Imaging of Anal Sepsis

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Introduction

Fistual-in-ano describes an abnormal communication between the anal canal (or occasionally the rectum) and the perianal skin. It is a common condition that has a tendency to recur despite apparently curative surgery. Recurrence after surgery is almost always due to infection that has escaped detection by the surgeon and thus gone untreated. It is now increasingly recognised that preoperative imaging, notably by MRI, is able to identify fistulas and associated abscesses that would otherwise have been missed. Not only can MRI elegantly display perianal fistulas, but preoperative MRI has been shown to influence subsequent surgery and significantly diminish the chance of recurrent disease as a result. Because of this, preoperative imaging is becoming increasingly routine, especially in patients with recurrent fistulas.

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Aetiology, Classification and Treatment of Fistula-in-Ano Relevant to Imaging

The previous chapter (Chap. 17) has described the pathophysiology and presentation of anal sepsis. Because cryptogenic fistula-in-ano is predicated by sepsis arising in the intersphincteric plane [1, 2], any useful imaging technique must be able to image this region with precision (i.e. with high spatial and contrast resolution). This is also the case for the patient with an acute perianal abscess, since 87 % may subsequently develop a fistula [3]; imaging during the acute episode (before incision and drainage) may be able to distinguish whether intersphincteric infection underpins the abscess.

By definition a fistula describes an abnormal communication between two epithelial surfaces. The anatomical course of the fistula will be dictated by the location of the infected anal gland and the anatomical planes and structures that surround it. The internal opening of the fistula will usually be in the anal canal at the level of the dentate line, i.e. at the original site of the duct draining the infected gland. In the radial plane, the internal opening is usually posterior at 6 o'clock, simply because anal glands are more abundant posteriorly, 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 on coronal images.

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The fistula can reach the perianal skin via a variety of routes, some more tortuous than others and thereby penetrating and involving the muscles of the anal sphincter and surrounding tissues to a variable degree. Fistulas are 'classified' according to the route taken by this 'primary track', which links the internal and external openings. Although there have been a variety of different attempts to classify fistula-in-ano, by far the most widely used is that proposed by Parks and colleagues in 1976 [4]. Parks carefully analysed a consecutive series of 400 patients referred to the surgeons of St. Mark's Hospital London, a specialist hospital dealing with coloproctological disease, and found that he was able to place all fistulas encountered into one of four broad groups: intersphincteric, transsphincteric, suprasphincteric and extrasphincteric [4]. Importantly, most of these groupings could be explained by the cryptoglandular hypothesis. A major role for imaging is the ability to distinguish between these different fistulas and so to arrive at an accurate preoperative classification for the operating surgeon before he or she puts a knife to the skin. Because of this, the interpreting radiologist must be fully conversant with Parks' classification.

While most fistulas probably start as a simple, single primary track, unabated infection may result in ramifications (often multiple) that branch away from this, generally, termed 'extensions'. Extensions are a major target for preoperative imaging because they frequently underpin recurrent disease. This is often because they may occur several centimetres away from the primary track and frequently lie deep in surrounding tissues, thus escaping easy detection. Extensions may be intersphincteric, ischioanal or supralevator (pararectal), and their morphology may suggest tracks or abscesses. Exactly when a 'track' becomes an 'abscess' has no precise definition on imaging.

The ischioanal fossa is the commonest site for an extension, especially one that arises from the apex of a transsphincteric fistula. The ischioanal fossa lies lateral to the sphincter complex, is filled with fat and is traversed by a network of fibroelastic connective tissue. Because this space lies adjacent to the anus (vs the rectum) and lies immediately below (vs above) the levator plate of the pelvic floor, the authors prefer the term 'ischioanal' fossa rather than 'ischiorectal', which is commonly used by surgeons. However, the two terms are interchangeable. Extensions also occur in the horizontal plane and are known as 'horseshoes' if there is ramification of sepsis on both sides of the internal opening.

