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Review

Clinical and MR imaging features of cryptoglandular and Crohn's fistulas and abscesses

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In the surgical literature, cryptoglandular fistulas and abscesses are distinguished from fistulas and abscesses due to Crohn's disease [1]. The fistulas resulting from an underlying disease such as Crohn's disease are termed *specific*, whereas the nonspecific type of fistulas result from localized infection of the anal crypts and glands [1].

In the radiological literature, such a distinction is often not made. There have been reports that describe the findings of either Crohn's [2] or cryptoglandular [3] fistulas, but other reports have described the findings without distinguishing between the two types of fistulas [4, 5]. Because of the limited definition of the patient populations and lack of distinction between the two types of perianal fistulas, the results of studies from different institutions are difficult to compare. In addition, unfamiliarity with the subtypes of perianal fistulas may lead to misinterpretation and hamper the communication between the radiologists and the referring physicians.

The purpose of the present paper was to provide the necessary background information and to display the predominant magnetic resonance (MR) imaging features of cryptoglandular and Crohn's perianal and perirectal fistulas and abscesses.

Etiology and epidemiology

Nonspecific or cryptoglandular fistulas and abscesses result from infection of anal crypts and glands [1, 6]. Anal glands, slightly more numerous in men than in women, are located at the level of the dentate line of the anal canal and sometimes penetrate through the internal anal sphincter and intersphincteric space into the ischioanal space [6]. Infection of these glands due to predisposing factors such as an acute episode of diarrhea or trauma plays an essential role in the development of cryptoglandular fistulas [1, 6]. The prevalence of this type of fistula is said to be approximately 10 per 100,000 of the general population [7].

Specific or Crohn's fistulas and abscesses result from transmural spread of chronic granulomatous inflammation [1]. Crohn's fistulas may be located at any site in the gastrointestinal tract, but usually they originate from the terminal ileum and colon and in particular the anorectum. The prevalence of Crohn's disease varies between three and seven per 100,000 of the general population [1, 2]. Approximately 36% of Crohn's patients have perirectal disease [2], which results in the specific type of pelvic fistulas and abscesses.

Diagnosis and treatment

Perianal fistulas and abscesses are often diagnosed clinically, based on typical symptomatology and physical examination [1]. The exact relationship between the fistula and the anorectum, in particular the anal sphincter complex, is often not evident at physical examination. The classification of fistulas (Fig. 1) determines the type of surgical treatment and depends on the degree of involvement of the anal sphincter complex. In addition to digital examination, with careful cannulation of the external opening in some patients, rectosigmoidoscopy with or without mucosal biopsies and fistulography are standard

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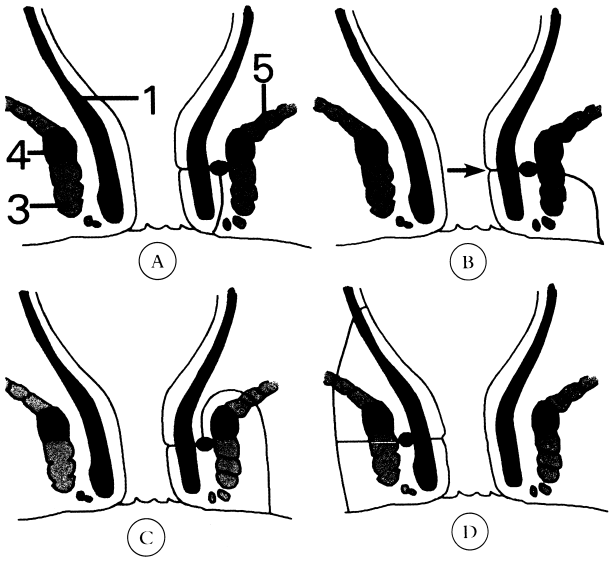

Fig. 1. Classification of perianal fistulas by Parks et al. [8]. **A** An intersphincteric fistula runs within the intersphincteric space, which is located between the internal anal sphincter (*1*), the external anal sphincter (*3*), and the puborectalis muscle (*4*). **B** Transsphincteric fistula, with the internal opening at the level of the anal canal (*arrow*), traverses both the internal and external anal sphincter. Extrasphincteric (**C**) and suprasphincteric (**D**) fistulas are less common types of lesions. Levator ani muscle (*5*).

techniques for fistula evaluation. Cross-sectional imaging modalities, such as computed tomography, ultrasound, and MR imaging, are becoming increasingly important for classification of perianal fistulas and abscesses because they can depict the soft tissues and do not depend on filling the tracts with contrast material for visualization. Due to the multiplanar capability and high inherent soft tissue contrast, MR imaging has been suggested as the modality of choice [3–5] for classification of perianal fistulas and abscesses. The classification of fistulas by Parks et al. is used most often [8]. Cryptoglandular fistulas, predominantly located at the level of the anal canal and direct surroundings, can be classified according to the classification by Parks et al. Perianal Crohn's fistulas are often extensive and complex, and the majority will not fit into the classification developed by Parks et al.

