Imaging and Surgical Management of Anorectal Vaginal Fistulas

Wendaline M. VanBuren, MD
Amy L. Lightner, MD
Sarasa T. Kim, MD
Shannon P. Sheedy, MD
Madeline C. Woolever
Christine O. Menias, MD
Joel G. Fletcher, MD

Anorectal vaginal fistulas (ARVFs) can result in substantial morbidity and potentially embarrassing symptoms in adult women of all ages. Despite having what may be obvious clinical manifestations, the fistulas themselves can be difficult to identify with imaging. MRI is the modality of choice for the diagnosis and characterization of ARVFs. A dedicated protocol involving the use of vaginal gel and optimized imaging planes with respect to the vagina, as well as an understanding of the MRI pelvic floor anatomy, is crucial for reporting surgically relevant details. Ancillary findings such as postsurgical changes, inflammation, abscess, sphincter destruction, and neoplasm are well evaluated. Vaginography, contrast enema, endoscopic US, and CT can be highly useful complementary diagnostic examinations. The entities that result in ARVFs may be obstetric, inflammatory (eg, Crohn disease and diverticulitis), neoplastic, iatrogenic, and/or radiation induced. Surgical management is heavily dependent on the cause and complexity of the fistulizing disease, which are related to the location of the fistula in the vagina, the type and extent of fistula branching, the number of fistulas, sphincter tears, inflammation, and abscess.

Radiographics 2018; 38:1385–1401
https://doi.org/10.1148/rg.2018170167

Content Codes: GI MR OB

From the Department of Radiology (W.M.V., S.P.S., M.C.W., J.G.F.), Department of Surgery (A.L.L.), and School of Medicine (S.T.K.), Mayo Clinic, 200 First St SW, Rochester, MN 55905; and Department of Radiology, Mayo Clinic, Scottsdale, Ariz (C.O.M.). Recipient of a Certificate of Merit award for an education exhibit at the 2016 RSNA Annual Meeting. Received June 26, 2017; revision requested September 27 and received December 15; accepted December 21. For this journal-based SA-CME activity, the authors, editor, and reviewers have disclosed no relevant relationships.

©RSNA, 2018 • radiographics.rsna.org

SA-CME LEARNING OBJECTIVES

After completing this journal-based SA-CME activity, participants will be able to:

■ Describe how MRI compares with other imaging modalities for detection of complex fistulas.
■ Identify the causes and imaging findings of ARVFs.
■ Discuss medication versus surgical management for simple and complex fistulas on the basis of their causes and locations.

See rsna.org/learning-center-rg.

Introduction

Anorectal vaginal fistulas (ARVFs) are abnormal communications between the vagina and the lower portion of the gastrointestinal tract. The treatment options for ARVFs are heavily dependent on the type and extent of anatomic involvement and the underlying causes.

Clinical Manifestations

The symptoms and presentations of patients with ARVFs vary widely. These patients range from those who are surprisingly asymptomatic to others who have a vaginal discharge, painful vaginitis, bleeding, and/or skin ulcerations. A malodorous vaginal discharge is not uncommon and is worse with loose bowel movements. Fecal urgency and incontinence may be reported.

Obstetric trauma is the most prevalent cause of trauma-related and likely all ARVFs (1–3). Other causes include inflammatory disease such as Crohn disease or diverticulitis (4,5), malignancy, Bartholin abscess, and side effects of treatment such as radiation therapy. These fistulas can also result from iatrogenic conditions such as those related to ileal pouch–anal anastomosis (IPAA); failed repair of third- and fourth-degree lacerations of the perineum; episiotomy infections; difficult hysterectomies; procedures involving the posterior vaginal wall, perineum, anus, or rectum; pessary treatment (6); and various mesh repairs (7). However, the classifications of ARVFs based on their location, size, and cause have not been shown to correlate with outcomes.
Low, or anovaginal, fistulas occur below the dentate line and involve the anal sphincter complex. These fistulas often involve the lower half of the vagina. As nearly half of patients with ARVFs may have incontinence, MRI and endoscopic US are essential. Typical causes of anovaginal ARVFs include Crohn disease, IPAA, and obstetric trauma.

High, or rectovaginal, fistulas occur above the dentate line and are usually larger. These fistulas often involve the posterior vaginal fornix. Typical causes include radiation, ulcerative colitis, diverticulitis, and cancer.

Systematic imaging assessment of the vagina, anorectum, and fistula often enables identification of the entity that is responsible for the ARVF. An understanding of the anatomy and cause of the fistula is essential for guiding appropriate medication and surgical treatment.

Use of a dedicated MRI protocol with a phased-array coil, vaginal gel, a small field of view, and multiplanar fast spin-echo T2-weighted imaging sequences facilitates the identification of ARVFs and their causes.

