Skagit RADIOLOGY	**Body: MR Protocols**		
	Reviewed:	Date: 3/10/25	J.Finizio
	Revised: Updated body protocols	Date: 3/10/25	Dr. Cai; Dr.Craig

Abdomen:

A 1: Pre- and post-contrast abdomen MRI (General, Liver)

A 1L: Abdomen MRI without contrast

A 1P: Pre- and post-contrast abdomen MRI (MRCP/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 cholangiopancreatography (default MRCP protocol)

A 4: Abdomen MRI without contrast (adrenal protocol)

A 5: Pre- and post-contrast abdomen and pelvis MRI (Enterography protocol)

A 6: MRI superficial mass protocol

A6a: Pre-and post-contrast Chest (chest oncology protocol)

Pelvis:

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: Multiparametric prostate MRI (prostate protocol)

P 2K: Non-contrast pelvis MRI (prostate radiation planning protocol)

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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)

P7: Pelvis MRI without contrast (placenta accreta protocol)

P8: Pelvis MRI without contrast (pelvic floor protocol)

P9: Pelvis MRI with and without contrast (anal fistula protocol)

P10: Pelvis MRI defecography

General Notes

- The order of sequences is suggested to minimize table time

- T2 Sequences
  - When doing fat-saturation, T2FS (chemical shift) is preferred
    - Expected to have inhomogeneity at edges from large patients and metal
  - Inversion recovery (STIR) and steady-state free precession (FISP, FIESTA) are generally not appropriate for body protocols and cannot be used post-contrast

- For longer sequences on patients who cannot breath-hold or inappropriate for respiratory-trigger, consider radial sequences (BLADE) or motion-correction acquisition if available
  - Prone positioning can also help

- If DIXON is used, please send only the "water" images (do not send the IP/OP/fat-only images)

- For IP/OP chemical shift imaging, do not use fat-sat

For GE users:

HASTE = SS-FSE

VIBE = LAVA

BLADE = PROPELLER

A 1: Pre- and post-contrast abdomen MRI (General, Liver)

Default protocol if abdominal MR if ordered without specific indication

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.
- Coronal VIBE with fat saturation portal venous phase
- Axial DWI and ADC
- Axial T2FS
- Delayed post-Gd axial VIBE (5 min)

EOVIST Variant:

Use if *first* MRI obtainined for a patient with an incidental liver lesion, if requested by the prior report, or if requested by the referring provider.

- Coronal HASTE: all sequences from hepatic dome to iliac crests.
- Axial 2-D FLASH in- and out-of-phase
- Axial dynamic VIBS: pre contrast, arterial, portal venous phases.
- Post-Gd coronal 2-D FLASH or VIBE with fat saturation
- Axial breath-hold t@ FSE: TE > 150 msec
- Axial T2FS
- Acial DWI and ADC
- Delayed post-Gd axial VIBE (15 min)

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.

- 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.
- Diffusion: use b=0, b=150, b=500. ADC.
- DIXON: send water only images

A 1L: Abdomen MRI without contrast

Indications: abdomen pain not further specified.

Sequences: patient supine (preferred) or prone if poor breath-holder.

- Coronal HASTE: hepatic dome to iliac crests.
- Axial 2D in- and out-of-phase
- Axial breath-hold T2 FSE
- Axial DWI and ADC.

Comments:

- Limited non-contrast abdomen MRI protocol. Avoid using unless requisition and patient's symptoms are truly vague.
- Coronal HASTE is the survey sequence with heavy T2 weighting. Suggested parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 3040, phase R/L, NEX 1, R&L sat bands, interleaved.
- Diffusion: use b=0, b=150, b=500. ADC.
- DIXON: send water only images

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.

- T2 coronal HASTE, full abdomen
- T2 breath-hold FSE thin-slice axial
  - No FS
  - Small FOV focusing on pancreas and bile ducts
- Axial 2D In/Out
- DWI/ADC
- 3D MRCP

- T1 axial VIBE non-con, arterial, venous
- T1 coronal VIBE venous phase
- T2 fat-sat, full abdomen, axial
    - This can be obtained while waiting for the delay phase post-contrast
- T1 axial VIBE delay

Comments:

Coronal HASTE is the survey sequence with heavy T2 weighting. Suggested parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 3040, phase R/L, NEX 1, R&L sat bands, interleaved.

- DIXON: send water only images
- 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.
- Diffusion: use b=0, b=150, b=500. 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.

