ARTICLE TITLE:

MRI of fistula-in-ano.

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SYNOPSIS

This chapter will explain the pathogenesis of fistula-in-ano and will detail the different classifications of fistula encountered, describe their features on MR, and will explain how imaging influences subsequent surgical treatment and ultimate clinical outcome. Precise preoperative characterization of the anatomical course of the fistula and all associated infection via MR is critical for surgery to be most effective. MR is the pre-eminent imaging modality used to answer pertinent surgical questions.

KEYWORDS

Anal fistula; Rectal fistula; Anus, diseases; magnetic resonance imaging; anal gland

KEYPOINTS

1. Preoperative classification of fistula-in-ano is pivotal for successful surgical treatment since this will determine what type of operation is performed.
2. MRI is the most appropriate imaging modality with which to classify fistula-in-ano. It is more accurate than other imaging modalities and is even more accurate than examination under anaesthetic overall.
3. The major therapeutic impact of MRI lies with its ability to both identify the course of the fistula (thereby indicating the extent of any sphincter division) and identify areas of infection that would have been missed otherwise.

TEXT BODY

Introduction

Fistula-in-ano describes abnormal communication between the anal (occasionally rectal) lumen and skin, usually perianal. Fistula-in-ano is relatively common and frequently recurs in the face of apparently curative surgery. Recurrence is usually due to infection that has escaped surgical detection, thereby going untreated. It is now well-recognised that pre-operative MR imaging identifies fistulas and associated abscesses and extensions that would have been missed otherwise. Because of this, pre-operative MRI has been shown to influence subsequent surgery and thereby diminish the chance of recurrence significantly. Pre-operative MR is routine in many centres, especially for patients with recurrent fistulas.

Aetiology, classification, and treatment of fistula-in-ano

Cryptogenic fistula-in-ano is caused by chronic intersphincteric sepsis. Infection of the anal glands, which arise at the level of the dentate line (the squamo-columnar junction of the anal canal) is believed to be the initiating factor. An intersphincteric abscess results, i.e. an abscess in the “gap” between the internal and external sphincter [1,2]. Acute glandular infection often presents as an acute perianal abscess, which is easy to diagnose clinically, and familiar to any surgical resident. While speedy incision and drainage provides substantial symptom relief, because the abscess is underpinned by glandular infection, and the gland drains to the anal lumen, patients frequently develop a subsequent fistula. 16% of 165,536 patients presenting with acute abscess developed a fistula subsequently, rising to 42% if there was inflammatory bowel disease [3]; fistulas usually developed within the first year. Acute MR imaging (before incision and drainage) may identify intersphincteric infection, thus identifying cryptoglandular infection as the cause [Figure 1]. A Cochrane review found that treatment of any underlying fistula found during surgery for acute abscess decreased the chance of recurrence substantially [4].

If intersphincteric sepsis is left untreated, it becomes chronic and “burrows” its way out, appearing as an external perianal opening. The anatomical course of the fistula is dictated by the location of the infected anal gland and the anatomical planes and structures that surround it. The internal opening will usually be within the anal canal at the level of the dentate line, i.e. the original site of the duct draining the infected gland. Radially, this is usually posterior at 6 o’clock, simply because anal glands are more abundant here, especially in men. The dentate line cannot be identified as a discrete anatomical structure by any imaging technique but its position can be approximated with sufficient accuracy by experienced radiologists – it lies approximately 2 cm cranial to the anal verge.

