MRI of Crohn’s Anoperineal Disease
Shaunagh McDermott*, Anuradha S Shenoy-Bhangle and Michael S Gee
Massachusetts General Hospital, Division of Abdominal Imaging and Interventional Radiology, 55 Fruit Street, Boston, MA 02114, USA

Abstract
Anoperineal involvement is seen in up to 38% of patients with Crohn’s disease. To adopt the best treatment strategy and avoid recurrences, it is important to obtain precise radiological information of the fistulous track. Magnetic resonance imaging provides precise information on the anatomy of the anal canal, the anal sphincter complex, and the relationship of the fistula to the pelvic floor structures. In this article we review the anatomy of the anal canal, the pathogenesis of perianal fistula, different MRI sequences for the evaluation of fistula with emphasis on their imaging findings and an MR imaging based grading system for their classification.

Keywords: Crohn’s disease; Perianal fistula; Magnetic resonance imaging

Introduction
The most current population-based series [from Sweden and Minnesota] have found that anoperineal involvement is seen in 14% to 38% of patients with Crohn’s disease [1-3], with isolated perianal disease seen in only 5% [4]. The prevalence of perianal manifestations increases as the disease progresses distally, with only 15% of patients with ileocolic Crohn’s disease developing fistula but fistulae occurring in 92% of patients with Crohn’s disease involving the colon and rectum [3]. There does not appear to be a predilection for age, with between 13% and 62% of children and adolescents with Crohn’s disease experiencing perianal manifestations [2,5,6]; however, a younger age of onset increases the odds of developing perianal disease over time [7,8].

Perianal Crohn’s disease is often recurrent, with 35% to 59% of patients relapsing within 2 years [9]. More than 80% of patients require surgery, and as many as 31% require a permanent stoma [1,3,10]. The presence of perianal disease is associated with a more disabling natural history [11], with increased extraintestinal manifestations [12] and greater steroid resistance [13]. Large studies have also shown an increased risk for squamous cell carcinoma and adenocarcinoma of the anus in patients with anorectal involvement [14,15].

The pathogenesis of fistulae formation in Crohn’s disease is still unknown but is thought to be the end result of severe transmural bowel inflammation. One histological hallmark of fistulae caused by Crohn’s disease is dense infiltration of B lymphocytes [16]. One recent study found that Crohn’s disease fistulae were lined by mesenchymal transitional cells rather than epithelium, implicating a role for Epithelial-Mesenchymal Transition (EMT) in the cellular invasion underlying fistula formation [17]. This suggests a potential role for inhibition of the genetic pathways underlying EMT as a therapeutic strategy.

Over the last decade, magnetic resonance imaging (MRI) has become the reference technique in the evaluation of perianal Crohn’s disease, showing high diagnostic ability, with sensitivity and specificity, respectively, of 100% and 86% in detection of fistula’s primary tracts, and of 96% and 97% in detection of abscesses [18,19]. Moreover, surgical management may be altered in up to 40% of patients by the addition of MRI to examination under anesthesia (EUA) [19,20]. In particular, MRI has been shown to be of value to study complex perianal fistulae, being able to detect sepsis outside the anal sphincter and their relationship with the sphincter and levator ani muscle [21]. Besides an accurate morphological evaluation of the perianal space, MRI has been demonstrated to provide information about perianal disease activity, assessing inflammatory changes in fistula tracks in response to treatment with infliximab [22-26].

Treatment Options for the Management of Perianal Crohn’s Disease
The main objective of perianal fistula treatment is to effectively close the internal opening of the fistula track while preserving sphincter integrity and continence. Treatment typically involves either or a combination of medical treatment and surgical techniques. A recently published study using evidence based practice techniques made the following recommendations for the treatment of perianal fistulae in Crohn’s disease [27]:

- Fistulotomy is considered for simple perianal fistula
- In complex perianal fistulas, antibiotics and azathioprine or 6-mercaptopurine, which are often combined with a loose seton, constitute the first-line medical treatment
- In cases with persistent secretions, infliximab at 5 mg/kg is given at weeks 0, 2 and 6 and subsequently every 8 weeks
- Adalimumab may improve fistula response in both infliximab-native patients and following infliximab treatment failure
- Local therapy with fibrin glue or fistula plugs is rarely effective
- Definitive surgical closure of perianal fistulas using an advancement flap may be attempted, but this procedure is associated with a high risk of relapse
- Colostomy and surgical proctectomy are the ultimate surgical treatment options for fistula

Anatomy of the Anal Region
The internal sphincter is involuntary and is composed of smooth muscle continuous with the circular smooth muscle of the rectum. It is responsible for 85% of resting tone. In most individuals, it can be divided without causing a loss of continence. The internal sphincter is supplied mildly hyperintense on both T1- and T2-weighted images. The external sphincter is composed of striated muscle and is continuous

