TRA-MINW

MR Rectal
MR Pelvis Without & With Contrast

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Standard uses: Rectal cancer staging, pre or post chemoradiation

Notes: Obtaining prior colonoscopy report and (when relevant) pre-chemoradiation MRI is **VERY** important so we know where to expect the tumor. Prior clinical notes can be very helpful, as well

Consider using saturation bands on the subcutaneous tissues of the anterior abdominal wall.

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

Coverage & coil: Phase array body coil over the pelvis
Coverage is from the level of the iliac crest to below the symphysis pubis, further detailed below

NOTE: For lower recta/anal tumors, coverage must extend below the anal verge

Intravenous contrast: Weigh- based Gadavist or Multihance

Oral contrast: None

Anti-peristaltic agent: None

Sequences:
1. **3 plane localizer**

2. **Coronal T2 Ultra fast SE (HASTE, SSFSE, FASE), large FOV**
   a. Multi-breath hold as needed
   b. Large FOV (400-450 mm)
      i. Complete front to back coverage
   c. Goal parameters
      i. Slice thickness 7-8 mm thick
      ii. Gap 10-15%

3. **Sagittal T2 fast SE (Turbo SE, Fast SE)**
   a. FOV: Extend from above sacral promontory to below anus
      i. Slices should cover entire rectum extending into each femoral head
   b. Goal parameters
      i. Slice thickness 3 mm
      ii. Gap 0%
      iii. In plane acquired resolution <1 mm

    iv. Number of averages = 2

4. **Oblique short axis (axial) T2 fast SE (Turbo SE, Fast SE), small FOV**
This is the most important sequence of the exam
  a. Plane: Imaging plane should be perpendicular to the lumen of the rectum at the level of the tumor (See Appendix)
    i. For lower recta/anal tumors, coverage must extend below the anal verge
    ii. Call reading room if you have trouble identifying the tumor, referring to colonoscopy or prior MRI report useful/helpful when calling radiologist
  b. FOV 200-240 mm
    i. Slices should cover entire tumor (usually 30-40 slices)
  c. Goal parameters
    i. Slice thickness 3 mm
    ii. Gap 0%
    iii. In plane acquired resolution <1 mm
    iv. Number of averages = 2
    v. Perform P→A

5. **Oblique coronal T2 fast SE (Turbo SE, Fast SE)**
  a. Plane: Perpendicular to oblique short axis (axial) in #4
  b. FOV 200-240 mm
    i. Cover entire tumor with involved segment in middle of image and in middle of stack (25-35 slices)
  c. Goal parameters
    i. Slice thickness 3 mm
    ii. Gap 0%
    iii. In plane acquired resolution <1 mm
    iv. Number of averages = 2

6. **Axial T1 dual echo GRE in-phase and out-of-phase**
  a. Breath hold
  b. FOV: Skin to skin as possible, iliac crest to below perineum
  c. Goal parameters
    i. Slice thickness 8 mm
    ii. Gap 10%
    iii. In plane acquired resolution approximately 1 mm x 1 mm

7. **PRECONTRAST Large FOV true axial T1 Ultra fast 3D-GE with fat suppression (VIBE, LAVA, TIGRE)**
  a. Breath hold
  b. FOV: skin to skin if possible, iliac crest to below perineum
  c. Goal parameters
    i. Slice thickness 3-4 mm
    ii. Gap 10%
    iii. In plane acquired resolution approximately 1-2 mm x 1-2 mm

8. **PRECONTRAST Oblique short axis (axial) T1 Ultra fast 3D-GE with fat suppression (VIBE, LAVA, TIGRE)**
  a. Breath hold
  b. Plane, FOV: same as #4
  c. Goal parameters
    i. Slice thickness 3mm
    ii. Gap 0%
    iii. In plane acquired resolution approximately 1 mm x 1 mm

9. **POSTCONTRAST Oblique short axis (axial) dynamic T1 Ultra fast 3D-GE with fat suppression (T1 VIBE, LAVA, TIGRE) x 3**
    a. Breath holds
    b. Plane, FOV: same as #4
    c. Goal parameters
        i. Slice thickness 3mm
        ii. Gap 0%
        iii. In plane acquired resolution approximately 1 mm x 1 mm
    d. Timing: 3 post-contrast phases
        i. #1: First post contrast acquired with center of K-space acquisition @ 45 seconds (or 40 second delay from start of injection)
        ii. #2: 60 sec delay
        iii. #3: 120 sec delay

