion: use b=0, b=150, b=500. Send to PACS b0 and b500 images only, along with ADC.
A 6: Chest, abdomen, or pelvis MRI with or without contrast (superficial mass protocol)

Indications: abdominal or chest wall lesion.

Sequences: place fiducial over area of concern; use smallest possible coil.
- Axial 2-D FLASH in-phase.
- Axial 2-D FLASH out-of-phase.
- Axial breath-hold T2 FSE
- Axial STIR FSE
- Post-Gd axial 2-D FLASH with fat saturation.

Comments:
- Acquire pre-contrast 2-D FLASH separately to enhance signal-to-noise ratio.
- Use EKG gating or flip phase/frequency if lesion is anterior to the heart.
- Gadolinium can be skipped if lesion has appearances of lipoma.
P 1: Pre- and post-contrast pelvis MRI (gynecologic protocol)

**Indications:** female pelvic pain, uterine and ovarian lesions.

**Sequences:** patient supine; scan from iliac wings or top of uterus to symphysis.
- Coronal HASTE
- Sagittal breath-hold T2 FSE (pelvic sidewall to sidewall).
- Uterine long-axis T2 FSE (non-breath-hold)
- Uterine short-axis T2 FSE (non-breath-hold)
- Axial T1 FSE: iliac crests to symphysis.
- Axial T1 FSE with fat saturation: iliac crests to symphysis.
- Sagittal or axial dynamic VIBE: pre-, arterial, venous phases.
- Axial post-Gd VIBE or 2-D FLASH with fat saturation
- Coronal post-Gd VIBE or 2-D FLASH with fat saturation
- **Opt:** sagittal post-Gd VIBE or 2-D FLASH with fat saturation for uterine lesions.
- **Opt:** Axial DWI and ADC.

**Comments:**
- 5-10 minutes before, administer 0.25 mg Levsin sublingually. Contraindications: glaucoma, bowel distention, myasthenia gravis, urinary obstruction, unstable heart disease.
- For known cervical and uterine mass workups, have patient inject 60 cc of prepared Surgilube in a cath-tip syringe attached to a truncated Yankauer suction device. Brown et al. AJR 2005; 185: 1221-1227.
- Sagittal T2 FSE: look for pelvic lymphadenopathy. Also used to set up for uterine T2 FSE images.
- Can skip uterine T2 FSE sequences if status post hysterectomy or if exam is done for ovarian pathology.
- Axial 2-D FLASH: useful for assessing ovarian dermoids or other fat-containing lesions.
- Axial T1 FSE with fat saturation: look for endometriosis deposits. Place superior and inferior sat bands to avoid venous inflow signal.
- VIBE planes: sagittal if exam done for uterine pathology, axial for all other indications.
Suggested VIBE timing formula: Delay = \( \frac{1}{2} \) injection time + arrival time – \( \frac{1}{2} \) acquisition time + fudge factor (4 sec). Arrival time = time to peak signal in abdominal aorta.

- Perform post-Gd 2-D FLASH out-of-phase to enhance fat saturation.
- Diffusion: use \( b=0 \), \( b=150 \), \( b=800 \). Send to PACS \( b0 \) and \( b800 \) images only, along with ADC.
P 2: Pre- and post-contrast pelvis MRI (non-gynecologic protocol)

Indications: pelvic pain, bladder cancer.

Sequences: patient supine. Scan from iliac crests to symphysis.
- Coronal HASTE
- Sagittal non-breath-hold T2 FSE (pelvic sidewall to sidewall)
- Axial T1 FSE: iliac crests to symphysis.
- Axial non-breath-hold T2 FSE (small FOV to pelvic sidewalls)
- Coronal non-breath-hold T2 FSE (small FOV to pelvic sidewalls)
- Axial dynamic VIBE: pre-, arterial, venous phases
- Coronal and axial post-Gd VIBE or 2-D FLASH with fat saturation
- Opt: Axial DWI and ADC.

Comments:
- Suggested HASTE parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- 5-10 minutes before, administer 0.25 mg Levsin sublingually. Contraindications: glaucoma, bowel distention, myasthenia gravis, urinary obstruction, unstable heart disease.
- Sagittal T2 FSE: look for pelvic lymphadenopathy.
- Suggested VIBE timing formula: Delay = ½ injection time + arrival time – ½ acquisition time + fudge factor (4 sec). Arrival time = time to peak signal in abdominal aorta.
- Perform post-Gd 2-D FLASH out-of-phase to enhance fat saturation.
- Diffusion: use b=0, b=150, b=800. Send to PACS b0 and b800 images only, along with ADC.
P 2R: Pre- and post-contrast pelvis MRI (rectal cancer protocol)

Indications: staging of known rectal cancer.

