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CHAPTER EIGHT

MRI of Rectal Cancer

After completing this chapter, the reader will be able to:

- **Identify the main anatomical structures of the rectal-pelvic area**
- **List the major imaging goals for evaluating rectal cancer**

Colorectal cancer is the second leading cause of cancer-related deaths after lung cancer. It is estimated that approximately 106,100 new cases of colon cancer and 40,870 new cases of rectal cancer will be diagnosed in 2009.[1] It is expected that more than 49,000 men and women will die from the disease in 2009, down from approximately 53,000 in 2005.[2] Great progress has been made in increasing the five-year survival because of early detection due in large part to increased public awareness of the disease and the effectiveness of treatment and survivability when the cancer is detected early. Diagnostic imaging plays an important role in the detection and staging of colorectal cancer.

CT VERSUS MRI

High-resolution spiral CT imaging has proven extremely effective in imaging the large colon. However, MRI recently has begun to play a complementary role in the detection and staging of anal/rectal cancer because it provides fast, high-resolution, high-contrast images of the rectal area. Patients with colorectal cancer typically face the prospect of many imaging exams and, when confined to the anal-rectal area, MRI provides the required information over many examinations without the associated risk of spiral CT. See Figure 102 on page 100 for an anal/rectal anatomy.

IMAGING PARAMETERS

High-resolution T2-weighted imaging is the most useful image contrast when imaging the anal/rectal area. Typically, three planes of imaging are acquired that are obliqued to be parallel and perpendicular to the tumor. If the tumor is multi-directional, angling to the plane of the rectum is preferred. Fat- and non-fat-suppressed imaging is typical. High spatial resolution is key to the success of the exam. Imaging slices are thin, typically 3-4 mm with a high matrix. To provide the required SNR, the use of a local high-channel (typically 8 to 16) pelvic array coil is essential. This coil provides higher SNR than does the body coil or other lower, four-channel array coils. See Table 15 on page 101 for a sample rectal scan protocol.

POINTS FOR PRACTICE

1. What are the advantages of MRI over CT in visualizing rectal cancer?
2. Name typical MRI findings of the rectum.

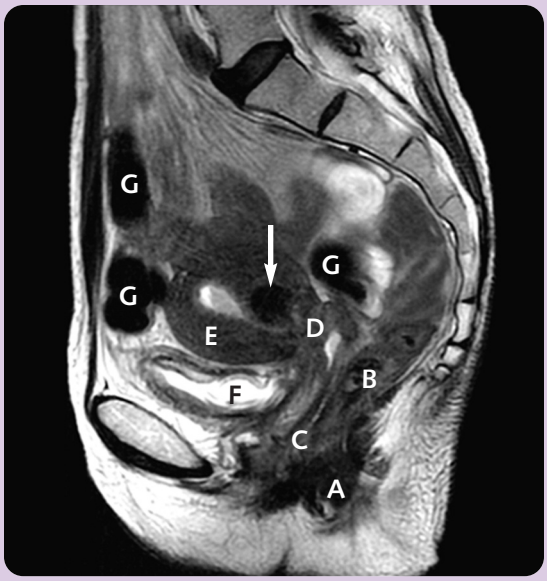

Figure 102. Anal/rectal anatomy.
A = anus
B = rectum
C = vagina
D = cervix
E = uterus
F = bladder
G = air-filled bowel loops
Arrow = uterine fibroid

Imaging at 3.0 T

Imaging at 3.0 T also provides a boost in SNR that allows for even higher-resolution or a faster scan time. Typically, the use of IV-gadolinium contrast is not required as any enhancement of the tumor does not necessarily add any diagnostic value to the exam (Figure 103).[3]

Patient Preparation

Patient preparation for this exam is not complicated. Typically, the patient is NPO for four hours prior to the exam. Neither a cleansing enema nor inter-rectal gel is required; unlike dynamic pelvis imaging, the gel adds no diagnostic value. Moreover, the use of inserted rectal tips or endorectal surface coils when rectal cancer may be present poses a risk of perforation or trauma to a mass. This can lead to bleeding and the spread of cancerous cells to other areas. Since IV contrast generally is not used,[3] an IV line is not required.