ARVFs remain notoriously difficult to treat despite advances in medication and surgical therapies. There are multiple surgical options, largely because no one option is particularly effective in facilitating complete healing. Small low (distal) fistulas are often amenable to local repairs, whereas complex fistulas due to radiation or Crohn disease might require multiple interventions, concurrent medical and biologic therapies, or even fecal diversion.

Differential Diagnosis

Anal and perianal processes that result in fecal soiling include differential considerations for ARVF such as fistula-in-ano, perianal abscess, and other causes of anal incontinence. The presence of a vaginal discharge may raise the differential possibility of infection rather than ARVF. Symptoms and physical examination results are often helpful in the diagnostic evaluation. Once an ARVF is suspected, a radiologic investigation can be performed to identify the fistula and help triage patients to medication management, a minimally invasive technique, or a more involved procedure such as tissue graft placement or bowel resection.

ARVF Classification

The management of ARVFs is based on the location in which they occur. Low, or anovaginal, fistulas occur below the dentate line (Figs 1, 2) and involve the anal sphincter complex. These fistulas often involve the lower half of the vagina. As nearly half of patients with ARVFs may have incontinence, MRI and endoscopic US are essential (8). Typical causes of anovaginal ARVFs include Crohn disease, IPAA, and obstetric trauma.

High, or rectovaginal, fistulas occur above the dentate line (Figs 3, 4) and are usually larger. These fistulas often involve the posterior vaginal fornix. Typical causes include radiation, ulcerative colitis, diverticulitis, and cancer. The anus should be well interrogated to ensure absence of concomitant sphincter involvement.

Pelvic Floor Anatomy

MRI has long been established as an excellent means of evaluating anorectal disease (9,10) and delineating the complex anatomy of the female perineum (11). The female perineum is a diamond-shaped structure that contains a complex network of muscles, ligaments, and fasciae (11) (Fig 1). The perineum contains the distal two-thirds of the urethra, the vagina at the level of the introitus, and the anal canal. In the sagittal plane (Fig 1a, 1b), the vagina is J shaped, with the lower part of the vagina immediately posterior and adjacent to the urethra. The T2-hypointense perineal body, which is a fibromuscular mass in the midline perineum at the junction of the anal and urogenital triangles, separates the lower part of the vagina from the anal sphincters. The urogenital diaphragm helps to support the intrinsic muscles of the urethral sphincter mechanism, including the compressor urethra and urethrovaginal sphincter. The perineal body aids in urinary continence, but it merges posteriorly with fibers from the external sphincter and merges superiority with fibers of the levator muscle of the anus and the rectovaginal septum (11). The upper part of the vagina lies immediately anterior to the rectum when the rectovaginal septum is intact.

The anal sphincter complex comprises several muscular layers (Fig 1a). The external sphincter is a striated muscular outer layer that extends inferiorly from the subcutaneous anal sphincter, which lies below the internal sphincter, to the anorectal junction, where its fibers are in continuity and inseparable from the puborectalis muscle superiorly. The internal sphincter is a smooth muscular layer that is in continuity with the circular muscle of the rectum. It forms the inner portion of the anal sphincter complex and is slightly hyperintense compared with the external sphincter. Anovaginal fistulas occur between the sphincteric complex and lower part of the vagina. Rectovaginal fistulas occur above the level of the sphincters (Fig 3a) and may extend to the upper or lower part of the vagina.

Imaging Assessment

Systematic imaging assessment of the vagina, anorectum, and fistula often enables identification of the entity that is responsible for the ARVF. An understanding of the anatomy and cause of the fistula is essential for guiding appropriate medication and surgical treatment (Table 1). After a fistula is detected, it should be categorized as anovaginal or rectovaginal, with a description of the locations of the fistula openings in the anorectum and vagina.
Figure 1. Normal pelvic floor anatomy. (a) Sagittal illustration shows the normal anatomy. (Reprinted, with permission, from Mayo Foundation for Medical Education and Research.) (b) Sagittal T2-weighted MR image shows gel distending the rectum (R) and vagina (V). DL = dentate line, ES = external sphincter, IS = internal sphincter, U = urethra. (c) Axial illustration shows the normal anatomy. (Reprinted with permission, from Mayo Foundation for Medical Education and Research.) (d, e) Axial T2-weighted MR images obtained with an endorectal coil. ES = external sphincter, ICL = ileococcygeal component of levator plate, IS = internal sphincter, LV/I = lower region of vagina at the introitus, PR = puborectalis muscle, U = urethra, UGD = urogenital diaphragm, V = vagina.