Sequences: patient supine, with saturation band across abdominal wall. Scan from iliac crests to symphysis.
- Sagittal HASTE.
- Axial T2 FSE
- Oblique axial and coronal T2 FSE (FOV 18): orient to mass lesion.
- Axial T1 FSE.
- Axial pre-Gd VIBE.
- Sagittal, coronal and axial post-Gd VIBE or 2-D FLASH with fat saturation (FOV 18). No dynamic imaging needed.
- Axial DWI and ADC.

Comments:
- Patients should empty bowel and bladder right before scan. For mid to high rectal tumors, consider 60-100 mL warm US gel as rectal contrast.
- FOV around 30 cm, except when specified as small FOV as above.
- Suggested HASTE parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- 5-10 minutes before, administer 0.25 mg Levsin sublingually. Contraindications: glaucoma, bowel distention, myasthenia gravis, urinary obstruction, unstable heart disease.
- Perform post-Gd 2-D FLASH out-of-phase to enhance fat saturation.
- Diffusion: use b=0, b=150, b=500-800. Send to PACS b0 and b800 images only, along with ADC.
P 2P: Pre- and post-contrast pelvis MRI (prostate protocol)

Indications: known prostate cancer, assess for extra-capsular invasion.

Sequences: patient supine. Scan from iliac crests to symphysis only.
- Coronal HASTE
- Axial T1 FSE with fat saturation
- Axial non-breath-hold T2 FSE (small FOV through prostate)
- Coronal non-breath-hold T2 FSE (small FOV)
- Sagittal non-breath-hold T2 FSE (small FOV)
- Dynamic post-Gd axial VIBE through prostate (6 time points).
- Axial post-Gd VIBE or 2-D FLASH with fat saturation
- Coronal post-Gd VIBE or 2-D FLASH with fat saturation
- Axial DWI and ADC.

Comments:
- Suggested HASTE parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- T2 FSE specifications (if technically possible): ST 3mm no gap, FOV 12-20 cm, pixel size 0.7 mm or less (phase) and 0.4 mm or less (frequency).
- 3D SPACE option in addition to T2 FSE sequences: TR/TE 1200/141, flip angle 150 degrees, ETL 67, 2 echo trains per slice, partition thickness 1.5 mm, FOV 192 x 192 mm, 192 x 123 matrix, receiver bw 744 Hz/pixel, iPat 2, NEX 2. Reconstruct at 3 mm thickness in 3 planes.
- DWI specifications (if technically possible): TE 90 ms or less, TR 3000 or more. ST 3 mm no gap. FOV 16-22 cm, pixel size 2.5 mm or less (phase and frequency). B values: 50-100, 800-1000, 1400 or greater. Send to PACS low- and high- b-value images, along with ADC.
- Suggested VIBE timing formula: Delay = ½ injection time + arrival time – ½ acquisition time + fudge factor (4 sec). Arrival time = time to peak signal in abdominal aorta.
- Dynamic contrast enhancement (DCE) specifications (if technically possible): 3D VIBE preferred, fat saturation and/or subtraction images recommended. TR <100 ms, TE <5 ms. ST 3 mm no gap, FOV to cover prostate gland and seminal vesicles, pixel size 2 x 2 mm or less.
Temporal resolution: <7 sec preferred; total observation rate: 2 min or more. Dose: 0.1 mmol/kg standard contrast, injection rate 2-3 mL/sec.

- Perform post-Gd 2-D FLASH out-of-phase to enhance fat saturation.
P2K: Non-contrast pelvis MRI (prostate radiation planning protocol)

Indications: radiation therapy planning for prostate cancer for Dr. Kantorowitz’s patients

Sequences:
- Axial GRE with the following parameters: 2 mm slice thickness with 0 mm gap, TR/TE = 650/15 ms, flip angle 25 degrees, bandwidth of 15.6 kHz, FOV = 20 cm, spatial resolution of 256 x 192, NEX = 2.