- T2 coronal HASTE, full abdomen
- T2 axial HASTE, full abdomen
- Axial 2D In/Out
- DWI/ADC
- T1 coronal VIBE non-con, arterial, 140s nephrographic
    - If large patient, ok to exclude top of liver dome and body wall, optimize FOV for kidneys
    - Send subtractions for the arterial and nephrographic phases
- T1 axial VIBE full abdomen nephrographic phase
- T2 fat-sat coronal, full abdomen
    - This can be obtained while waiting for the 8min delay phase post-contrast
- T1 coronal VIBE delay (8min)
    - No need to send subtraction on this one

*Do not image the bladder/pelvis, no T2 "urogram" needed

Comments:

- For large patients, optimize FOV for the kidneys on the VIBE sequences, ok to exclude top of liver and body wall as long as the T2 HASTE sequences capture these regions
- Pre-exam hydration: 1000 cc of water *OR* 250 cc IV NS (preferred).

Coronal HASTE is the survey sequence with heavy T2 weighting. Suggested parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 3040, phase R/L, NEX 1, R&L sat bands, interleaved.

- DIXON: send water only images
- 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.
- Diffusion: use b=0, b=150, b=500. ADC.
- DIXON: send water only images

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): liver to iliac crests.
- Axial 2D In/Out
- Axial HASTE (preferred): liver dome to iliac crests.
- DWI/ADC
- Dynamic axial VIBE: pre-contrast, arterial, and portal venous phases.
- Coronal VIBE

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 cholangiopancreatography (MRCP stones non-contrast) DEFAULT PROTOCOL for MRCP

Indications: assess for biliary obstructions and strictures.

Sequences: patient supine (preferred); prone if poor breath-holder.

- T2 coronal HASTE, full abdomen
- T2 axial HASTE, full abdomen
- Axial 2D In/Out
- DWI/ADC
- T2 FSE thin-slice axial (no FS)
    - Small FOV focusing on pancreas to top of gallbladder
- 3D MRCP
- Coronal T2 (FS optional)
    - Small FOV focusing on pancreas and bile ducts
    - No need to acquire with multiple angles
- T1 axial VIBE non-con

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.
- DIXON: send water only images
- Negative oral contrast agent to reduce signal from overlying stomach, taken a few minutes before exam (optional): 300 mL GastroMark, pineapple juice.

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 in-phase
- Axial 2-D out-of-phase
- Axial 2-D FLASH subtraction images
    - *In-phase minus out-phase (i.e.: high TE minus low TE)*

Comments:

- Coronal HASTE: survey sequence with heavy T2 weighting. Suggested parameters: TR 1060/TE 116; BW 195; ST/gap of 6/0, 256x256, FOV 3040, 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.
- Liver, renal, MRCP, pancreas protocols incorporate the above sequences already and can also workup adrenal lesions

A 5: Pre- and post-contrast abdomen and pelvis MRI (enterography protocol)

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

Sequences: patient prone (preferred).

- T2 coronal HASTE, large FOV

- T2 axial HASTE, centered between the lower pole of the kidneys and the iliac crest
- T2 fat-sat coronal, centered between the lower pole of the kidneys and the iliac crest
- T2 FS axial, pubic symphysis to below the anus^
- T2 FS coronal oblique parallel to sphincter, pubic symphysis to below the anus^
- DWI/ADC, centered between the lower pole of the kidneys and the iliac crest
- T1 VIBE coronal pre, 90s, 3min
    - Centered between the lower pole of the kidneys and the iliac crest
- Axial VIBE 90s abdomen
    - Centered between the lower pole of the kidneys and the iliac crest
- Axial VIBE whole pelvis^

Comments:

Do not acquire FISP/FIESTA to assess peristalsis

For large patients on the axials, do NOT split the upper and lower abdomen, center the FOV between the bottom of the kidneys and the iliac crest. Ok to cut off the hepatic dome.

For large patients on the coronals, ok to cut off the top of the abdomen and body wall as long as the large FOV coronal T2 HASTE catches the anatomy

- ^These sequences are part of a perianal fistula screen, they do not replace the perianal fistula protocol.
- Prone positioning will spread out bowel loops and decrease number of coronal slices needed for adequate coverage.
- Oral contrast: three bottles of Volumen/ Breeza (450 mL x 3) oral contrast, 60 minutes prior to scan.
- 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 (optional).
    - Contraindications: glaucoma, bowel distention, myasthenia gravis, urinary obstruction, unstable heart disease.
- DIXON: send water only images

A 6: MRI with/without contrast Superficial Mass Protocol

Indications: abdominal or chest wall lesion.