The fistula can reach the skin via a variety of routes, some more tortuous than others and penetrating anal sphincter muscles and surrounding tissues to a variable degree. Fistulas are “classified” according to the route taken by this “primary track”, i.e. the main track that links the internal and external openings. There are many classification systems, both clinical and radiological, but the only system recognized commonly by surgeons is from Parks and colleagues in 1976 [5]. Generally speaking, Parks’ is the only system that surgeons use, which obliges radiologists to use it as well. Parks and co-workers analyzed 400 consecutive fistula patients referred to St. Mark's Hospital London, a specialist hospital dealing with coloproctological disease and found that all fistulas could be placed into one of four broad groups. They termed these: intersphincteric; transsphincteric; suprasphincteric; extrasphincteric [4] [Figure 2]. The first three types pivot on intersphincteric infection, explained by the cryptoglandular hypothesis. The fourth type, "extrasphincteric", does not exhibit intersphincteric infection and usually arise from primary disease beyond the sphincter complex, for example rectal Crohn's disease or sigmoid diverticulitis. MRI has been adopted widely simply because it provides accurate pre-operative classification for the surgeon. It is worth noting that if either the external or internal opening is absent, then "sinus" is the correct description.

While most fistulas probably start as a single primary track, unabated infection may result in ramifications (often multiple) that branch away from this, generally termed "extensions". Extensions may be intersphincteric, ischioanal, or supralevator (pararectal), with either track or abscess morphology. Exactly when a "track" becomes an "abscess" and vice-versa has no precise definition on imaging and the surgical community also has no generally accepted definition. The ischioanal fossa is the commonest site for an extension, especially those arising from the apex of a transsphincteric fistula. The ischioanal fossa lies lateral to the sphincter complex and is largely fat-filled. Because this compartment lies adjacent to the anus (vs. the rectum) and lies below the pelvic floor (defined by the levator plate), the author prefers the term "ischioanal" fossa rather than "ischiorectal", which surgeon use commonly. The two terms are largely interchangeable. Extensions also occur in the horizontal plane and are known as “horseshoes”, only when there is ramification of sepsis on *both* sides of the internal opening. Extensions are the prime cause of recurrent disease because they are missed frequently, left untreated, and thereby allow infection to continue. Supralevator extensions are a particular problem because the levator plate presents a relative barrier to free drainage, so that infection may persist even when the extension has been identified and incised.

So, the surgeon’s prime objective is to identify the primary track and any associated extensions, eradicate these by draining all associated infection, and simultaneously preserving anal continence via minimal sphincter division. The surgeons needs answers to the following two questions:

- What is the relationship between the fistula and the anal sphincter? Will my surgery risk incontinence?
- Are there any extensions from the primary track that need to be treated in order to prevent recurrence? If so, where are they?

Surgical treatment is usually straightforward. Laying-open the fistula, a procedure known as “fistulotomy”, is the obvious surgical option but risks incontinence if a substantial proportion of sphincter muscle is divided. Fistulotomy is therefore preceded by examination under (general) anaesthetic (EUA), during which the surgeon attempts to classify the fistula via palpation and probing the external opening. This is not as easy as it sounds: The surgeon cannot visualise underlying muscles without incision, the internal opening may be very small and difficult to identify, the fistula may be very tortuous, and extensions may travel far from the external opening, etc. Furthermore, injudicious, over-enthusiastic probing can convert a simple fistula into a disaster. For example, probing the apex of a transsphincteric fistula could rupture through the levator plate, thereby causing a supralevator extension. Even worse, the probe can rupture into the rectum, causing an extrasphincteric fistula.

So, fistula classification by EUA alone can be very difficult, presenting ample opportunity to make matters worse. Patients with recurrent disease are a particularly difficult: They are most likely to harbour extensions but also the most difficult to assess because multiple failed previous operations previously results in scarring and induration that frustrates palpation. It can be extremely difficult to differentiate between an abscess or scar tissue on the basis of palpation alone. Furthermore, this group are also most likely to have extensions very remote from the primary track, frustrating their detection further. The more chronic the fistula, the more complicated associated extensions tend to be. The inevitable result is that these patients become progressively more difficult to treat, with both patient and surgeon becoming ever more exasperated. The key to breaking this loop is accurate pre-operative imaging.

If imaging suggests that extensive sphincter division will be necessary to lay open the fistula, then procedures aiming to minimise sphincter division can be deployed but these often have a greater chance of post-operative recurrence. A variety of are now available: Mucosal advancement flap is the most established and involves closing the internal opening using rectal mucosa. Newer techniques include ligation of the intersphincteric fistula tract (LIFT) and video-assisted anal fistula treatment (VAAFT), which aim to close the internal opening and eradicate intersphincteric infection while avoiding sphincter division [6]. Plugs and glue have also been inserted into the fistula to try and achieve closure without surgical incision [6].