The treatment of perianal abscesses, due either to cryptoglandular disease or Crohn's disease, is incision and drainage [1, 9].

The treatment of cryptoglandular fistulas is mainly surgical, with a number of options: fistulotomy, fistulectomy, seton placement, advancement flap closure, and fecal deviating colostomy. Fistulotomy, which denotes only the unroofing of a fistula, is preferred to fistulectomy, which involves the unroofing and coring out of a fistula in combination with the excision of the sphincter muscle below the level of the internal opening. In general, intersphincteric and low transsphincteric fistulas are preferably treated with fistulotomy, whereas other types of fistulas require stepwise or modified procedures.

Management of perianal Crohn's fistulas is controversial [1]. The treatment of relatively simple perianal Crohn's fistulas is fistulotomy [7, 9]. Complex and extensive fistulas involving the anal canal are more difficult to manage because the surgical wounds may not heal, and surgical procedures may induce or worsen fecal incontinence [1]. Therfore, complex or extensive perianal Crohn's fistulas are best treated by optimizing nutritional support and antiinflammatory therapy. If such measures fail, a long-term seton placement in combination with a defunctioning ileostomy or colostomy are considered to maintain the patency of the anal sphincters and drainage of the fistula. To avoid a fistulotomy or proctectomy, some patients may require multiple seton insertions [1]. A seton may be any foreign substance that can be inserted into the fistula tract to encircle the sphincter muscle. Materials commonly employed include silk or other nonabsorbable suture materials, penrose drains, rubber bands, vessel loops, and Silastic catheters [1]. A defunctioning ileostomy or colostomy is performed to create a stoma and is used to relieve the anorectum from the passage of potentially harmful stool in patients with extensive perianal fistulas. Fecal deviating colostomy is reserved for patients with uncontrollable extensive perianal Crohn's disease, which usually is associated with Crohn's proctitis and severe clinical symptoms.

MR imaging of cryptoglandular fistulas

A typical cryptoglandular fistula has an internal opening at the level of the anal canal, a primary tract, and an external opening [7]. Occasionally, cryptoglandular fistulas have a secondary tract, a horseshoe-shaped spread, an abscess, and more than one external opening. At T2-weighted MR images, fistulas have a distinct appearance, with a central high-signal-intensity tract that is surrounded by a relatively low-signal-intensity wall [7]. Presumably, the inner high-signal-intensity region of fistulas consists of the true lumen and granulation tissue, and the outer part of fistulas with lower signal intensity is comprised of fibrotic tissue. The ratio of high- and low-signal-intensity areas is expected to decrease as a fistula becomes more chronic, which is consistent with the development of an increasing amount of fibrotic tissue [3, 7].

Most of the MR images of cryptoglandular fistulas shown in the present review were acquired at a 0.5-T MR imager (Philips Medical Systems, Best, The Netherlands). For the MR imaging sequences, the following parameters are suggested: axial three-dimensional turbo spin-echo images [repetition time (TR) = 2000 ms, effective echo time (TE) = 150–170 ms, field of view = 140 mm, matrix = 68 × 256, slice thickness = 2 mm without gaps,