Although surgical treatment of fistula-in-ano is usually straightforward, most frequently by laying open the fistula, this seemingly simple procedure has many unexpected traps waiting for the unwary. Injudicious incision and overenthusiastic exploration can very quickly convert a simple fistula into a surgical nightmare by creating additional extensions, tracks and communications, with disastrous consequences for the patient. The surgeon's prime objective is to identify the primary track and any associated extensions and then eradicate these by draining all associated infection all while simultaneously preserving anal continence. Thus, there are two surgical questions that should ideally be answered preoperatively:

- What is the relationship between the fistula and the anal sphincter? That is, can the track be safely laid open with only a low risk of post-operative incontinence?
- Are there any extensions from the primary track that need to be treated in order to prevent recurrence? If so, where are they?

Although frequently used for this purpose, it is now well established that examination under (general) anaesthesia (EUA) is not infallible. At EUA, the surgeon attempts to classify the fistula via palpation and probing, so as to determine the relationship to the sphincter. However, the surgeon cannot visualise underlying muscles directly, and general anaesthesia and consequent loss of muscular tone impair precise identification further. The internal opening may be difficult to identify, but probes must not be advanced forcefully for fear of causing unintentional tracks and extensions. For example, forceful probing of a transsphincteric fistula track in the roof of the ischioanal fossa can easily rupture through the levator plate, thereby causing a supralevator extension. In the worst instance, the probe can even rupture into the rectum, converting

a transsphincteric fistula into an extrasphincteric fistula. Although identification of all extensions at EUA is central for cure, missed extensions are the commonest cause of recurrence, reaching 25 % in some series [5].

The net result is that at EUA, it can be very difficult to classify the primary track with confidence, and there is also ample opportunity to make matters worse. Patients with recurrent disease are a particular case in point: They are most likely to harbour foci of missed sepsis but are also most difficult to assess at EUA. In the context of multiple failed operations previously, digital palpation frequently cannot distinguish between scarring due to repeated surgery and induration due to an underlying extension. Furthermore, this group is also most likely to have extensions that travel several centimetres away from the primary track, which further hampers their detection. 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 preoperative imaging.

Imaging of Fistula-in-Ano

For many years radiologists have tried to answer the surgical questions posed in the section above, but with varying degrees of success. Contrast fistulography was the first modality employed. The external opening is catheterised with a fine cannula and water-soluble contrast injected gently in order to define the fistula. Unfortunately, fistulography suffers from two major drawbacks. Firstly, extensions from the primary track may fail to fill with contrast if they are plugged with debris, are very remote, or if there is excessive contrast reflux from either the internal or external openings. Secondly, the sphincter muscles are not imaged directly, which means that the relationship between the fistula and the sphincter must be guessed. Furthermore, inability to visualise the levator plates directly means that it can occasionally be very difficult to decide whether an extension is supra- or infralevator. The net result is that fistulography is both difficult to interpret and its results are unreliable. While initial reports of computerised tomography (CT) for fistula-in-ano were encouraging, simple visualisation of the fistula is not enough; they must be classified correctly, and more mature data suggests that CT cannot do this accurately. This is because the attenuation of the anal sphincter and pelvic floor is similar to the fistula itself unless the latter contains air or contrast, so they cannot be distinguished. This is compounded with a relative inability to image in the surgically relevant coronal plane.

Anal Endosonography

Anal endosonography (AES) was the first technique to directly visualise the anal sphincter complex in detail, and naturally, AES has been applied to the classification of fistula-in-ano (Fig. 18.1). While AES can be very useful, accurate interpretation is highly dependent on the experience of the sonographer. Also, being an ultrasound technique, structures remote from the transducer are difficult to see because penetration of the ultrasound beam is limited. The result is that extensions beyond the