3.0 Imaging fistula-in-ano; which technique to use?

Before MRI, radiologists trying to answer the surgical questions posed in the section above met with little success. Contrast fistulography involves catheterising the external opening with a fine cannula and injecting water-soluble contrast. It suffers two major drawbacks: Firstly, extensions may fail to fill with contrast if they are plugged with debris, very remote, or if there is excessive contrast reflux from the internal and/or external openings. Secondly, the sphincter muscles and pelvic floor are not imaged directly, which means that the relationship between these and the fistula is largely conjecture. For example, it is frequently very difficult to decide whether a visualized extension is supra-levator or in the roof of the ischioanal fossa (i.e. infra-levator). Ultimately, fistulography is difficult to interpret and unreliable. Initial reports of computerized tomography (CT) were encouraging but simple identification of the fistula is insufficient; correct classification is key. Compared to MRI, CT suffers insufficient tissue contrast, especially if the fistula has not been cannulated, and it's multiplanar capability also lags behind.

Anal endosonography (AES) was the first technique to visualize the anal sphincter complex with high spatial resolution and, naturally, AES has been applied to fistula classification. While AES can be very useful, accurate interpretation depends highly on the experience of the sonographer. Also, structures remote from the endoluminal transducer are difficult to image because of limited beam penetration, especially if high frequency. Accordingly, extensions beyond the sphincter complex are missed easily and false-positives also occur. For example, AES cannot differentiate infection/pus from fibrosis reliably, since all appear hyporeflective. This causes particular difficulties in patients with recurrent disease since infected tracks and fibrotic scars frequently occur together. While there is no doubt that AES is valuable in the right hands, MRI is superior: A study comparing AES to digital evaluation and MRI in 108 primary tracks found that digital evaluation in clinic correctly classified 61%, AES 81%, and MRI 90% [7]. While AES was particularly adept at predicting the site of the internal opening correctly, there is little doubt that MRI is a superior technique overall and is certainly more generalizable.

3.1 MRI technique

MRI has emerged as the pre-eminent imaging modality to classify fistula-in-ano because it can depict infected tracks and extensions vividly and define their relationship to surrounding structures precisely. It is straightforward to image in the surgically relevant coronal plane and fistula morphology can be determined easily. The ability of MRI to not only accurately classify tracks but also to identify disease that would otherwise have been missed has had a palpable effect on surgical treatment and, ultimately, patient outcome [8,9]; this underpins its widespread adoption.

Field strength is not critical and excellent results can be obtained using relatively modest MRI scanners without specialized coils. Phased array surface coils increase signal to noise ratio and spatial resolution to good effect [10,11], and are generally available. Although the best spatial resolution is achieved via dedicated endoluminal anal coils [12], these suffer the same limitation as AES - the limited field of view means that distant extensions are missed easily [13]. They are also frequently uncomfortable for the patient. So, following initial enthusiasm, they are now used rarely. It should also be stressed that endoluminal anal coils are not rectal coils; they are smaller in diameter and their active element crosses the sphincter apparatus, not the rectal ampulla.

The MRI sequences used to classify fistula-in-ano must combine anatomic precision (to determine the course of the fistula with respect to adjacent structures), with the facility to highlight sepsis (usually pus) and tissue inflammation. Many investigators employ widely available fast spin-echo T2-weighted sequences, which highlight the hyper-intense fluid within the fistula while simultaneously discriminating the individual layers of the anal sphincter complex. Fat suppression techniques are very useful. The earliest reports used STIR imaging, with the addition of T1-weighted scans to help anatomical clarification [14], and gadolinium contrast may be used if desired [15]. Other approaches have included saline instillation into the external opening or rectal contrast medium, but such measures increase complexity in the face of already excellent results, so there is little motivation to adopt them. For the majority of his clinical work the Author uses either 1.5T or 3.0T magnets and STIR/T2-weighted sequences, which makes for a very rapid and easy examination. A typical examination would comprise sagittal and axial T2-weighted acquisitions with axial and coronal STIR acquisitions.