Sequences: place fiducial over area of concern; use smallest possible coil.

- Axial T2 HASTE large FOV
- Axial 2D IP/OP small FOV focusing on fiducial
- Axial T2 FS small FOV focusing on fiducial
- Coronal T2 FS small FOV focusing on fiducial
- Axial VIBE pre and post small FOV focusing on fiducial
- Coronal VIBE post small FOV focusing on fiducial

Comments:

- Use EKG gating or flip phase/frequency if lesion is anterior to the heart.
- Suggested post-Gd delays: chest 25 sec, abdomen 30 sec, pelvis 35 sec. Better to wait too long than not long enough.

A 6a : Pre- and post-contrast Chest MR (oncology protocol)

Indications: Intrathoracic(non-MSK) lesion or malignancy evaluation/follow-up

Sequences:

Sequences:

- Axial 2D in- and out-of-phase.
- Coronal 2D in- and out-of-phase.
- Axial T2 HASTE (Full Chest)
- Coronal HASTE (Full Chest)
- Axial Diffusion and ADC (Full Chest)
- Axial T2 FS (Use small FOV if focusing on particular lesion)
- Axial VIBE pre and post-contrast (Full chest)
- Axial VIBE post-contrast small FOV if focusing on particular lesion
- Coronal VIBE post-contrast (full chest)

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.
- Axial post-Gd VIBE or 2-D FLASH with fat saturation
- Coronal post-Gd VIBE or 2-D FLASH with fat saturation
- Sagittal post-Gd VIBE or 2-D FLASH with fat saturation for uterine lesions.
- Axial DWI and ADC.

Comments:

- Patient Prep: Consider Fleet Enema prior to scan *(Right before patient leaves home to come to exam)*
- 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.
- 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.
- 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 desmoids 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 = 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.

P 2: Pre- and post-contrast pelvis MRI (general pelvis, default pelvis protocol if specific indication not specified)

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
- Axial DWI and ADC.

Comments:

- Patient Prep: Consider Fleet Enema prior to scan *(Right before patient leaves home to come to exam)*
- 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. Contra-indications: 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. 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:

- Patient Prep: Fleet Enema prior to scan *(Right before patient leaves home to come to exam)*
- 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. Contra-indications: 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. ADC.

P 2P: Multiparametric prostate MRI (prostate protocol)

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

Sequences: patient supine. Scan from iliac crests to symphysis only.

- Localizer
- Coronal T2 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)
- Axial DWI and ADC.
- 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

Comments:

- Patient Prep: Fleet Enema prior to scan *(Right before patient leaves home to come to exam)*
- 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, 800, 1400. ADC.
    1. Please send b2000 calculated B-value if available
- **Match small FOV** of axial prostate and ADC/ DWI.
- 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): Dose: 0.1 mmol/kg standard contrast, injection rate 2-3 mL/sec. 3D VIBE preferred, fat saturation. 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. **Post contrast dynamic images**: ***6*** time points should be sufficient. Do not need subtractions.

- 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.

Sequence	TR/TE	Phase encode	ST/gap	Matrix	FOV (cm)	Notes
Axial T2 RESTORE	5250/122	L to R	2.5/0	384/380	24	100% oversample 50 slices 2 concatenations, 2 averages
Axial T1	600/12	L to R	2.5/0	384/380	24	100% oversample 50 slices 5 concatenations, 1 average
Axial STIR	5000/76 TI of 150	L to R	2.5/0	256/256	24	100% oversample 50 slices 3 concatenations, 1 average
Coronal T2	5000/128	L to R	2.5/0	384/380	24	100% oversample 40 slices 2 concatenations, 1 average
Sagittal T2	5420/128	A to P	2.5/0	384/380	24	100% oversample 40 slices 2 concatenations,

						1 average
Axial DWI/ADC	10900/85 b 0, 50, 750	L to R	5.0/0	192/100	32-45	18% oversample 36 slices 2 averages

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 DWI and ADC.
- 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)
- Axial DWI and ADC.
- *Optional*: axial and/or coronal T1 FSE with fat saturation
- *Optional*: 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: center on uterus
- Uterine long axis breath-hold T2 FSE
- Uterine short axis breath-hold T2 FSE
- Axial DWI and ADC.
- 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.
- Axial DWI and ADC.