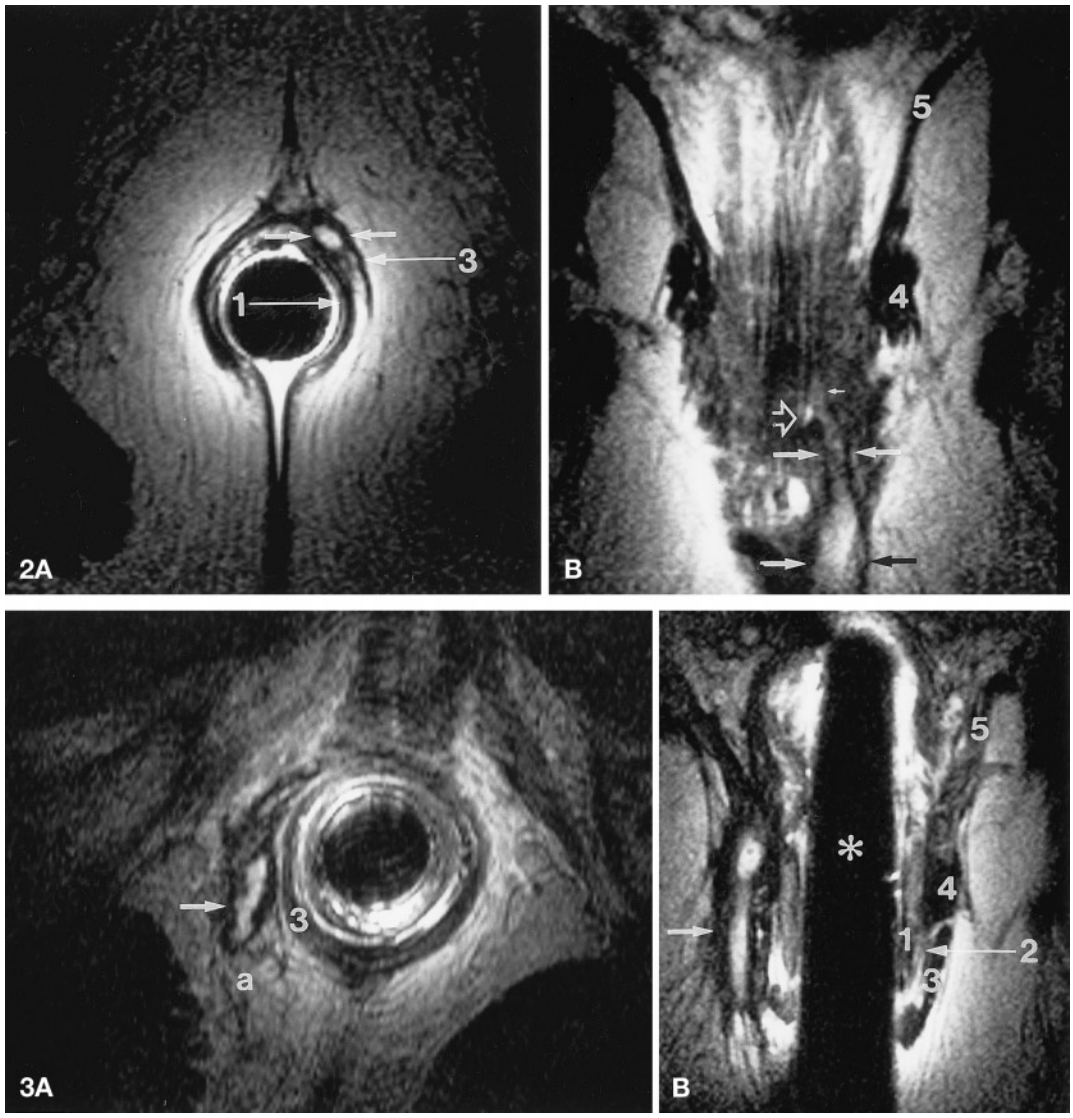

Fig. 2. A 40-year-old man with a cryptoglandular intersphincteric fistula. **A** Axial T2-weighted fast spin-echo endoanal image (TR/effective TE = 2000/150 ms) shows the fistula (*arrows*) located between the internal (*1*) and external (*3*) anal sphincters within the intersphincteric space. The fistula has a high signal intensity centrally and a low signal intensity peripherally. **B** Coronal T2-weighted fast spin-echo endoanal image (TR/effective TE = 2136/120 ms) shows the fistula (*large arrows*), with the internal opening (*open arrow*) and a short secondary blind tract (*small arrow*). Puborectalis muscle (*4*), levator ani muscle (*5*).

Fig. 3. A 36-year-old man with a cryptoglandular transsphincteric fistula. **A** Axial T2-weighted fast spin-echo endoanal image (TR/effective TE = 2000/170 ms) shows the fistula (*arrow*) located just lateral to the external anal sphincter (*3*) within the ischioanal fossa (*a*). **B** Coronal T2-weighted fast spin-echo endoanal image (TR/effective TE = 2136/120 ms) clearly shows the fistula (*arrows*) just lateral to the external anal sphincter on the left side. On the right side, note the normal anal sphincter complex, including the internal anal sphincter (*1*), longitudinal layer (*2*), the external anal sphincter (*3*), the puborectalis muscle (*4*), and the levator ani muscle (*5*). *Asterisk* endoanal coil.

60 slices], coronal, and sagittal two-dimenstional turbo spin-echo images (TR = 2100 ms, effective TE = 120 ms, field of view = 120 mm, matrix = 205 × 256, slice thickness = 4 mm/0.4 mm, nine slices).