Perhaps more important than the sequences used is the need to align the scan planes with respect to the anal sphincter axis. This is because the anal canal is tilted forwards from the vertical by approximately 45 degrees. Straight axial and coronal images with respect to the table will provide oblique images of the sphincter complex making the geography of any fistula very difficult to ascertain. This is especially so when trying to determine the height of the internal opening. Oblique axial and coronal planes orientated orthogonal and parallel to the anal sphincter are fundamental, and planned easily from a midline sagittal image (Figure 3). It may be necessary to align supplementary scans to the rectal axis for complex extrasphincteric cases with high rectal openings, but this is seldom necessary.

It is important the imaged volume extends several centimeters above the levator muscles and also includes the whole pre-sacral space, in order to capture remote extensions. The entire perineum should also be included as the external opening may be beyond the immediate perianal region. Indeed, tracks may extend for several centimeters, reaching the groins or legs. Any track visible on the standard image volume should be followed to its termination. The precise location of the primary track (e.g. ischioanal or intersphincteric) is usually most easily appreciated via axial images, which also best display the radial site of the internal opening. Coronal images best visualise the levator plates, which separate supra- from infra-levator disease. The height of the internal opening is also best appreciated on coronal images, with the caveat that the anal canal must be imaged along its entire cranio-caudal extent, as explained above.

3.2 MRI interpretation and reporting

Active fistula tracks are filled with pus and granulation tissue, and thus appear hyperintense on T2-weighted or STIR sequences. Chronic tracks are often surrounded by a hypointense fibrous wall, which can be relatively thick, especially in patients with recurrent disease following previous surgery. The external anal sphincter is relatively hypointense and its lateral border contrasts sharply against fat within the ischioanal fossa, especially on T2-weighted studies. Consequently, it is relatively easy to determine whether a fistula remains within the boundaries of the external sphincter or extends beyond it.

If a fistula remains contained by the external sphincter throughout its course, then it is highly likely to be intersphincteric (Figure 4). In contrast, the hallmark of transsphincteric, suprasphincteric, and extrasphincteric fistulas is sepsis in the ischioanal fossa: It is the level of the internal opening and the level at which the primary track crosses the sphincter complex that differentiates between these types. A track in the ischioanal fossa is usually indicates a transsphincteric fistula (Figure 5) simply because this type is much commoner than suprasphincteric or extrasphincteric classifications.

It can be difficult to identify the exact location of the internal opening. Two questions must be answered: what is its radial location and what is its cranio-caudal level? The vast majority of fistulas enter the anal canal at the level of the dentate line, commensurate with the cryptoglandular hypothesis of fistula pathogenesis. Furthermore, most fistulas also enter posteriorly, at 6 o’clock, especially in men. Although the dentate line cannot be identified as a discrete anatomical entity, even when using endoanal receiver coils, its general position can be estimated with sufficient precision by the experienced radiologist. The dentate line lies at approximately mid-anal canal level, which is generally midway between the superior border of the puborectalis muscle and the most caudal extent of the subcutaneous external sphincter. These landmarks define the ‘surgical’ anal canal (as distinct from the ‘anatomical’ anal canal, which is shorter, and defined as the canal caudal to the anal valves). Dentate level is estimated most easily using coronal views, which allow the cranio-caudal extent of the puborectalis muscle and external sphincter to be appreciated. Nevertheless, its approximate location can also be estimated from axial views given sufficient experience. It should be noted that in many patients the puborectalis muscle is rather gracile, quite unlike the bulky muscle depicted in many anatomical textbooks. Notably, the puborectalis frequently blends imperceptibly into the deep external sphincter, which hampers precise identification of mid-anal canal level on imaging. Again, this can be overcome with experience. Any fistula track that penetrates the pelvic floor above the level of the puborectalis muscle is potentially suprasphincteric or extrasphincteric. The level of the internal opening distinguishes between these, being anal in the former (Figure 6) and rectal in the latter (Figure 7).