Figure 2. Crohn disease in a 21-year-old woman with a Hartmann pouch, who underwent end colostomy owing to perforation during dilation of a sigmoid stricture. (a) Sagittal T2-weighted MR image shows a hyperintense fistula tract (arrow) between the anus and the lower region of the vagina. Note the decreased conspicuity of the fistula without use of vaginal gel. The rectum (♦) is inflamed, and there is perirectal fat proliferation (arrowhead), which is probably secondary to chronic inflammation. (b) Axial T2-weighted MR image findings confirm the presence of a wide opening (arrow) in the anterior anus; the opening extends to the lower region of the vagina. Gynecologic reconstruction was not possible owing to the rectal inflammation, and proctectomy and end colostomy were recommended. Crohn disease often manifests with complex fistulas and proctitis. Medication management was no longer an option, given the extensive disease.
Figure 3. Illustrations of the relevant anatomy and repair of rectovaginal ARVs. A, Sagittal-view drawing and inset illustrate the location of a rectovaginal fistula, which is a fistula above the dentate line that communicates with the posterior vaginal wall. (Anovaginal fistulas develop below the dentate line.) B, Sagittal-view drawing and inset illustrate the multiplicity and branching pattern of fistulas, which complicate the management and healing processes. C, Sagittal-view drawing illustrates the use of a draining seton for treatment of a rectovaginal fistula. D, Sagittal-view drawing and insets illustrate the use of sutures to repair the rectal wall layers. E, Sagittal-view drawing and inset illustrate the temporary use of a fistula plug to promote healing. (Reprinted, with permission, from Mayo Foundation for Medical Education and Research.)

Figure 4. Post–radiation therapy findings in a 61-year-old woman with cervical cancer, who presented with flatulence from the vagina and pneumaturia. (a) Sagittal T2-weighted MR image shows a high (rectovaginal) fistula (arrow). Identifying a fistula is easy when the vagina is filled with gel. (b) On the axial T2-weighted MR image, the distention of the tract is well seen. As seen on this image, gel in the rectum also may be useful. High fistulas generally occur above the perineal body such that the sphincter mechanism is left intact. Treatment is highly dependent on the patient’s symptoms and comorbidity. A vesicovaginal fistula also was present (not shown). The patient was treated with pelvic exenteration, a sigmoid conduit with bilateral ureterosigmoidostomy, and end sigmoid colostomy.
Table 1: Critical Fistula-related Features to Assess and Report

<table>
<thead>
<tr>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence and anatomic classification of the fistula (anovaginal or rectovaginal), vaginal location (upper or lower region)</td>
</tr>
<tr>
<td>Branching or number of fistulas, associated ramifications, degree of fistula distention</td>
</tr>
<tr>
<td>Sphincteric assessment: tear, other fistulas, sphincteric involvement, exclusion of abscess</td>
</tr>
<tr>
<td>Rectal inflammation or mass</td>
</tr>
<tr>
<td>Prior therapy: presence of setons or drains, IPAA, radiation therapy, hysterectomy</td>
</tr>
</tbody>
</table>

MR Imaging

MRI has evolved to have a critical role in the evaluation of perianal fistulas (13). In addition to enabling identification of a fistula, MRI can be used to assess the regional anatomy, sphincter integrity, relationship of the fistula to the dentate line, fistula complexity and multiplicity, presence of abscess, and associated disease. In a retrospective study (14) to evaluate endoluminal MRI, the modality had a positive predictive value of 92% for delineating the location of ARVFs. However, use of a targeted MRI protocol (Table 2), systematic review of the imaging findings, and reporting of pertinent information are key to rendering a correct diagnosis.

Use of a dedicated MRI protocol with a phased-array coil, vaginal gel, a small field of view, and multiplanar fast spin-echo T2-weighted imaging sequences facilitates the identification of ARVFs and their causes. The fistulas can be adequately visualized at 1.5- and 3.0-T MRI. However, 3.0-T imaging is preferred owing to an increase in the available signal-to-noise ratio and the capability for subsequent higher-resolution imaging (15). A dedicated phased-array torso coil should be used in all instances. The gel insertion technique, imaging coverage, and section orientation stay the same, regardless of the magnetic field strength. The vagina should be adequately distended with up to 60 mL of water-soluble US gel inserted into the vaginal vault via a catheter and syringe. Vaginal distention can be reduced in the postradiation setting. All imaging planes should be oriented with respect to the vagina, as visualized on sagittal T2-weighted MR images. An in-plane resolution of approximately 1 × 1 mm is ideal for aiding visualization of the smallest fistulas, with a maximal section thickness of 4 mm (Fig 2).