10. **POSTCONTRAST Large FOV true axial T1 Ultra fast 3D-GE with fat suppression (T1 VIBE, LAVA, TIGRE)**
    a. Breath hold
    b. FOV: same as #7
    c. Goal parameters
        i. Slice thickness 3-4 mm
        ii. Gap 10%
        iii. In plane acquired resolution approximately 1-2 mm x 1-2 mm
    d. Timing: 180 sec delay

11. **Axial T2 Turbo SE (TSE) with fat suppression**
    a. Breath hold
    b. FOV 340 mm: Skin to skin if possible, iliac crest to below perineum
    c. Goal parameters
        i. TR 4000
        ii. TE 104
        iii. 25% gap 1mm
        iv. Slice thickness 4 mm
        v. 45 slices
        vi. Perform P→A

12. **Axial DWI**
    a. Free breathing
    b. Same coverage
    c. Mandatory parameters
        i. B-value of 0, 100, 800

Radiologist's perspective:

MR of rectal cancer has emerged as a tool for the clinical team to decide if a patient needs chemotherapy and radiation prior to surgery. Smaller tumors confined to the rectum can go straight to surgery. Larger tumors that extend beyond the rectum are more likely to develop a recurrence if they go straight to surgery. As such, these patients will undergo preoperative chemotherapy and radiation.

We rely most heavily on the oblique axial T2 TSE small FOV sequence to determine the extent of tumor (within confines of rectum or not). Correctly aligning the imaging stack to the rectum so that it is perpendicular to the walls of rectum is *critical*.

References

1. Kaur, H. et al. MR Imaging for Preoperative Evaluation of Primary Rectal Cancer: Practical Considerations. RadioGraphics 32, 389–409 (2012).
2. Rectal Imaging: Part 1, High-Resolution MRI of Carcinoma of the Rectum at 3 T, AJR 2012, 199, W35-W42. At - https://www.ajronline.org/doi/full/10.2214/AJR.11.8134

Appendix

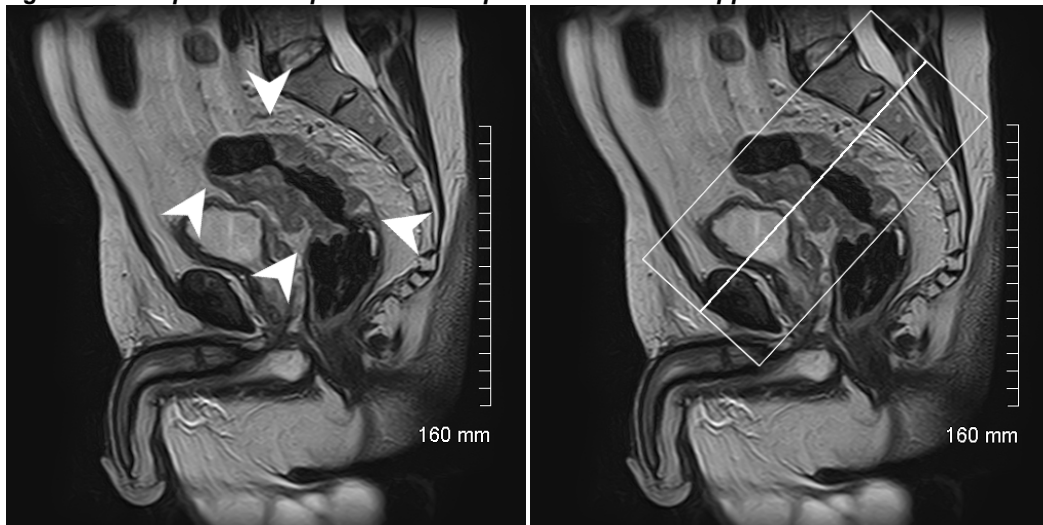*Figure 1. Example of "Oblique short axis" plane selection for upper rectal tumor*

Figure 2. Example of "Oblique short axis" plane selection for lower rectal tumor