Transsphincteric fistulas penetrate the external sphincter directly, a feature that can be easily appreciated on axial or coronal views (Figure 5). MRI has revealed that a transsphincteric track may cross the sphincter at a variety of angles [16]. For example, it may arch upwards as it passes through the external sphincter, thus crossing the muscle at a higher level than would be anticipated merely from inspecting the level of the internal opening. This is important because such tracks will require a greater degree of sphincter incision if fistulotomy is performed, with a correspondingly increased risk of post-operative incontinence. Coronal MRI is best able to estimate the precise angulation of the track with respect to the surrounding sphincter [16].

The radial site of the internal opening is simple to identify if the fistula track can be traced right to the anal mucosa but this is unusual because the internal opening is rarely widely patent; rather, it is usually compressed and can be very difficult to see directly. In most cases intelligent deduction is all that is needed: There internal opening is likely to lie in the region of maximal intersphincteric sepsis. The intersphincteric space lies between the internal and external sphincter and contains the longitudinal muscle which often appears rather fragmented. The internal sphincter is hyperintense on both T2-weighted fast spin echo and STIR sequences.

3.3 Extensions

The major advantage of MRI is the ease with which it identifies extensions associated with the primary track. Like tracks, extensions manifest as hyperintense regions on T2-weighted and STIR imaging, and their margins also enhance further following intravenous contrast. Like the primary track, collateral inflammation can be present to variable extent. The commonest type of extension is one arising from the apex of a transsphincteric track, extending into the roof of the ipsilateral ischioanal fossa (Figure 8). The major benefit of preoperative MRI is that it alerts the surgeon to extensions that would otherwise be missed at EUA. This is especially the case when extensions are either contralateral to the primary track or are several centimetres remote from it. It is especially important to image supralevator extensions (Figure 9) since these are both difficult for the surgeon to detect and pose specific difficulties with treatment because of their location above the pelvic floor.

“Horseshoe” extensions are recognized by their unique semilunar configuration (Figure 10). Strictly speaking, sepsis should extend on *both* sides of the internal opening for a correct diagnosis of a horseshoe. Horseshoes may be intersphincteric, ischioanal, or supralevator. As emphasized previously, complex extensions are especially common in patients with recurrent fistula-in-ano nad/or those who have Crohn’s disease.

3.4 The radiological report

The Author reports his MRI studies as follows: The clinical details that accompany the referral are stated first. This is followed by the fistula classification and its radial or quadrantic location. The radial site of the enteric communication is stated along with its level. The location of the external opening is mentioned (although this is usually obvious to the surgeon on clinical inspection). A statement is then made regarding extensions, i.e. whether there are any associated present or not and, if so, the anatomical compartment (intersphincteric, ischioanal, supralevator), and radial location. This procedure is repeated for each individual fistula if multiple and a statement made regarding the relationship between multiple fistulas, e.g. do some share a common internal opening, which structures do they communicate across? A statement is then made regarding comparison to previous imaging, if this is available. It is not useful to describe the many twists and turns of each individual fistula since this is not how colorectal surgeons conceptualise fistula-in-ano; use the

Parks classification so that the report is in a language that they understand. An example of a recent report by the Author is as follows: "*Clinical details: Anal fistula ?classification. Findings: There is a transsphincteric fistula in the right posterior quadrant at 5 o'clock with an internal opening at 6 o'clock at dentate line level. There are two extensions: The first is in the roof of the ipsilateral ischioanal fossa, just subjacent to the levator plate; the second is a cranial intersphincteric extension at 3 o'clock that terminates in a 2cm left-sided supralevator abscess. Conclusion: Complex transsphincteric fistula with ipsilateral supra- and infralevator extensions as described above."* That is a fairly brief report in terms of words but one that describes a very complex fistula in language that a competent colorectal surgeon will understand and, importantly, alerts him or her to the surgical issues that they will face at subsequent EUA.