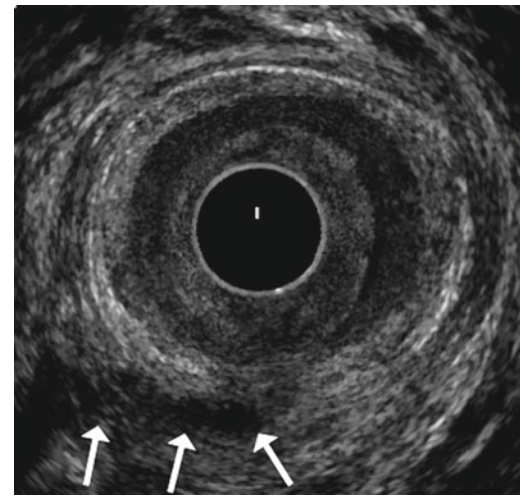

Fig. 18.1 Anal endosonography of a man with a transsphincteric fistula (same patient as Fig. 18.4). There is a hyporeflective track (*arrows*) through the external sphincter, but it is more difficult to appreciate that this is due to a transsphincteric fistula than on the corresponding MR image unless the sonographer is very experienced

sphincter complex are easily missed. Also, AES cannot reliably distinguish infection from fibrosis since both appear hyporeflective, and 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 a valuable technique in the right hands, MRI is generally superior: A study comparing AES to digital evaluation and MRI in 108 primary tracks found that digital evaluation correctly classified 61 %, AES 81 % and MR imaging 90 % [6]. While AES was particularly adept at correctly predicting the site of the internal opening, achieving this in 91 % compared to 97 % for MRI [6], there is little doubt that MRI is a superior technique overall.

MRI Technique

Over the last decade, MRI has emerged as the leading contender for preoperative classification of fistula-in-ano. This is because MRI can vividly separate infected tracks and extensions from surrounding structures, imaging both with precision. Furthermore, MRI can image in the surgically relevant coronal plane so that the geographical course of the fistula can be determined. Indeed, 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 [7, 8].

Field strength does not appear to be a critical factor, and excellent results can be obtained using relatively modest MRI scanners with no need for specialised coils. External phased array surface coils increase signal-to-noise ratio (SNR) and spatial resolution, to good effect [9, 10], and are generally available. Although the best spatial resolution is achieved by using dedicated endoluminal anal coils [11], these suffer the same limitation as AES – the limited field of view means that distant extensions will be missed [12]. Because of this, they are now rarely used. It should also be stressed that anal endoluminal coils are not the same as rectal coils. Rather, they are smaller in diameter and are intended to cross the anus.

The MRI sequences used to image fistula-in-ano need to combine anatomic precision (so that the course of the fistula with respect to adjacent structures can be determined), with the facility to highlight sepsis (usually pus). Many investigators employ the rapid and convenient fast spin-echo T2-weighted sequence, which provides good contrast between hyperintense fluid within the track and its hypointense fibrous wall while simultaneously enabling good discrimination between the several layers of the anal sphincter. Fat suppression techniques are very useful. The earliest reports used STIR imaging, with the addition of T1-weighted scans to help anatomical clarification [13], and gadolinium contrast may be used if desired [14]. While other approaches have included saline instillation into the external opening or rectal contrast medium, such measures increase examination complexity in the face of the already excellent results achieved by less invasive procedures, and there is little motivation to adopt them. For the majority of their clinical work, the authors use a 1.5 T magnet and STIR sequences in just two planes, combined with the sagittal acquisition described below, which makes for a very rapid and easy examination.

It is central to success that imaging planes are correctly aligned with respect to the anal sphincter. Because the anal canal is tilted forward from the vertical by approximately 45°, straight axial and coronal images with respect to the patient/scanner tabletop will result in oblique images of the anus, and the geography of any fistula will be 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 definitely necessary and are most easily planned from a midline sagittal image (Fig. 18.2). It may be necessary to align supplementary scans to the rectal axis in complex cases with an internal opening high in the rectum, but this is seldom necessary. It is important that the imaged volume extends several centimetres above the levator muscles and also includes the whole presacral space, both of which are common sites for extensions. The entire perineum should also be included. Occasionally, tracks may extend for several centimetres, even leaving the pelvis or reaching the legs, and any track visible on the