Comments:
- Scan to include top of seminal vesicles all the way down to include the base of the penis.
P2JB: Non-contrast pelvis MRI (prostate radiation implant protocol, from Jim Borrow of First Hill Imaging)

Indications: radiation implant planning for prostate cancer, courtesy of Dr. Jim Borrow from First Hill Imaging.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>TR/TE</th>
<th>Phase encode</th>
<th>ST/gap</th>
<th>Matrix</th>
<th>FOV (cm)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial T2</td>
<td>5250/122</td>
<td>L to R</td>
<td>2.5/0</td>
<td>384/380</td>
<td>24</td>
<td>100% oversample 50 slices 2 concatenations, 2 averages</td>
</tr>
<tr>
<td></td>
<td>RESTORE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axial T1</td>
<td>600/12</td>
<td>L to R</td>
<td>2.5/0</td>
<td>384/380</td>
<td>24</td>
<td>100% oversample 50 slices 5 concatenations, 1 average</td>
</tr>
<tr>
<td>Axial STIR</td>
<td>5000/76</td>
<td>L to R</td>
<td>2.5/0</td>
<td>256/256</td>
<td>24</td>
<td>100% oversample 50 slices 3 concatenations, 1 average</td>
</tr>
<tr>
<td></td>
<td>TI of 150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coronal T2</td>
<td>5000/128</td>
<td>L to R</td>
<td>2.5/0</td>
<td>384/380</td>
<td>24</td>
<td>100% oversample 50 slices 2 concatenations, 1 average</td>
</tr>
<tr>
<td>Sagittal T2</td>
<td>5420/128</td>
<td>A to P</td>
<td>2.5/0</td>
<td>384/380</td>
<td>24</td>
<td>100% oversample 40 slices 2 concatenations, 1 average</td>
</tr>
<tr>
<td>Axial DWI/ADC</td>
<td>10900/85</td>
<td>L to R</td>
<td>5.0/0</td>
<td>192/100</td>
<td>32-45</td>
<td>18% oversample 36 slices 2 averages</td>
</tr>
<tr>
<td></td>
<td>b 0, 50, 750</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:
- Use phased array coil.
- Adjust FOV to patient size.
- Subject to revisions, including using glucagon and Gadolinium.
P 3: Pelvis MRI without contrast (appendicitis protocol)

Indications: assess for appendicitis in a pregnant female after an inconclusive ultrasound.

Sequences: patient supine.
- Coronal HASTE
- Axial HASTE
- Sagittal HASTE
- Axial HASTE with fat saturation
- Axial 2D TOF
- Axial 2D FLASH in- and out-of-phase.
- Axial DWI and ADC.

Comments:
- Scan coverage: kidneys through symphysis. FOV 30-40 cm.
- Suggested HASTE parameters: ST/gap 4/1, 256 x 192 matrix, TR 800-1100/TE 60-80, NEX 1.
- Suggested axial 2D time of flight parameters: ST/gap of 3/1, 256 x 128 matrix, TR 300-360, TE 4.5-10, non breath hold.
- Suggested DWI parameters: ST/gap of 5/0, 64 x 64 matrix.
- Suggested axial 2D FLASH parameters: ST gap of 5/1, 256 x 160 matrix.
- Radiologist to check images before patient leaves.

GUIDELINES ON PERFORMING APPENDICITIS MRI:
- Gadolinium is relatively contra-indicated in ALL pregnant patients.
- Even though MRI has to date demonstrated no adverse effects to the fetus, it is relatively contra-indicated in the first trimester due to the amount of organogenesis in early pregnancy.
- Because the long-term effects of MRI on the fetus are still unknown, MRI is a second-line test to evaluate right abdominal pain after an inconclusive ultrasound, when the only available other imaging options involve ionizing radiation.
- Radiologist’s option: oral mixture of 300cc or GastroMark and 300cc ReadiCat ingested 90 minutes before imaging may improve visualization of the cecum and appendix by providing negative contrast.
P 4: Pre- and post-contrast pelvis MRI (urethral and perineal protocol)

**Indications:** assess and characterize urethral diverticula/masses.

**Sequences:** patient supine.
- Coronal HASTE: iliac crests to symphysis
- Axial non-breath-hold T2 FSE: small FOV from bladder to perineum.
- Sagittal non-breath-hold T2 FSE: small FOV centered on urethra.
- Coronal non-breath-hold T2 FSE: small FOV centered on urethra.
- Axial T1 FSE: iliac crests to symphysis.
- Axial 2-D FLASH in-phase with fat saturation: small FOV
- Post-Gd axial VIBE or 2-D FLASH with fat saturation: small FOV
- Post-Gd sagittal VIBE or 2-D FLASH with fat saturation: small FOV

**Comments:**
- Suggested HASTE parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- All but initial sequence performed with coned-down field of view centered on the urethra and bladder.
P 5: Pelvis MRI with or without contrast (scrotal protocol)

Indications: testicular masses or infection.