4.0 Effect of pre-operative MRI on surgery and subsequent clinical outcome

Over the last twenty years MRI has revolutionised treatment of patients with fistula-in-ano. As stated already, this is because MRI can classify fistulas pre-operatively with very high accuracy and, in doing so, alerts the surgeon to disease that might otherwise have been missed. While there are MRI reports in radiological journals dating from 1989 [17] it was not until the seminal description by Lunniss and co-workers [14] that the true potential of MRI was appreciated fully by a surgical audience. Lunniss imaged 16 patients with cryptoglandular fistula-in-ano and compared the MRI classification with that from subsequent EUA. MRI agreed with EUA 14 of the 16 cases (88%), confirming immediately that it was by far the most accurate pre-operative assessment available. In the remaining two patients, MRI had suggested disease but EUA was normal. Two months later, both patients represented with disease at the site initially indicated by MRI. The clear implication was that EUA had missed disease, not MRI. This led the authors to conclude, “MRI is the most accurate method for determining the presence and course of anal fistulae” [14]. What is even more impressive by today’s standards, was that scanning was performed at 0.5 T, suggesting clearly that high resolution etc. is unnecessary for MRI to be clinically useful.

Lunnis’ excellent results were confirmed rapidly by others, and then elaborated on. Spencer and colleagues classified 37 patients into those with simple or complex fistulas on the basis of MRI and EUA independently. They found that imaging was the better predictor of clinical outcome, with positive and negative predictive values of 73% versus 57% and 87% versus 64% for MRI and surgery respectively [18]. This study provided compelling evidence that MRI was related more closely to clinical outcome than EUA, indicating that pre-operative MRI could identify features that caused post-operative recurrence. Beets-Tan and colleagues extended this hypothesis by investigating the therapeutic impact of MRI; preoperative findings in 56 patients were revealed to the operating surgeon after they had completed an initial EUA [10]. MRI provided important additional information that precipitated further surgery in 12 of 56 patients (21%), mostly in those with recurrent fistulas or Crohn’s disease [10]. Buchanan and co-workers therefore hypothesized that the therapeutic impact and consequent beneficial effect of pre-operative MRI would be greatest in patients with recurrent fistulas, since these were most likely to harbor occult infection while simultaneously being the most difficult to evaluate clinically [11]. After an initial EUA, they revealed the findings of pre-operative MRI in 71 patients with recurrent fistulas. The surgeon was then free to act on the MRI findings as they saw fit, EUA completed, and the clinical course of each individual patient followed subsequently. They found that post-operative recurrence was 16% for those surgeons who always acted when MRI suggested they had missed areas of sepsis. In contrast, recurrence was 57% for those surgeons who always chose to ignore imaging, believing their own assessment to be superior [11]. Furthermore, of the 16 patients who needed further unplanned surgery, MRI correctly predicted the site of recurrent disease in all cases [11].

Ever since Lunnis' work suggested that EUA might not be as accurate as MRI [14], comparative studies have been plagued by lack of a genuine reference standard. It is now well-recognised that surgical findings at EUA are often incorrect. In particular, false-negative diagnoses at EUA are relatively frequent. In a recent comparative study of endosonography, MRI and EUA in 34 patients with fistulas due to Crohn's disease, Schwartz and co-workers found that a combination of results from at least two modalities was necessary in order for classification to be correct [19]. Because surgical false-negatives will only reveal themselves over the course of long-term clinical follow-up, comparative studies that ignore clinical outcome are likely to be seriously flawed. Recognising this, Buchanan and co-workers examined 108 primary fistula tracks by digital examination, anal endosonography and MRI, and then followed patients' clinical progress to establish an enhanced reference standard for each patient that was based on ultimate clinical outcome rather than EUA [7]. The authors found that digital evaluation correctly classified 61% of primary tracks, AES 81%, and MR imaging 90% [7]. While endosonography was particularly adept at predicting the site of the internal opening correctly, achieving this in 91%, MRI was even better at 97%. Indeed, MRI was superior to endosonography in all assessments investigated by the authors [7]. While endosonography is undoubtedly a useful tool to classify fistula-in-ano, it cannot compete with MRI, especially for detection of extensions, which is undoubtedly the most important role for pre-operative imaging. Furthermore, MRI is also more generally available and less operator dependent.