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 with fat saturation: 26 x 26 FOV, 4.0 mm ST w/ 1 mm gap. 384 x 224 matrix.
- Oblique coronal non-breath-hold T2 FSE with fat saturation: 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.
- Axial DWI and ADC.
- 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.

P 10: Pelvis MRI defecography

Indications: pelvic floor, prolapse

Prep:

No solid food 4h prior to exam, No IV required

Clear liquids ok up to 1h prior to exam

Warm ultrasound gel in 60cc slip-tip syringes

Diaper patient

Administer ultrasound gel up to patient's tolerance using Foley (180cc in rectum, 60cc in vagina)

Do not push air (causes artifact)

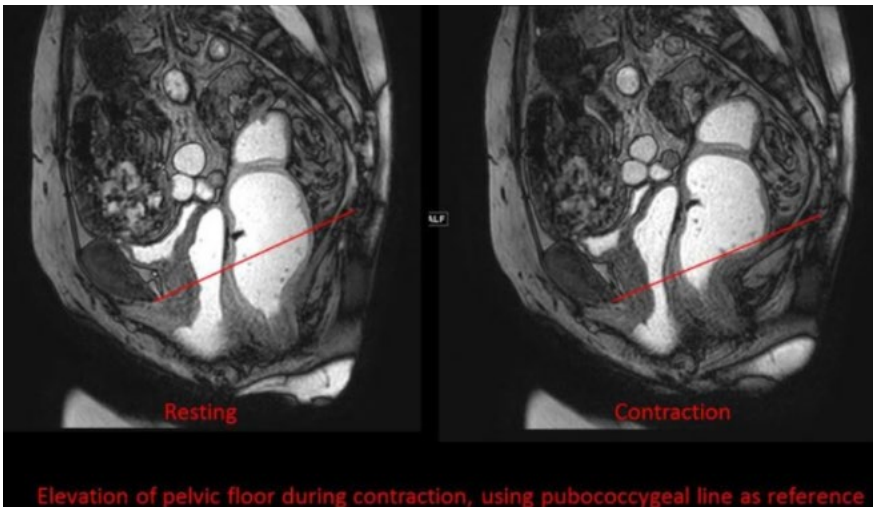
Sequences:

1. T2 FSE breath-hold sagittal

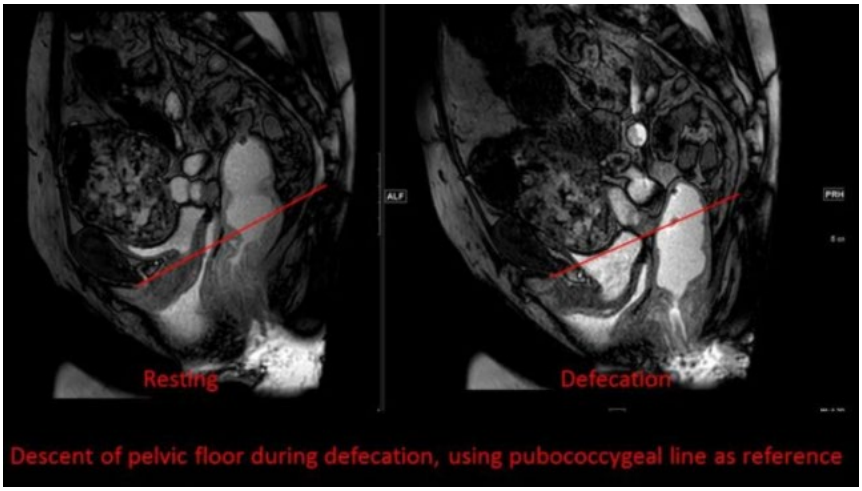
- Acetabulum-to-acetabulum, top-of-sacrum to below perineum

2. FISP CINE with contraction, use best midline sagittal slice

- 0.5s temporal resolution
- Sample instructions
    - "Perform a Kegel, hold…. Relax"
    - "Pretend you are stopping urination mid-stream, hold it…. Relax"
- Repeat as necessary with coaching, send best 3 attempts, discard other attempts



3. FISP CINE with defecation, use best midline sagittal slice
   - 0.5s temporal resolution
   - Sample instructions
     - "Push, bear-down and defecate… relax"
   - Repeat as necessary with coaching, send best 3 attempts, discard other attempts



4. T2 FSE coronal and axial (full pelvis)