At MR imaging, the identification and localization of the entire cryptoglandular fistula, including the internal opening, the primary tract, the secondary tract, the circumferential spread, the abscesses, and the external opening, are essential. Fistulas with unrecognized components may cause problems during surgery and are more likely to recur [1, 7, 9]. For classification of cryptoglandular fistulas, the following information is important: (a) localization of the internal opening, (b) the distinction between the intersphincteric and transsphincteric fistulas, (c) iden-

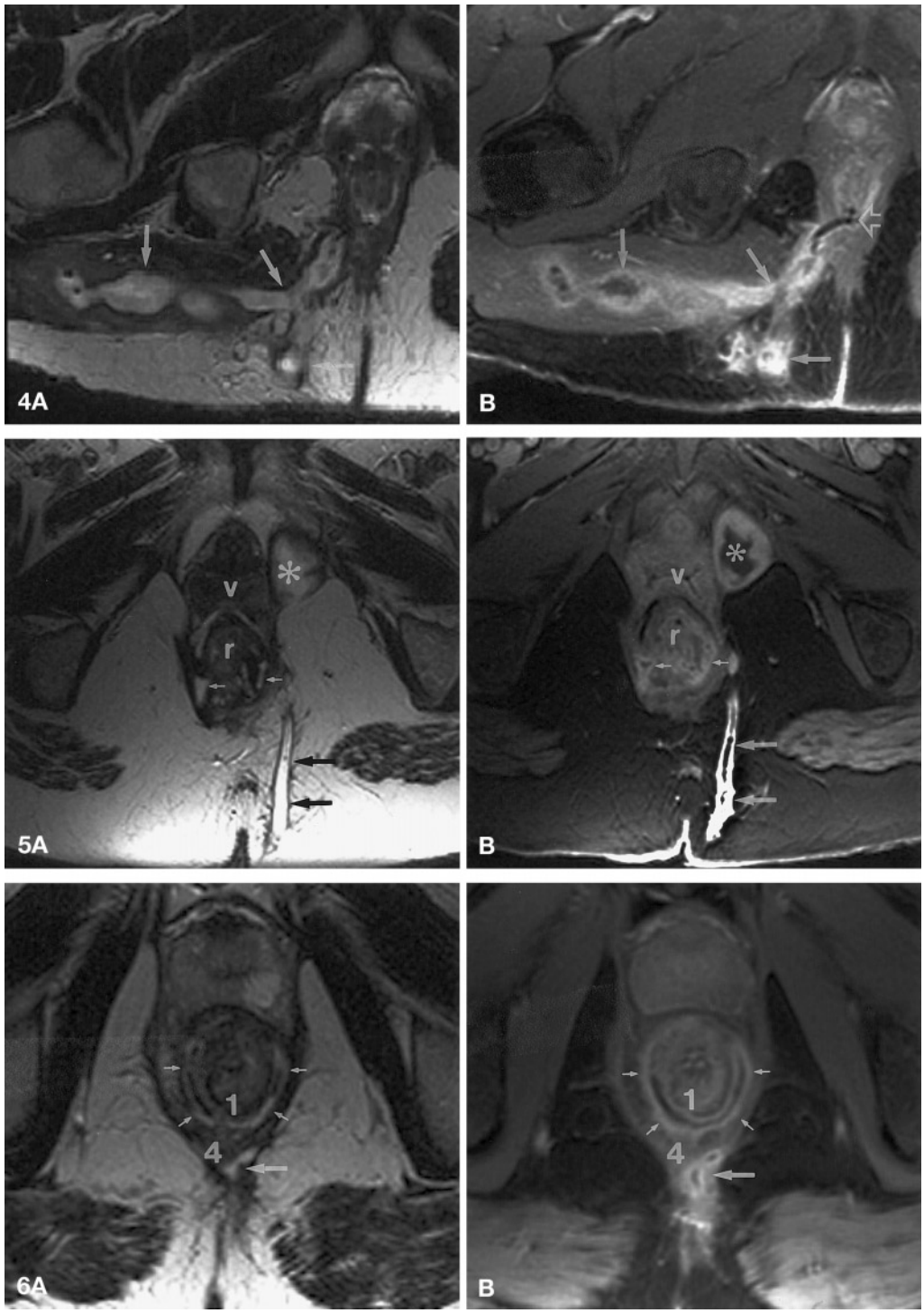

Fig. 4. A 38-year-old man with extensive perianal and perirectal Crohn's fistulas, with extension into the ischioanal fossa and into the right gluteus muscle. **A** Axial T2-weighted fast spin-echo phased-array coil image (TR/effective TE = 3000/128 ms) shows a large fistula (*arrows*) that is predominantly hyperintense relative to the gluteus muscle. **B** Axial fat-saturated T1-weighted gradient echo image (TR/TE = 250/2.9 ms), obtained after administration of gadolinium-DTPA, shows enhancement of much of the granulation tissue within the wall of the fistula (*solid arrows*). No enhancement is seen of the fluid- or air-filled lumen. Because of the presence of air in the fistula near the anorectum, the internal opening shows a better conspicuity on the postgadolinium image (*open arrow*).