5.0 Differential diagnosis of perianal sepsis

Not all perianal sepsis is caused by fistula-in-ano. For example, acne conglobata, hidradenitis suppurativa, pilonidal sinus, actinomycosis, tuberculosis, proctitis, human immunodeficiency virus, lymphoma, and anal and rectal carcinoma may all cause peri-anal infection. While clinical examination is often conclusive, this is not always so and imaging helps frequently with differential diagnosis. As explained previously, the cardinal feature of fistula-in-ano is intersphincteric infection, which is not generally found in other conditions, although it may be detected if MRI is used to image acute anorectal abscesses. Whenever imaging suggests that infection is superficial rather than deep-seated, and that there is no sphincteric involvement, then other conditions such as hidradenitis suppurativa should be considered [20]. For example, a study comparing patients with pilonidal sinus (Figure 11) and fistula-in-ano found that MRI could reliably distinguish between the two on the basis of intersphincteric infection and an enteric opening, both of which were always absent in pilonidal sinus [21].

The possibility of underlying Crohn's disease should always be considered in patients who have particularly complex fistulas, especially if the history is relatively short. Indeed, a perianal fistula is the presenting symptom in approximately 5% of Crohn's patients and up to 40% will experience anal disease over the course of their disease [22]. MRI examination can be extended cranially to encompass the small bowel if Crohn's disease is suspected and the possibility of underlying pelvic disease should be considered in any patient with an extrasphincteric fistula, whether thought due to Crohn's disease or not.

6.0 Which patients should be imaged?

While most patients with fistula-in-ano are simple to both diagnose and treat, a significant proportion will benefit from pre-operative MRI. Where MRI is accessed easily, it could be argued that all patients should be imaged pre-operatively. Supporting this, while the therapeutic impact of MRI is greatest in patients with complex disease [9,10], it has been estimated that MRI will benefit around 10% of patients presenting for the first time with seemingly simple fistulas, but who ultimately prove to be more complex [23]. Where MRI access is more restricted, the referring clinician will need to be more selective. MRI should be routine in patients with recurrent disease, since evidence that MRI alters surgical therapy and improves clinical outcome is overwhelming. Patients presenting for the first time with a fistula appearing complex on clinical examination should also be referred, as should patients with known Crohn's disease since the prevalence of complex fistulas is so high.

There are also surgical situations where imaging is likely to be particularly beneficial, even when the fistula itself is simple. For example, the anterior external sphincter is very short in women and dividing this during fistulotomy risks post-operative incontinence, even when the fistula is simple. Faced with such a dilemma, rather than incising the fistula the surgeon may choose to pass a seton thread through the track in order to stimulate drainage. The patient can then be imaged post-operatively in order to assess the potential extent of sphincter division by visualizing the relationship of the seton to the external sphincter. A decision can then be made whether to progress with fistulotomy or to keep the seton in place for a few months, after which time the internal opening can be closed with a rectal mucosal advancement flap or another sphincter saving procedure adopted. Setons may also be placed at EUA when the surgeon is uncertain about the relationship between the track and the sphincter, and then imaged postoperatively in order to answer this question (especially if MRI was not performed beforehand).

The benefit of MRI is not restricted to surgical assessment. The advent of monoclonal antibody to human tumor necrosis factor alpha has impacted dramatically upon the medical management of patients with Crohns fistulas. However, therapy is contraindicated if an abscess is present (since this can be associated with overwhelming sepsis) and MRI is useful to search for this. Indeed, MRI is now frequently used to monitor therapy since MRI has shown that fistulas may persist in the face of clinical findings suggesting remission. An early MRI study of patients whose external opening has closed revealed that deeoer sepsis often persisted, indicating that therapy should continue [24].