Anovaginal (low) fistulas are generally collapsed, small, and short. They have a complex trajectory and are frequently missed at initial imaging assessment. An endoanal coil may obscure the fistula opening. The vagina, unlike the rectum, can be maximally distended, with the distention facilitating delineation of the vaginal wall and communicating fistula, occasionally causing filling of a collapsed tract with gel. Although the use of rectal gel also may be helpful, it does not facilitate the same pressure effect as vaginal gel. Despite necessitating a small sacrifice in some anatomic details of the sphincter anatomy, the use of vaginal gel (Fig 1b) rather than an endoluminal coil (Fig 1d) nearly always improves visualization of an anovaginal fistula tract (16,17). If proctocolectomy and J pouch creation with ileoanal anastomosis have been performed, insertion of a small-caliber catheter into the anus, across the IPAA, is often helpful for delineating important surgical anatomic features. With dynamic examinations such
as defecating proctography, fistula tracts can be distended during simulated defecation (Fig 6b). Given the complex orientation of female pelvic organs and the often confounding pelvic floor laxity, multiple imaging planes are required for visualization of ARVF s (Fig 7).

The MRI appearances of pelvic fistulas have been described as those of linear or branching T2-hyperintense tracts that communicate between the low-signal-intensity interface of the outer vagina and the bowel adventitia (18) (Fig 4). The signal intensity of a fistula can also vary greatly and depends on the chronicity of the fistula and the presence of internal fluid or granulation tissue, inflammation, and/or tumor. Chronic or trauma-induced fistulas may have low signal intensity owing to a lack of active inflammation, or they may have low T1 and T2 signal intensity because they contain air or feces (Figs 8–10).

Dedicated perineal MRI is the method of choice for detection and imaging assessment of ARVF s. However, numerous other correlative imaging methods with complementary advantages may be used to detect ARVF s. These modalities are described in the sections that follow.

**Fluoroscopy**

Conventional fluoroscopic evaluation of the vagina, or vaginography (Fig 11a), involves the insertion of a catheter into the vagina, with the...
balloon inflated within the vagina to create the necessary filling pressure and distention. Anteroposterior and oblique projections should be obtained with an adequately small field of view. High-quality spot-film exposures are necessary to visualize small tracts. Although the use of barium contrast material may enable delineation of the fistula, water-soluble contrast material may be preferred, given the complexity of the fistula and the potential for peritoneal spill (19). At our institution, water-soluble enema examinations and vaginography are performed by using a mixture of one part iohexol (Omnipaque 300; GE Healthcare, Milwaukee, Wis) and one part water, 300 mL of each, for a total of 600 mL. Variability in contrast medium, techniques, and user experience may account for the wide range of diagnostic performance (between 40% and 100%) with vaginography (20). In addition, the occlusion balloon has been known to occlude low fistulas (21,22). Fluoroscopic evaluation through the anus is the preferred imaging technique to perform within 1 year after a J pouch is created to exclude a leak at the surgical anastomosis, and it may be helpful in patients with known rectovaginal fistulas. If an ARVF is not initially visualized at vaginography, enema examination may be helpful for demonstrating the fistula.

Computed Tomography
Although CT is not the modality of choice for ARVF assessment, rectal contrast material or gas tracking toward the vagina may suggest a fistula and prompt further evaluation. CT frequently facilitates the identification of fistulas associated with diverticulitis (Fig 11b), which may extend to

### Table 2: Basic Parameters Used to Perform 3-T MRI Sequences

<table>
<thead>
<tr>
<th>Parameter</th>
<th>T2-weighted FSE</th>
<th>Fat-suppressed T2-weighted FSE</th>
<th>T2-weighted FSE</th>
<th>DW EP</th>
<th>Contrast-enhanced T1-weighted 3D Dixon</th>
<th>Fat-suppressed T1-weighted SPGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matrix</td>
<td>416 × 224</td>
<td>416 × 224</td>
<td>416 × 224</td>
<td>128 × 128</td>
<td>288 × 288</td>
<td>320 × 256</td>
</tr>
<tr>
<td>Section thickness (mm)</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>5.0</td>
<td>2.6</td>
<td>3.5</td>
</tr>
<tr>
<td>Intersection spacing (mm)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>0.5</td>
</tr>
<tr>
<td>Repetition time (msec)/echo time (msec)</td>
<td>6000/85</td>
<td>6000/85</td>
<td>6000/85</td>
<td>2800/59</td>
<td>7.9/1.2</td>
<td>175.0/4.1</td>
</tr>
<tr>
<td>No. of signals acquired</td>
<td>Three</td>
<td>Three</td>
<td>Three</td>
<td>Eight</td>
<td>Two</td>
<td>Two</td>
</tr>
<tr>
<td>FOV (mm)</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>240</td>
<td>280</td>
<td>220</td>
</tr>
<tr>
<td>Orientation</td>
<td>Sagittal</td>
<td>Oblique axial</td>
<td>Oblique axial and oblique coronal</td>
<td>Oblique Axial</td>
<td>Oblique Axial</td>
<td>Sagittal</td>
</tr>
<tr>
<td>Bandwidth (Hz)</td>
<td>41.67</td>
<td>41.67</td>
<td>41.67</td>
<td>250.00</td>
<td>142.86</td>
<td>31.25</td>
</tr>
</tbody>
</table>