Fig. 5. A 43-year-old woman with Crohn's fistula and an abscess. **A** Axial T2-weighted fast spin-echo phased-array coil image (TR/effective = 9983/126 ms) shows a large fistula (*large arrows*) extending posteriorly in relation to the anorectum (*r*) and an abscess (*) located lateral to the vagina (*v*). The fistula and the abscess have predominantly higher signal intensities relative to the surrounding fat. There are also smaller components of the fistula within the intersphincteric space (*small arrows*). **B** Axial fat-saturated T1-weighted gradient echo image, obtained after administration of gadolinium-DTPA, shows irregular thick enhancement of much of the wall of the fistula (*arrows*) and the abscess (*).

Fig. 6. A 40-year-old man with horseshoe-shaped Crohn's fistula. **A** Axial T2-weighted fast spin-echo phased-array coil image (TR/effective TE = 5000/126 ms) shows a fistula (*large arrow*) within the puborectalis muscle (*4*), with a horseshoe-shaped spread (*small arrows*) located between the internal anal sphincter (*1*) and the puborectalis muscle (*4*) within the intersphincteric space. **B** Axial fat-saturated T1-weighted gradient echo image (TR/TE = 375/3.2 ms), obtained after administration of gadolinium-DTPA, shows enhancement of the fistula components (*large and small arrows*).