7.0 Conclusion

In patients with fistula-in-ano who have a high likelihood of complex disease, the evidence that preoperative MRI influences the surgical approach, extent of exploration, and improves ultimate outcome is overwhelming. The Author hopes that this Chapter will stimulate more surgeons to ask this service from their radiologists, and for radiologists to provide it. Doing so will reduce the incidence of recurrent fistula-in-ano and the misery it causes.

7.1 Future Directions

Multiple peer-reviewed, indexed studies have proven that MRI classification of fistula-in-ano is highly accurate in the right hands. Given that MRI is already so effective, the incentive to further develop the technique is relatively limited and research in this specific area has slowed over the last decade. Nevertheless, workers are investigating whether the degree and nature of dynamic enhancement is able to provide prognostic information regarding disease trajectory in patients with Crohns disease [25] and large randomised trials of the various new surgical therapies now available (e.g. the FIAT trial, ISRCTN78352529) will provide the substrate for further research given that MRI is now embedded in these as the reference standard for fistula healing.

SUMMARY

Preoperative MRI is undoubtedly the most effect method with which to classify fistula-in-ano and is especially useful for complex cases, where its ability to identify remote and unsuspected extensions has considerable therapeutic impact. Postoperative recurrence is reduced when surgeons act on MRI findings, thereby avoiding the misery that this disease causes for patients.

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Display box:

What the referring clinician needs to know:

- What is the relationship between the fistula and the anal sphincter muscles? Will my surgery risk incontinence by sacrificing too much sphincter?
- Are there any extensions from the primary fistula track that need to be drained in order to prevent recurrence? If so, where are they?

Figure Legends

Figure 1

Axial STIR (left) and T2-weighted (right) images in a man with acute perianal abscess. The abscess and associated inflammation is easily seen on the STIR sequence. Careful inspection shows that the inflammation (arrow, T2 sequence) extends into the intersphincteric plane, diagnosing anal gland infection as the underlying cause.

Figure 2

Coronal illustration of the anal canal showing important anatomical landmarks and the Parks classification of fistula-in-ano.

Figure 3

Sagittal T2-weighted midline scan showing correct orientation of axial scan planes for optimal examination of the anus for fistula-in-ano. Coronal scanning is planned at 90 degrees to these. A posterior transsphincteric fistula (arrow) is present.

Figure 4

Axial T2-weighted scan in a patient with an intersphincteric fistula (white arrow). The fistula lies within the intersphincteric plane. The lateral margin of the external sphincter (black arrow) is appreciated easily on MRI.

Figure 5

Axial T2-weighted scan in a patient with a transsphincteric fistula (white arrow). The fistula track clearly lies lateral to the external sphincter boundary (black arrow), and penetrates the sphincter to reach a posterior internal opening at 6 o'clock, at dentate line level.

Figure 6

Coronal STIR image of a suprasphincteric fistula (long white arrow). The primary track in the ischioanal fossa arches over the puborectalis to descend towards an internal opening (short white arrow) at dentate line level.

Figure 7

Coronal T2-weighted scan in a patient with bilateral extrasphincteric fistulas (white arrows). The internal opening for each fistula is directly into the distal rectum, well above the level of the levator plate (black arrow), which indicates pelvic floor level.

Figure 8

Axial STIR scan in a man with extensions in the roof of both ischioanal fossae. The left-sided extension contains a seton thread (short white arrow). The right-sided extension (long white arrow) is predominantly gas filled, indicating that it is well-drained.

Figure 9

Coronal STIR scan in a patient with Crohns disease and an extrasphincteric fistula. There is extensive bilateral sepsis (white arrows) above the level of the pelvic floor.

Figure 10

Axial T2-weighted scan in a patient with a horseshoe extension (white arrows). The extension lies medial to the external sphincter and publorectalis, confirming sepsis in the intersphincteric and supralevator compartments.

Figure 11

Axial T2-weighted scan in a patient with pilonidal sinus. The sinus (black arrow) manifests as an infected pit in the subcutaneous tissues overlying the coccyx. The is no communication with the anal sphincter complex. In particular, there is no sepsis in the intersphincteric plane (white arrow).