*Corresponding author: Shaunagh McDermott, Massachusetts General Hospital, Division of Abdominal Imaging and Interventional Radiology, 55 Fruit Street, Boston, MA 02114, USA, Tel: (857) 205-8501; Fax: (617) 726-4891; E-mail: smcdermott1@partners.org

Received February 01, 2012; Accepted April 02, 2012; Published April 04, 2012

Citation: McDermott S, Shenoy-Bhangle AS, Gee MS (2012) MRI of Crohn’s Anoperineal Disease. J Gastroint Dig Syst S9:001. doi:10.4172/2161-069X.S9-001

Copyright: © 2012 McDermott S, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
superiorly with the puborectalis and levator ani muscles. It contributes only 15% of resting anal tone, but its strong voluntary contractions resist defecation. A division of the external sphincter can lead to incontinence. The external sphincter appears hypointense against the background of the ischiorectal fossa fat on non-fat-suppressed T2-weighted images and appears similarly hypointense on T1-weighted and STIR images, although its conspicuity with respect to the adjacent fat is somewhat diminished with fat-suppression techniques (Figure 1).

**Evaluation of Perianal Fistula, Before and After Treatment**

The objectives in performing and interpreting any imaging study for perianal fistulas are simple [28]:

- To determine the relationship of any fistulous track to the sphincter complex. Is the sphincter involved, does the track transverse both layers of the sphincter (transspincteric) or only the internal sphincter (intersphincteric)? Surgeons also want to know distance of the fistula from the levator ani complex in order to guide as to whether fistulotomy vs. seton placement is warranted. Setons being placed in complex fistulae or high fistulae to avoid incontinence associated with open fistulotomy.
- To identify any secondary fistulous tracks and the sites of any abscess cavities. The presence of abscess mandates antibiotic therapy and/or surgical drainage, and precludes use of many immunosuppressive Crohn's medications.

At present, two classifications are most commonly used: a classification proposed by Parks in 1976, which was created for surgical use [29], and the St James University Hospital classification, which was developed based on a MRI examination [28,30] (Tables 1 and 2) (Figure 2 and 3).

---

**Table 1:** Parks classification of perianal fistula [29].

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal appearances</td>
</tr>
<tr>
<td>1</td>
<td>Simple linear intersphincteric fistula</td>
</tr>
<tr>
<td>2</td>
<td>Intersphincteric fistula with intersphincteric abscess or secondary fistulous track</td>
</tr>
<tr>
<td>3</td>
<td>Transspincteric fistula</td>
</tr>
<tr>
<td>4</td>
<td>Transspincteric fistula with abscess or secondary track within the ischioanal or ischiorectal fossa</td>
</tr>
<tr>
<td>5</td>
<td>Supralevator or translevator disease</td>
</tr>
</tbody>
</table>

**Table 2:** St James’s University Hospital MRI classification system [28].

<table>
<thead>
<tr>
<th>Fistula Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersphincteric</td>
<td>Confined to intersphincteric plan, does not cross external sphincter or levator muscles</td>
</tr>
<tr>
<td>Transspincteric</td>
<td>Tracks passes radially through external sphincter</td>
</tr>
<tr>
<td>Suprasphincteric</td>
<td>Track passes upward within intersphincteric plane over puborectalis muscles and descends through levator muscles, ischiorectal fossa</td>
</tr>
<tr>
<td>Extrasphincteric</td>
<td>Fistula’s course is completely outside external sphincter</td>
</tr>
</tbody>
</table>

**Figure 1:** Coronal: (A) Coronal and axial; (B) T2-weighted images outlining the normal anatomy. IS – internal sphincter; ES – external sphincter; LA – levator ani; IAF – ischioanal fossa; R – rectum; BL – bladder; U – urethra; and M - anal canal.

**Figure 2:** Illustrations of the Parks classification system. A – intersphincteric fistula; B – transspincteric fistula; C – suprasphincteric fistula; and D – extrasphincteric fistula.
A study has shown that MR imaging is better than initial surgical exploration in the prediction of patient outcome [30]. When the St James's University Hospital classification was used, the MR imaging grading of fistulas was significantly associated with outcome: MR imaging grades 1 and 2 were associated with a satisfactory outcome (i.e. no further surgery needed), whereas grade 3-5 were associated with unsatisfactory outcome (i.e. further surgery needed).

More recently, MR imaging has been used to monitor the response of fistulous tracks to medical treatments. MRI demonstrates that skin healing may not be an appropriate determinant of outcome in patients with fistulous disease. Van Asche et al. [22] reported that despite healing on clinical examination, fistulous tracks persist in patients with Crohn’s disease treated with infliximab therapy. Eleven of 18 patients demonstrated clinical response evidenced by the absence of any further drainage from the fistula but 8 patients had evidence of persistent tracks and residual inflammation on MRI, raising the clinical concern about the durability of the long-term response [22].