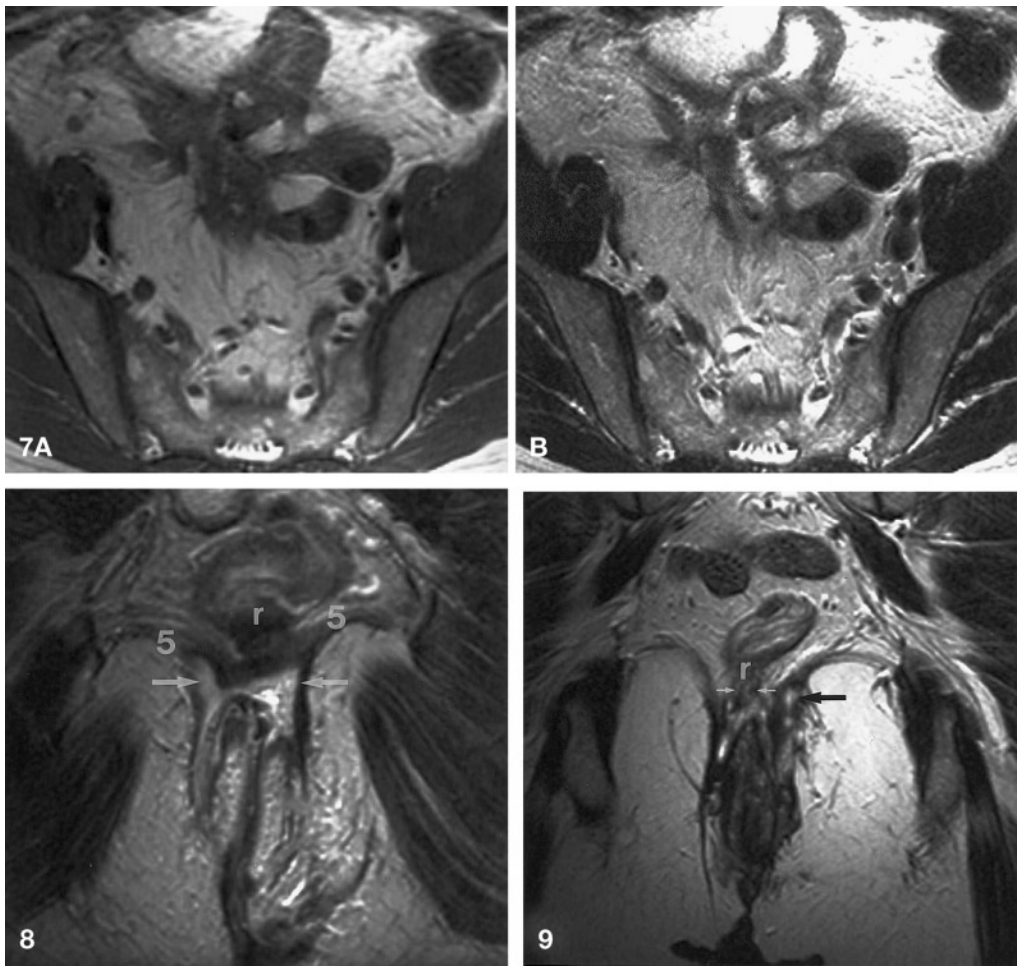

Fig. 7. A 55-year-old man with Crohn's enteroenteric fistula. **A** Axial T1-weighted spin-echo image (TR/TE = 566/14 ms) shows the small bowel loops with an abnormal configuration. **B** Axial T2-weighted fast spin-echo phased-array image (TR/effective TE = 3583/120 ms) shows high-signal fluid-filled areas facilitating communications among the bowel loops. The findings are consistent with enteroenteric fistulas.

Fig. 8. A 43-year-old woman with a horseshoe-shaped Crohn's fistula. Coronal T2-weighted fast spin-echo image (TR/effective TE = 6000/119 ms) shows the predominantly hyperintense fistula (*arrows*) located below the levator ani muscles (*5*). Rectum (*r*). Fig. 9.

Fig. 9. A 40-year-old man with a Crohn's fistula. Coronal T2-weighted fast spin-echo image (TR/effective TE = 5000/126 ms) shows the fistula, with an extension into (*large arrow*) and above (*small arrows*) the levator ani muscle. Rectum (*r*).

tification of secondary tract(s), (d) the presence of abscesses, and (e) the presence of a horseshoe-shaped fistula.

Cryptoglandular fistulas are often relatively small and are located close to the anal sphincter complex [1, 7]. Depiction of the fistula in relation to the components of the normal anal sphincter complex, including the internal anal sphincter, the longitudinal layer, the external anal sphincter, the puborectalis muscle, the levator ani muscle, the intersphincteric space, the ischioanal space, and the supralevator space, is essential for classification of cryptoglandular fistulas [2, 3, 7]. MR imaging with an endoanal surface coil provides high-resolution images of the anal sphincter complex and is also accurate in the depiction and classification of cryptoglandular fistulous disease [7]. If one considers the anatomic knowledge obtained by using the endoanal coil, MR imaging with a phased-array coil may also be sufficient for classification of cryptoglandular fistulas.

Localization of the internal opening with respect to the anal verge and anal sphincter complex is the first and most important step for the classification of the cryptoglandular fistulas [9]. After the identification of the primary tract, the distinction between an intersphincteric and a transsphincteric tract is often a challenge (Figs. 2,

3). Typically, an intersphincteric tract runs in a straight or a spiral path between the internal and the external anal sphincters within the intersphincteric space (Fig. 2). A typical transsphincteric tract runs through the external anal sphincter into the ischioanal space (Fig. 3). The distance between a transsphincteric tract and the external anal sphincter may differ; some tracts run directly outside the external anal sphincter, whereas others are located a few centimeters from it.

Secondary tracts are the side branches of a primary tract. Cryptoglandular fistulas commonly have no secondary tracts. If present, secondary tracts are relatively small, and abscesses may or may not be present (Fig. 2). Any widening of the primary or the secondary tract is considered a fistulous abscess [1]. The presence, size, and exact location of a secondary tract and abscess should be described. MR imaging enables direct multiplanar visualization of the anatomic structures and spaces, which facilitates the detection and localization of secondary tracts and abscesses.

Cryptoglandular horseshoe-shaped fistulas can accurately be assessed with MR imaging [3–5]. Any type of fistula may show a circumferential spread, but a typical horseshoe-shaped fistula has two tracts within the ischioanal space and one internal opening, often in the midline posteriorly at the level of the inferior border of the puborectalis muscle. Horseshoe-shaped fistulas should be distinguished especially from transsphincteric fistulas. Sometimes one leg of a horseshoe-shaped fistula may be shorter than the other, with only one external opening. Such a fistula could be misclassified as a transsphincteric fistula during surgical assessment [3].

MR imaging in Crohn's fistulas

Typical Crohn's fistulas consist of multiple tracts and abscesses. A well-defined primary tract is often not recognizable [1, 2]. The tracts tend to be relatively large, often with circumferential or horseshoe-shaped spread and intramuscular spread (Figs. 4–6). In addition to the anal canal, the tracts involve the rectum, sigmoid colon, small bowel loops (Fig. 7), and other pelvic organs such as the bladder and vagina. The fistulas and abscesses can be located below (Fig. 8), within, or above the level of the levator ani muscle (Fig. 9). There may not be an internal opening at the level of the anal canal. The external opening may be absent, or there may be several external openings. Proctitis and thickened perirectal fascia are common findings with pelvic Crohn's disease (Fig. 10). The presence of proctitis predicts a worse course of perianal and perirectal fistulous disease [1, 2].