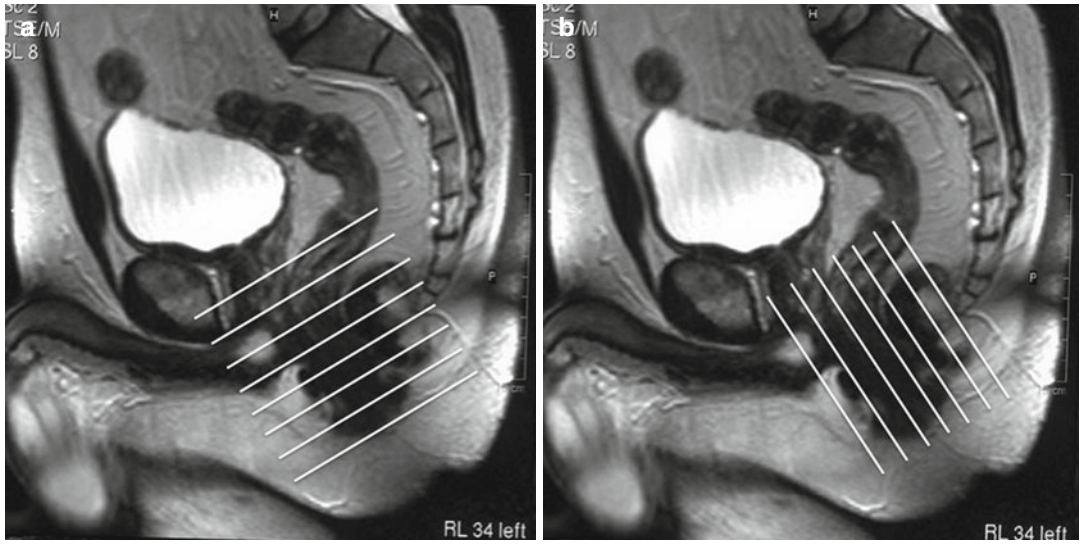

Fig. 18.2 Sagittal T2-weighted planning scan showing the orientation of the anal canal and the oblique axis to which the axial (**a**) and coronal (**b**) scans must be aligned (*white lines*). Images should extend well into the supralevator compartment and also cover the entire presacral space

standard image volume must be followed to its termination if this has not been included. The precise location of the primary track (e.g. ischioanal or intersphincteric) is usually most easily appreciated using axial images, and the radial site of the internal opening is also well seen using this plane. Coronal images best visualise the levator plate, which separates supra- from infralevator infection. The height of the internal opening may also be best appreciated on coronal images, with the caveat that the anal canal must be imaged along its entire craniocaudal extent, as explained above.

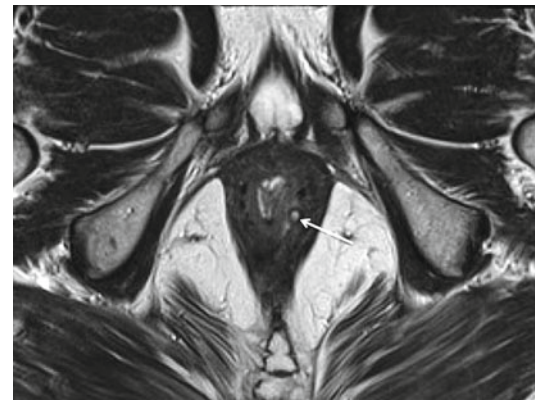

Fig. 18.3 Axial T2-weighted MR images in a man with an intersphincteric fistula (*arrow*). Note that the fistula is contained by the external sphincter; there is no sepsis in the ischioanal fossa

MRI Interpretation

All competent MRI reports should include the following information: The radial location and classification of the primary track(s), the radial location and level of the internal opening(s) and a description of any extensions.