Note.—All MRI sequences were performed with a 24-cm field of view (FOV) body coil and vaginal gel. DW EP = diffusion-weighted echo planar, FSE = fast spin echo, SPGR = spoiled gradient echo, 3D = three dimensional.
Figure 7. Multiplanar identification of an anovaginal fistula in a 44-year-old woman with peri-anal and small-bowel Crohn disease. (a) Sagittal T2-weighted MR image shows a thin hyperintense tract (arrowhead) between the anus and the lower region of the vagina. Many rectovaginal and anovaginal fistulas are missed on MR images because the anus and vagina often do not lie within a single imaging plane. As these fistulas can be subtle, critical anatomic information must be obtained in other planes once they are detected. (b) Axial fat-saturated T2-weighted MR image shows transsphincteric disruption (arrowhead) at the 12-o’clock position. (c) Coronal T2-weighted MR image shows the length of the fistula (arrowhead) and can help in defining the trajectory of the tract. Low (anovaginal) fistulas are below the dentate line and usually involve the anal sphincter complex.

Figure 8. Extreme perianal Crohn disease, with complete sphincter destruction, in a 63-year-old woman. (a) Sagittal T2-weighted MR image obtained after ileostomy shows a large ARVF (☆) with a “cloaca” effect and little to no inflammation. (b) Axial T2-weighted MR image shows a large defect (☆) containing debris and gas. Note the frank leakage of rectal contrast material (arrowhead) posteriorly in the absence of sphincter function. The perineum was nonrepairable. These are the sequelae of multiple anterior transsphincteric fistulas with destruction of the perineal body and external openings to the base of the labia. Previous attempted treatments included the use of setons and Penrose drains.
the bladder or vagina, and not infrequently it depicts perianal Crohn disease. If the fistula is sizable, a defect may be seen. Increased conspicuity of the fistula may be possible with use of oral and intravenous contrast media. Suspected tracts that are not clearly delineated at vaginography may be identified at CT, with water-soluble contrast material in the vagina. CT remains a practical means of evaluating possible ARVFs in those who are not candidates for MRI (23). At CT, fistulas

Figure 9. Rectal adenocarcinoma invading the vagina in a 57-year-old woman. (a, b) Sagittal (a) and axial (b) T2-weighted MR images show a heterogeneous predominantly T2-hyperintense rectal mass invading the middle to upper region of the vagina and thus causing an enormous fistula (♦). The patient underwent radiation therapy. (c) Subsequently obtained axial T2-weighted MR image shows a marked treatment response in the tumor (arrow). Persistence of the fistula resulted in a loss of substantial portions of the right lateral and anterior rectal walls, with destruction of the vagina and right piriformis muscle. Permanent diverting colostomy was recommended; however, the patient selected incontinence rather than diversion.

Figure 10. Passage of stool from the vagina in a 59-year-old woman who underwent chemoradiation for treatment of cervical cancer. (a, b) Sagittal (a) and axial (b) T2-weighted MR images show a high fistula (arrow). (c) Water-soluble enema radiograph shows contrast material leakage into the upper posterior vaginal vault through a large rectovaginal fistula (arrow). Fistulas in the setting of malignancy must be sampled at biopsy to exclude residual or recurrent cancer. Diversion, often for at least 6 months, can enable the inflammation in the surrounding tissue to resolve. Permanent colostomy is often the best option if the patient is elderly and/or has comorbid conditions, substantial sphincter damage, and/or fecal incontinence. Surgical repair is considered in the appropriate setting, and if the fistula is high, interposition through the abdomen may be considered. If there is a stricture or severe radiation damage in the rectum, rectal resection with reconstruction may be performed.
also appear as extraenteric tracts connecting the anorectum or sigmoid colon to the vagina. Air within the otherwise collapsed vagina is suggestive of a fistulous communication; however, it may be incidental.

**Endoluminal US**

In small patient cohorts, endoluminal US performed with a transrectal probe has had positive predictive values similar to those of MRI (14). Although endoluminal US facilitates excellent sphincter evaluation, it enables limited evaluation of other entities in the pelvis. The small field of view may limit visualization of longer or more complex tracts, especially those seen with Crohn disease, which may extend into the ischioanal fossa or suprarelevator space. Some groups have advocated the use of hydrogen peroxide to elucidate side tracts and fluid collections (24).