Most of the MR images concerning Crohn's fistulas shown in the present review were acquired with a 1.5-T system (Signa, GE Medical Systems, Milwaukee, WI). For signal reception, a phased-array multicoil was used in all cases. Axial T1-weighted spin-echo images were acquired with the following parameters: TR = 400–750 ms, TE = 8–17 ms, matrix = 256 × 160–192, slice thickness = 4–6 mm, section interval = 0–2 mm, signals acquired = 1–2, and field of view = 160–260 mm. Axial T2-weighted fast spin-echo images were acquired with the following parameters: TR = 3000–9900 ms, effective TE = 117–144 ms, matrix = 256 × 224–256, slice thickness = 4–5 mm, slice interval = 0–2 mm, signals acquired = 2–4, and field of view = 160–260 mm. The echo train length was 16. In addition, pre- and postgadolinium-DTPA (0.1 mmol/kg, Magnevist; Berlex Laboratories, Wayne, NJ) T1-weighted fat-suppressed axial gradient echo images were performed: TR = 120–375 ms, TE = 1.6–6.3 ms, matrix = 256 × 128–192, slice thickness = 4–8 mm, slice interval = 0–2 mm, signals acquired = 2–4, and field of view = 160–300 mm.

The multiplanar capabilities of MR imaging are advantageous in characterizing the perianal and perirectal lesions in Crohn's disease [2, 10, 11–13] because they are often difficult to evaluate by clinical means or other techniques. In patients with a high clinical suspicion of perianal or perirectal complications of Crohn's disease, MR imaging can be performed in a relatively noninvasive manner, i.e., without bowel preparation or use of antispasmodics [2]. The use of gadolinium in combination with fat-suppression techniques increase the conspicuity of the lesions, allowing the diagnosis to be made with confidence. The use of an intraluminal coil can be avoided in favor of phased-array multicoils. The rationale for such an MR imaging examination is to obtain as much information as possible with a minimum of discomfort to the patient [2]. Accurate assessment of perianal Crohn's disease with MR imaging can play a crucial role during management [2, 7]. MR imaging can identify an abscess and characterize fistulas as simple or complex lesions. Hence, MR imaging findings may help the physician to individualize treatment.

Various features of perirectal Crohn's fistulas are compared with cryptoglandular fistulas in Table 1.

Pitfalls

Medical history, clinical examination, and findings from other investigations may help to avoid pitfalls during MR imaging of pelvic fistulas. Hemorrhoids can resemble small submucosal fluid collections on MR images. Fistulas located at the anterior aspect of the anorectum may simulate rectovaginal, rectourethral, or rectovesical fistulas.

Unilateral thickening of the levator ani, which has been described previously [2], may be reactive and is not always due to an intramuscular abscess. An abscess located in close contact with the levator ani muscle, either below or above it,

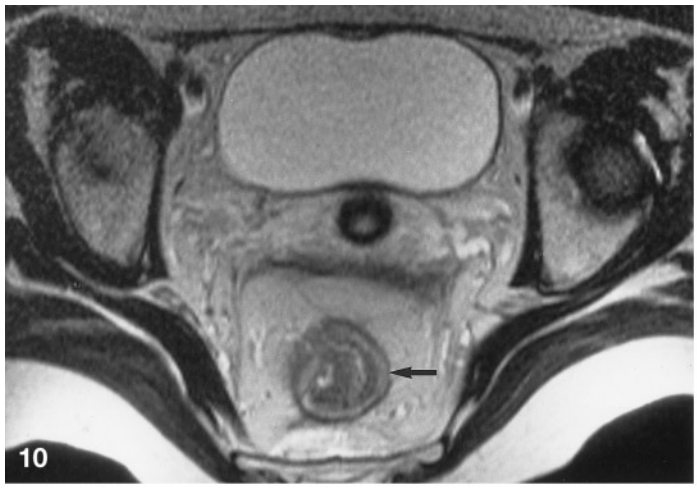

Fig. 10. A 35-year-old woman with proctitis due to Crohn's disease. Axial T2-weighted fast spin-echo external surface coil image (TR/effective TE = 5736/100 ms) shows thickening of the rectal wall (*arrow*).