**MR Imaging Techniques**

MR imaging uses magnetic fields and radiofrequency energy to create images of soft tissues without the use of ionizing radiation. This is an important consideration, especially in young patients who, over the course of treatment and surveillance, will require multiple imaging sessions. An additional advantage is that no patient preparation is required if a body coil is used. MR imaging in the coronal and axial planes demonstrates fistulous tracks in relation to the sphincter complex, ischiorectal fossa, and levator plate. Imaging in the sagittal and oblique planes is helpful in selected cases (e.g. anovaginal or presacral disease).

Currently, MR examinations may be performed with either endoluminal anal or external phased array coils, or a combination of the two, with use of the phased array coil being the most common approach [31]. Endoluminal anal coils offer higher spatial resolution than body coils [32], and their use resulted in an initial increased accuracy of classification of the primary track to up to 93% [33,34]. However, examinations performed using endoanal coils alone are limited by field of view and by patient discomfort, a result of which is often suboptimal image quality due to patient motion [35]. External phased array coils represent an excellent alternative in providing high spatial resolution images with a large field of view, while avoiding the discomfort of an endoluminal coil. The larger fields of view are important for better delineation of secondary tracks and extensions [36].

Intramuscular glucagon for reduction of bowel motion is not necessary for most patients, as the majority of bowel motion occurs in the upper pelvis, beyond the region of interest at the level of the anal canal.

Many different MR imaging techniques have been described for perianal fistula assessment (Figures 4-8).
Unenhanced T1-weighted images

These provide an excellent anatomical overview of the sphincter complex, levator plate, and the ischiorectal fossae. Fistulous tracks, inflammation, and abscesses, however, appear as areas of low to intermediate signal intensity and may not be distinguished from normal structures.

These images may be helpful in postoperative assessment. In the immediate postoperative period, hemorrhage will appear hyperintense and may thus be differentiated from a residual track. Also, fat containing ‘grafts’ may be placed to fill cavities and resection voids in restorative surgery. These hyperintense structures are readily identified on unenhanced T1-weighted sequences and can be distinguished from active disease, which appears hyperintense only after enhancement with gadolinium [28].
method for evaluating perianal fistula activity, as the apparent diffusion 
coefficient [ADC] was significantly lower in the positive inflammation activity group compared to the negative inflammation activity group [40].

Studies have shown that for experienced readers, combining fat-saturated contrast enhanced T1-weighted gradient echo images with either T2-weighted or STIR images collected in both the coronal and axial planes was sufficient to make an assessment before deciding the surgical extent of the procedure [41].

Limitations of MRI

The use of MRI requires a radiologist with additional experience in pelvic anatomy. The inter- and intra-observer agreement among expert radiologists is excellent, but outside the field, the quality of information is substandard [42]. In managing patients with fistulous tracks, the internal opening and its relationship with the dentate line influences whether one will perform a primary fistulotomy or a staged procedure. However, a limitation of MRI is that it is unable to identify the dentate line. In addition, some patients have relative or absolute contraindications to MRI including those with specific implanted devices such as pacemakers and certain cerebral aneurysm clips. Imaging will also be limited in patients who cannot receive intravenous contrast due to renal insufficiency.

Comparison with other Imaging Modalities

Fistulography was the traditional technique used to define fistula anatomy. However its reliability was unpredictable and very often it failed to define the extent of primary tracks or secondary extensions. In addition, it gave no information on the relationship of tracks to the sphincter complex or pelvic floor. Its limited value was confirmed by Kuijpers et al. [43], who reported that it was accurate in only 16% of cases. In addition, false-positive results occurred in 10% causing surgeons to search for nonexisting tracks, increasing the potential for iatrogenic injury.

Differentiating fistulae and resolving structures of the pelvic floor using computed tomography (CT) can be difficult [44], primarily because of the poor soft contrast of CT. One study found that CT scanning had a sensitivity of only 24% in the diagnosis of fistula-in-ano [45].

Endoanal Ultrasound (EAUS) has a high level of accuracy in the characterization of perianal fistula, with diagnostic accuracy ranging from 63-94% for classification of the primary track and with accuracy of prediction of site of the internal opening as high as 93% [46]. Several studies have found EAUS to be inferior to pelvic MRI in the diagnosis of perianal disease [47-49]. With the use of three-dimensional reconstruction of two-dimensional images, however, some investigators have shown that the results of EAUS are comparable with MRI, with excellent patient tolerance [34,50]. The use of hydrogen peroxide injection in the fistula track during EAUS substantially improves accuracy [51]. The diagnostic accuracy of EAUS can also be improved to values comparable with those of MRI by using a computer-assisted evaluation of the ultrasound images [52].

The question of which modality is best for discriminating simple and complex fistulas was specifically addressed using established evidence based practice principals by Sahni et al. [21]. They found that MRI is the superior technique with sensitivity and specificity of 97% and 96% compared with 92% and 85% for anal ultrasound and 75% and 64% for clinical examination.
Conclusion
MRI has an important role in the management of Crohn's Perianal disease. Preoperative MRI can dictate the surgical procedure and is an important determinant of outcome. It also plays a critical role in assessing the response of fistulous tracks to the milieu of new medical therapies.

References