**Causes and Imaging Findings of ARVFs**

**Obstetric Injury and Prior Therapy for Gynecologic Malignancies**

Obstetric injury is the most common cause of acquired ARVFs, with a fistula generally manifesting 7–10 days after delivery as a result of third- to fourth-degree laceration, inadequate repair, or subsequent repair breakdown (Figs 6, 12). There is a higher incidence of these cases in developing countries owing to prolonged labor that causes necrosis of the rectovaginal septum. Radiologic imaging has a vital role in establishing the site, course, and complexity of ARVFs and yields crucial information for optimal presurgical planning. ARVFs can also occur in association with advanced-stage gynecologic malignancy and the related surgical and radiation treatments. MRI is the modality of choice for local staging of gynecologic malignancies and detection of fistula formation.

Surgery is often required for management of obstetric ARVFs; however, these fistulas may close spontaneously during the early postpartum period. Proper presurgical assessment of the sphincter anatomy and function, as well as confirmation of the absence of infection or induration in the surrounding tissue, is necessary before surgery. Often there is an associated perianal abnormality, such as perianal intersphincteric fistula, abscess, and/or sphincter defects, that requires sphincteroplasty to close the fistula and repair the sphincter defect (25). Depending on the mode of repair selected, subsequent deliveries may need to be performed by means of cesarean section.

**Inflammatory**

**Crohn Disease.**—Crohn disease is the second most common cause of ARVFs after obstetric trauma and probably the most common type of ARVF detected at imaging. Crohn disease–related ARVFs represent about 9% of Crohn disease–related fistulas and are difficult to detect and treat (4,5). With the peak patient age at Crohn disease onset being 15–30 years, proper management can help prevent long-term effects on the developmental, sexual, reproductive, and psychologic health of young and reproductive-age women.

Early methods used for detection of Crohn disease–related ARVFs included CT, with 60% accuracy; vaginography, with 79% sensitivity; and proctography, with an even lower sensitivity of 35% (22,26,27). MRI has been proven to be
the most effective for the diagnosis of ARVFs, with an accuracy approaching 100% (25). According to a relatively recent global consensus statement (28), owing to these considerations, MRI is considered the reference-standard imaging modality for examination of perianal Crohn disease. However, the detection of ARVFs is often challenging, with careful inspection required to detect fistula tracts that are iso- or hypointense owing to the absence of active inflammation (Fig 8). Even with active inflammation, the signal of the fistula at T2-weighted MRI is only slightly hyperintense, with minimal gadolinium-based contrast material enhancement on axial two-dimensional, fat-saturated, spoiled gradient-echo MR images (17). Furthermore, as an ARVF heals, the T2 signal intensity and gadolinium enhancement decrease. Use of techniques such as US gel insertion in the vagina is helpful when investigating findings that are clinically suspicious for an ARVF. Finally, an intentional search for Crohn disease–related postoperative pouch-vaginal fistulas also is important, as these tracts can be difficult to identify and can arise at, above, or below the site of the anastomosis (17,29).

Perianal fistulas associated with Crohn disease tend to be more complex, with increased branching and horseshoe ramifications or abscesses. In addition, Crohn disease–related fistulas are frequently associated with Crohn proctitis, which complicates the situation because definitive surgical therapy cannot be performed until the proctitis is under control. If the proctitis persists, multimodality therapy is administered and includes seton placement, generally in conjunction with antibiotic and biologic therapies (17). The anatomy and localization of branching ramifications have a large role in deciding the treatment. Ultimately, the management of ARVFs depends on the magnitude of symptoms, degree of patient discomfort, level of Crohn disease activity, and height of the fistula. For closure of a Crohn disease–related ARVF, a combination of medication (infliximab) and surgical management is recommended.

It should also be recognized that patients with Crohn disease are at increased risk for malignancy...
owing to chronic colorectal inflammation and the use of immunosuppressive medications. Thus, imaging findings of soft tissue involving the fistula, anus, or rectum should prompt endoscopic assessment and potentially biopsy (Fig 5).

**Diverticulitis.**—ARVF s usually arise as a result of microperforations of inflamed diverticula (Fig 11). ARVF s are seen in 2% of diverticulitis cases at surgery and most often involve the sigmoid colon owing to its proximity to the vagina (30). Among the internal fistulas seen with diverticulitis, colovesical fistulas are the most common, with some investigators suggesting that the uterus has a protective role in women. Colovesical fistulas are followed in frequency by colocutaneous, colocolonic, and coloureteral fistulas (31,32). Urgent surgical intervention is rarely indicated; however, diverticular fistulas generally do not resolve spontaneously. Therefore, an elective one-stage procedure involving resection and primary anastomosis is feasible in the majority of cases, with lower morbidity. Infrequently, when the inflammation is severe or there is concurrent active perforation, two-stage procedures involving fecal diversion are necessary.