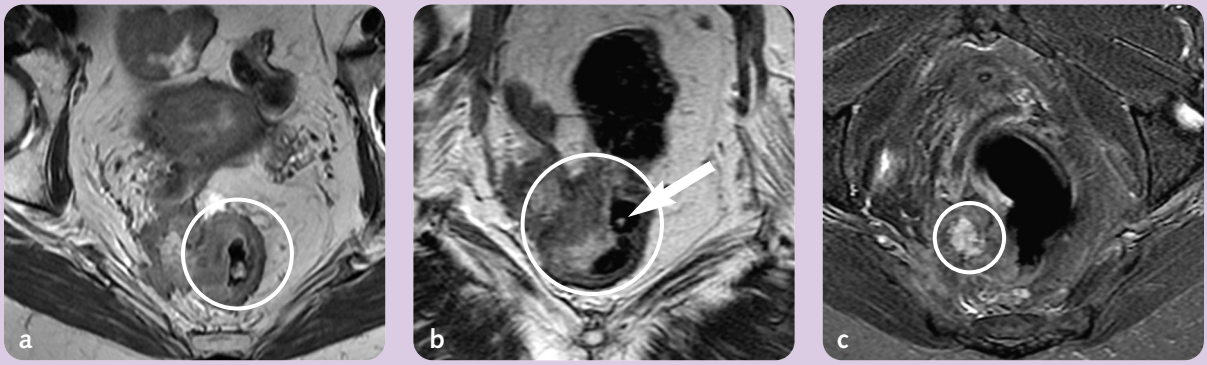

Figure 103. Circles = cancer. (a) Axial T2-weighted view of a 72-year-old female with a rectal tumor. The tumor involves the right piriformis and lavator ani musculature. (b) Coronal T2-weighted view. Arrow points to air-filled rectum. (c) Axial T2-weighted fat-suppressed view. Note how the fat suppression depicts contrast differences between various aspects of the tumor and its constituents.

The patient is placed supine on the MR table and, if possible, enters the magnet bore feet first (feet-first entry for pelvic imaging is less claustrophobic to the patient since their head will most likely be outside the bore). The typical exam takes no more than 30 minutes. Afterward, the patient can resume normal activities.

MRI FINDINGS

MR imaging demonstrates not only the size and shape of the tumor but also its composition and extent. High-resolution images exhibit tissue distinctions of the mucosa and bowel wall, as well as the extent of tumor involvement into the pelvic cavity and any obstruction of the rectum. Axial imaging of the entire pelvis will reveal any adenopathy in the pelvis. Typically, one plane of fat-suppressed imaging (either chemical fat saturation or IR-pulse fat suppression) is performed to differentiate between peri-rectal fat and potential cystic fluid and blood.

SUMMARY

MR imaging of the rectal area is a quick and convenient method for scanning and staging patients with known or suspected rectal cancer. The exam provides images of high diagnostic value through high-contrast and high-resolution scanning. The exam is not difficult or invasive for the patient. There is little preparation required by the patient and IV contrast typically is not needed.

Table 15.

SAMPLE RECTAL CANCER MRI PROTOCOL

Parameter	Sagittal FIESTA (FISP)	Axial T1 Pelvis	O-Axial T2	O-Coronal T2	O-Axial Fat Sat
Imaging Parameters					
Pulse Sequence	FIESTA	Fast Spin Echo	Fast Spin Echo	Fast Spin Echo	Fast Spin Echo
Plane	Sagittal	Axial	Oblique Axial	Oblique Coronal	Oblique Axial
Repetition Time (TR)	Min	500-600	3000	2400	3000
Echo Time (TE)	Min	Min Full	100	90	100
Slice Thickness (mm)	5	6	3.5	3.5	4
Field of View (FOV) (cm)	30	26	20	20	20
ETL		5	21	19	21
Flip Angle	65				
NEX (NSA)	4	3	4	4	4
Phase	320	288	384	288	288
Frequency	256	192	224	192	224

POINTS FOR PRACTICE

1. **What are the advantages of MRI over CT in visualizing rectal cancer?**
   Patients with rectal cancer typically face several imaging exams. MRI can provide the required information over the course of many evaluations without the associated ionizing radiation of CT.

2. **Name typical MRI findings of the rectum.**
   MRI demonstrates the size, shape, composition, and extent of tumor. High-resolution images exhibit tissue distinctions of the mucosa and bowel wall, as well as tumor extent into the pelvic cavity and any rectal obstruction.

REFERENCES

1. American Cancer Society. What are the key statistics for colorectal cancer? Available at: http://www.cancer.org/docroot/cri/content/cri_2_4_1x_what_are_the_key_statistics_for_colon_and_rectum_cancer.asp Accessed October 13, 2009.
2. Centers for Disease Control and Prevention. Colorectal Cancer Statistics. Available at: http://www.cdc.gov/cancer/colorectal/statistics/ Accessed October 13, 2009.
3. Taylor FG, Swift RI, Blomqvist L, Brown G. A systematic approach to the interpretation of preoperative staging MRI for rectal cancer. *Am J Roentgen.* 2008;191:1827-1835.

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