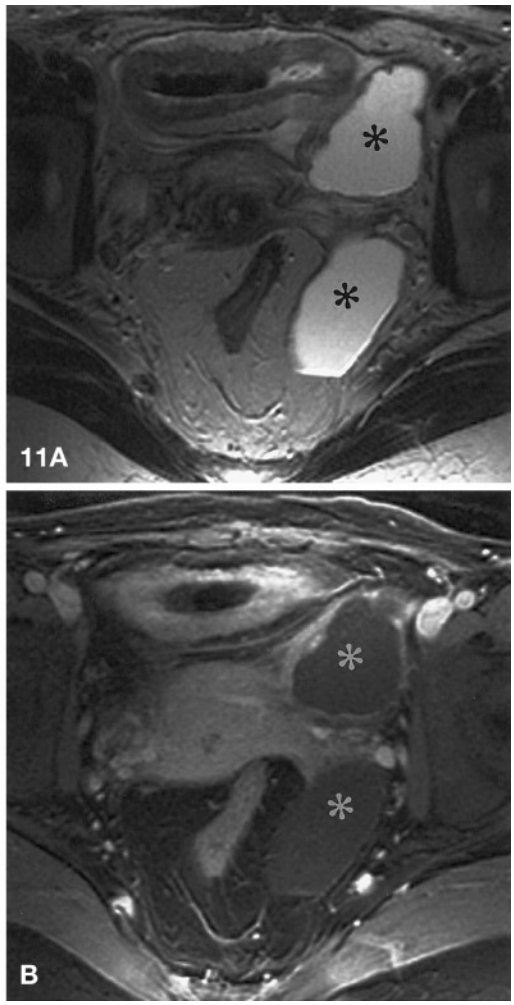

Fig. 11. A 33-year-old woman with a pelvic pseudocyst. The patient had a history of Crohn's disease and a colostomy. **A** Axial T2-weighted fast spin-echo phased-array coil image (TR/effective TE = 3066/120 ms) shows high-signal-intensity peritoneal pseudocysts (*) adjacent to the ovary, mimicking abscesses. **B** Axial fat-saturated T1-weighted gradient echo image shows minimally enhancing thin walls of the pseudocysts (*). Compare the wall enhancement of the pseudocyst to that in the abscess (Fig. 5B).

may cause unilateral reactive thickening of the levator ani muscle [2]. At MR imaging, old nonactive fibrotic tissue in the perianal region, which sometimes produces perianal pain and simulates a recurrent fistula, may be difficult to distinguish from a recurrent or a long-standing active fistula. Imaging during a period with clinically evident symptoms, preferably with perianal inflammation and fluid discharge, may be helpful.

Pelvic abscesses and specific types of fistulas may also occur in AIDS, tuberculous or ulcerative colitis, or amoebiasis or may occur secondary to trauma, irradiation, and previous pelvic surgery [1, 7]. Peritoneal pseudocysts should not be confused with pelvic abscesses in patients with Crohn's disease (Fig. 11). Peritoneal pseudocysts are created when fluid released from functioning ovaries is trapped by peritoneal adhesions [14]. These patients lack the symptoms of a pelvic abscess, and the pseudocysts have a close relationship to the ovaries.

Rectal wall thickening is not specific to Crohn's disease and can also be caused by tumor infiltration, postradiation changes, or endometriosis [2]. Therefore, MR imaging findings of proctitis should be interpreted along with the appropriate clinical history.

Conclusions

Cryptoglandular and Crohn's fistulas are distinguished on the basis of etiology, epidemiology, modes of diagnosis, and treatment. The present review illustrates that these fistulas have different characteristic appearances and patterns of anatomic involvement on MR imaging. Familiarity with the critical pathoanatomic features of these types of fistulas may facilitate the description of perianal and perirectal fistulous disease.

Table 1. Comparison of various features of cryptoglandular and perirectal Crohn's fistulas

	Cryptoglandular fistulas	Perirectal Crohn's fistulas
Prevalence	10 per 100 000 of the general population	About 36% of all patients with Crohn's disease
Etiology	Inflammation of the anal glands	Transmural spread of chronic granulomatous inflammation
Affected structures	Anal canal, and in lesser extent the rectum	Anorectum as well as other large or small bowel loops in the pelvis
Type of fistula	Relatively simple; usually small tracts with inter- or transsphincteric spread	Relatively complex, usually large tracts with circumferential or transmuscular spread, and abcesses
Internal opening	Must be present at the level of the dentate line	May or may not be present: the location may also vary
Proctitis	Unusual	May occur with rectal wall thickening and infiltration of the perirectal fat
Involvement of the adjacent pelvic organs	Unusual	May occur and cause rectovaginal, rectourethral or rectovesical fistulas
Treatment	Surgical	Combined, medical and surgical

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