**Radiation**
Radiation-induced ARVFs are a major cause of morbidity in patients with cancer who are undergoing therapy. Although the tumors themselves may result in tissue destruction that results in fistulas (33), radiation-induced fistulas can be large and may not be repairable with surgery (Fig 13). These fistulas occur within 6 months to 2 years and are believed to result from tissue necrosis secondary to obliteratorive endarteritis, with possible superimposed proctitis and ulceration of the anterior rectal wall (34). Fistulas occurring after radiation therapy must be analyzed with biopsy to exclude recurrent or residual tumor. Radiation for treatment of cervical cancer is one of the most prevalent causes of these fistulas (Fig 10), with rectovaginal fistulas arising in nearly 8% of patients (23). The incidence of fistula formation increases with higher doses of radiation and without the protective barrier of the uterus in the setting of hysterectomy (35). The morbidity associated with fistulizing disease is one of the reasons that most cervical cancer regimens include hysterectomy or radiation therapy, but not both.

**Ileal Pouch–Anal Anastomosis**
IPAA is not the standard of care for patients with Crohn disease, but it is sometimes performed in patients who are initially believed to have ulcerative colitis and later present with findings of Crohn disease. IPAA is a surgery that involves subtotal proctocolectomy, creation of an ileal reservoir or pouch, and an anastomosis between the pouch and anus (36). A pouch-vaginal fistula can arise as a postoperative complication, or it may result from unsuspected Crohn disease. Crohn disease is more likely to be the cause if the fistulas manifest more than 6–12 months after surgery, the fistulas are complex or branching rather than simple, and/or the internal opening is away from the actual anas-
tomosis or suture lines of the pouch (37). After IPAA, careful assessment of MR images should be performed to identify the pouch-anorectal anastomosis, rectal cuff, and anus, as vaginal fistulas seen in this setting may arise from the anus (raising suspicion for perianal Crohn disease), inflamed rectal cuff (raising suspicion for Crohn disease), anastomosis (potentially indicating delayed recognition of leak), or pouch itself (raising suspicion for Crohn disease of the pouch) (Fig 14).

Figure 14. Crohn disease, complex branching fistulas, and an IPAA pouch-vaginal fistula in a 34-year-old woman. (a, b) Axial fat-suppressed T2-weighted (a) and sagittal T2-weighted (b) MR images show a hyperintense fistula tract (arrow) from the anal portion of the pouch, extending to the lower left region of the vagina. (c) Coronal T2-weighted MR image shows a perianal abscess (arrowhead). While IPAA is not the standard of care for patients with Crohn disease, treatment is sometimes based on an initial presumption of ulcerative colitis. The fistula can be the result of postoperative complications or unsuspected Crohn disease. Crohn disease is more likely if the fistula occurs more than 6–12 months after surgery, the fistula is complex or branching, or the internal opening is away from the anastomosis. In this case, the fistula is away from the anastomosis and occurred years after surgery, with complex or branching fistulas and an abscess.

Malignancy
Rectal, uterine, cervical, and vaginal cancers may have marked regional extension, placing patients with these neoplasms at risk for ARVFs (34). These advanced-stage tumors usually are aggressive, with destruction of tissue planes resulting in highly symptomatic disease and tissue destruction (Fig 9). Malignancy can also occur within a chronic preexisting fistula, or it may mimic a fistula in a patient with Crohn disease who has suspected or prior perianal disease (Fig 5). Any tissue thickening must be carefully sampled with biopsy and interrogated, as patients who have this thickening are at increased risk for malignancy secondary to immunosuppressive medication use and chronic inflammation. Rapid expansion of the fistula tract, regional desmoplastic reaction, and diffusion restriction may be helpful MRI features that indicate a suspicious process.

Iatrogenic Causes
Postoperative leaks, which can lead to abscess formation, place patients at risk for ARVF development (Fig 15). The surgical trauma itself may directly result in a fistula. Colorectal anastomoses performed with a stapler may cause ARVFs if the vagina is inadvertently incorporated into the procedure (34). The key to the diagnosis is somewhat temporal, as leaks and abscesses will
be evident early in the postoperative course and patients may become newly symptomatic. CT is often useful as a primary means of assessing for free fluid or a fluid collection. Occasionally there may be a tract, which is possibly gas filled, communicating with the vagina. Fluoroscopy or MRI is useful for further evaluation (38).

**Surgical Management**

ARVs remain notoriously difficult to treat despite advancements in medication and surgical therapies. There are multiple surgical options, largely because no one option is particularly effective in facilitating complete healing (39). Small low (distal) fistulas are often amenable to local repairs, whereas complex fistulas due to radiation or Crohn disease might require multiple interventions, concurrent medical and biologic therapies, or even fecal diversion. The choice of surgical technique depends on the degree of anal sphincter involvement, the underlying diagnosis, and the surgeon’s and/or patient’s preference. It is important to counsel the patient regarding the potential need for multiple surgeries to achieve long-term success and clearly articulate the potential lack of effectiveness with multiple interventions.