Sequences: patient supine.
- Coronal HASTE (iliac crests through perineum)
- Axial T1 FSE (small FOV)
- Axial T2 FSE (small FOV)
- Coronal T1 FSE (small FOV)
- Coronal T2 FSE (small FOV)
- Opt: axial and/or coronal T1 FSE with fat saturation
- Opt: post-Gd axial and/or coronal T1 FSE with fat saturation

Comments:
- Suggested HASTE parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- All but initial sequence performed with coned-down field of view (FOV) centered on the scrotum.
- Give Gadolinium only for infections or abscess, NOT for tumor workup (will not change the diagnosis).
P 6: Pre- and post-contrast pelvis MRI with MR angiography (uterine fibroid embolization protocol)

**Indications:** characterize fibroids, planning study for embolization.

**Sequences:** patient supine. Scan from top of uterus to symphysis
- Coronal HASTE
- Sagittal breath-hold T2 FSE: cemter on uterus
- Uterine long axis breath-hold T2 FSE
- Uterine short axis breath-hold T2 FSE
- Axial T1 FSE: iliac wings to symphysis.
- Coronal MRA: pre-Gd, arterial phase, delayed venous phase.
- Post-Gd sagittal VIBE or 2-D FLASH with fat saturation.

**Comments:**
- Suggested HASTE parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- Perform post-Gd 2-D FLASH out-of-phase to enhance fat saturation.
P 7: Pelvis MRI without contrast (placenta accreta protocol)

**Indications:** assess for placenta accreta or percreta in the setting of prior C-sections and/or placenta previa.

**Sequences:** patient supine. Scan from top of uterus to symphysis
- Coronal HASTE
- Axial HASTE
- Sagittal HASTE
- Sagittal T2 FSE (non-breath-hold), FOV centered on placenta.
- Axial T2 FSE with fat saturation (non-breath-hold), FOV centered on placenta
- Axial T1 FSE.

**Comments:**
- Suggested coronal HASTE parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- Interpreting radiologist to check exam and add any additional sequences before patient leaves the scanner.
P 8: Pelvis MRI without contrast (pelvic floor protocol)

Indications: assess pelvic floor dysfunction, pelvic organ prolapse, urinary and defecatory abnormalities.

Sequences: patient supine, with wedge under slightly spread knees.
  - Sagittal HASTE at rest.
  - Sagittal truFISP during Valsalva.
  - Sagittal HASTE during Valsalva.
  - Coronal HASTE during Valsalva.
  - Axial T2 FSE at rest.
  - Coronal T2 FSE at rest.

Comments:
  - Suggested HASTE parameters: ST/gap of 6/0, 256x256, FOV 35.
    Scan from femoral head to femoral head.
  - TruFISP parameters: continuous 60 sec acquisition along mid sagittal 6 mm slice.
  - T2 FSE parameters: 4 mm ST, FOV 30, 300x384 matrix.
P 9: Pre- and post-contrast pelvis MRI (anal fistula protocol)

Indications: assess and characterize anal fistulas and abscesses.

Sequences: patient supine.
- Coronal HASTE: iliac crests to symphysis
- Sagittal non-breath-hold T2 FSE: 30 x 30 FOV, 2.5 mm ST w/ 0 gap. 320 x 256 matrix.
- Oblique axial non-breath-hold T2 FSE: 26 x 26 FOV, 4.0 mm ST w/ 1 mm gap. 384 x 224 matrix.
- Oblique coronal non-breath-hold T2 FSE: 24 x 24 FOV, 4.0 mm ST 1/1 mm gap. 512 x 224 matrix.
- Oblique axial T1 FSE: 26 x 26 FOV, 4.0 mm ST w/ 1 mm gap. 384 x 224 matrix.
- Post-Gd oblique axial VIBE or T1 FSE with fat saturation: 26 x 26 FOV, 4.0 mm ST w/ 1 mm gap. 384 x 224 matrix.
- Post-Gd oblique coronal VIBE or T1 FSE with fat saturation: 24 x 24 FOV, 4.0 mm ST w/ 1 mm gap. 512 x 224 matrix.

Comments:
- Suggested HASTE parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 30-40, phase R/L, NEX 1, R&L sat bands, interleaved.
- All oblique axial and coronal sequences should be oriented perpendicular and parallel to the anal canal, respectively, based off the sagittal sequence.
- 3D SPACE may be substituted for the T2 FSE sequences if available on scanner.