Before undergoing any definitive repair for an ARVF, the patient needs to be examined for any signs or symptoms of perianal sepsis. If perianal sepsis is present, it should be controlled, most often with use of setons placed in the fistula tract for drainage. Once the sepsis has been controlled, typically within 6 weeks, a more definitive repair can be conducted.

Local approaches, including transanal, transvaginal, and transperineal techniques, may be attempted in the setting of simple low fistulas. One of the simplest and least invasive approaches is to use fibrin glue and/or plugs, with both used to fill the fistula tract and seal it. Although these methods are simple and pose minimal risk to the sphincter mechanism, healing rates are poor. The most common transanal repair is endorectal advancement flap placement, whereby the rectal tissue is used to cover the internal opening of the fistula. A U-shaped flap of mucosa, submucosa, and circular muscle is raised proximally 4–5 cm and brought down over the anorectal opening of the fistula. A similar repair can be performed with a transvaginal approach, whereby a flap of vaginal tissue is raised and used to cover the vaginal opening, and the rectal and vaginal defects, as well as the vaginal flap, are closed with absorbable sutures. An approach involving the placement of anocutaneous flaps, which are rarely used, is an alternative way of addressing an extremely distal fistula. A flap of anoderm or perianal skin is created and lifted retrograde into the anal canal (43).

Ligation of the intersphincteric fistula tract (LIFT) is a procedure that involves dissecting into the intersphincteric space, identifying the fistula tract, and ligating the tract on either side (44). This approach can be used for low fistulas that pass through an intact sphincter complex. When a bioprosthetic graft is placed between the rectum and vagina in combination with the LIFT procedure, healing rates are improved.

Transperineal repairs are designed to place tissue or prosthetic material between the rectal and vaginal openings. The most commonly used tissue interposition grafts are bulbocavernosus and gracilis muscle grafts. Both of these grafts can be used to close large defects, facilitating neovascularity, dead-space filling, and enhanced granulation tissue formation. The use of bulbocavernosus
muscle or the labial fat pad is called Martius flap creation (Fig 16) (45). The perineum is dissected to identify the plane and fistula tract between the rectum and vagina, and the fistula tract is ligated. The bulbocavernous muscular fat pad is harvested from either labium majus pudendi, depending on the vascular supply from the perineal branch of the pudendal artery, and then transposed through a subcutaneous tunnel to separate the vaginal and rectal walls. Success rates of up to 100% have been reported in the setting of Martius flap creation with fecal diversion.

A gracilis flap repair is performed with the patient in the modified lithotomy position (Figs 17, 18). An incision is made posterior to the vaginal introitus, and the rectovaginal septum is entered. A dissection is performed to identify and ligate the fistula tract. The harvested gracilis muscle (Fig 17) is then passed through a subcutaneous tunnel between the perineal and thigh incisions. The muscle is then interposed between the rectum and vagina and sutured in place (Figs 17, 18). To facilitate healing, diversion with a temporary ostomy is recommended. Healing rates of up to 100% have been achieved with this technique (46).

Recently, mesenchymal stem cells have been used increasingly to treat perianal Crohn disease. Owing to the favorable healing rates seen, some groups are beginning to design clinical trials to test mesenchymal stem cell–based therapies for rectovaginal fistulas. This treatment most often involves the direct injection of cells, with an
Figure 18. Gracilis flap repair. (a) Photograph shows the left thigh of a patient in the modified lithotomy position, with mobilization of the gracilis muscle (>). (b) The muscle is advanced by way of a transperineal approach, interposed between the rectum and vagina, and sutured in place with use of an incision at the rectovaginal septum (arrow). All steps are performed through the vagina.

exceedingly low risk of injury to the anal sphincter complex. Data collected within the next few years should shed light as to whether this may be a more optimal surgical approach (47,48).

Conclusion

The diagnosis and management of ARVFs are complex and vary greatly according to the cause of the fistula. MRI performed by using a dedicated protocol is the modality of choice for primary assessment, as it can yield details regarding the number of tracts, their anatomic locations, and complicating features such as abscess, inflammation, sphincter destruction, and neoplasm. Vaginography, CT, and endoscopic US also may aid in the identification of fistulas; however, each of these examinations has limitations. Because ARVFs can be difficult to identify and treat, it is important for radiologists to apply the modalities necessary to report those details regarding ARVFs that may alter the surgical management.

Acknowledgments.—The authors acknowledge the assistance of Sonia Watson, PhD, in editing the manuscript and Brent Warndahl, RT, for contributions regarding the MRI techniques.

References