Active tracks are filled with pus and granulation tissue and thus appear as hyperintense on T2-weighted or STIR sequences, often surrounded by hypointense fibrous walls, 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 the fat within the ischioanal fossa, especially on T2-weighted studies. Consequently it is relatively easy to determine whether a fistula is contained by the external sphincter or has extended beyond it.

If a fistula remains contained by the external sphincter throughout its course, then it is highly likely to be intersphincteric (Fig. 18.3).

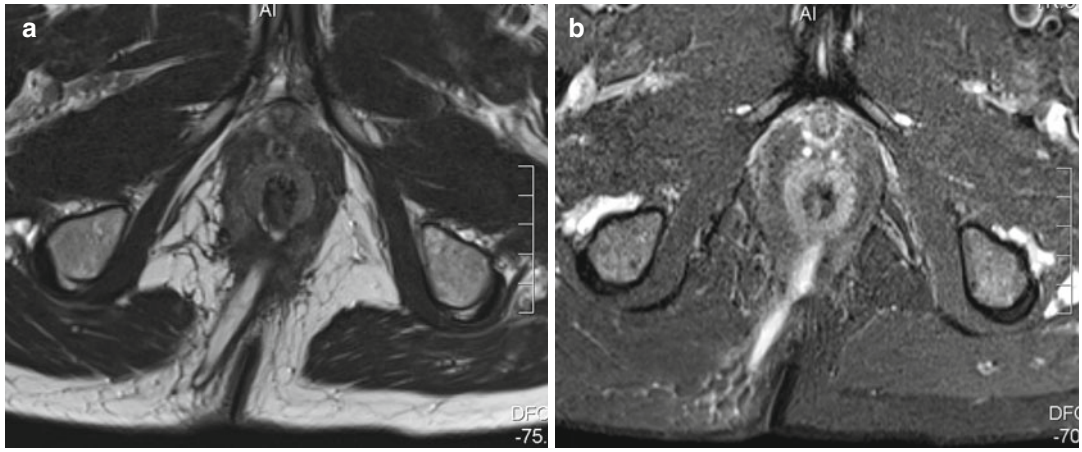

Fig. 18.4 Axial T2-weighted (**a**) and STIR (**b**) images in a man with a transsphincteric fistula in the right posterior quadrant with an internal opening at 6 o'clock at dentate line level (same patient as Fig. 18.1)

In contrast, transsphincteric, suprasphincteric and extrasphincteric fistulas all show sepsis in the ischioanal space – it is the level of the internal opening and the level at which the fistula crosses the sphincter complex that differentiates between these types. A track in the ischioanal fossa is usually due to a transsphincteric fistula (Fig. 18.4) simply because it is much commoner than suprasphincteric or extrasphincteric classifications.

The exact location of the internal opening can be difficult to define. Two questions need to be answered: what is the radial site of the internal opening and what is its level? The vast majority of anal fistulas open into 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. 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 an 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 best estimated using coronal views, which allow the craniocaudal extent of the puborectalis muscle and external sphincter to be appreciated, but its 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, unlike the bulky muscle suggested in many anatomical illustrations. Notably, the puborectalis frequently blends imperceptibly into the external sphincter, which hampers precise identification of mid-anal canal level on imaging. Nevertheless, this can be overcome with experience. Any fistula track that penetrates the pelvic floor above the level of the puborectalis muscle is potentially a suprasphincteric or extrasphincteric fistula. The level of the internal opening distinguishes between these, being anal in the former (Fig. 18.5) and rectal in the latter (Fig. 18.6). Transsphincteric fistulas penetrate the external sphincter directly, a feature that can be easily appreciated on axial or coronal views (Fig. 18.4). However, recent MR studies have revealed that a transsphincteric track may cross the sphincter at a variety of angles [15]. For example, it may arch upwards as it passes through the external sphincter and thus cross the muscle at a higher level than would be deduced merely from inspecting the level of the internal opening. This is important because such tracks will require a greater degree of sphincter incision during fistulotomy, with a correspondingly increased risk of post-operative incontinence. Coronal MRI is best placed to estimate the

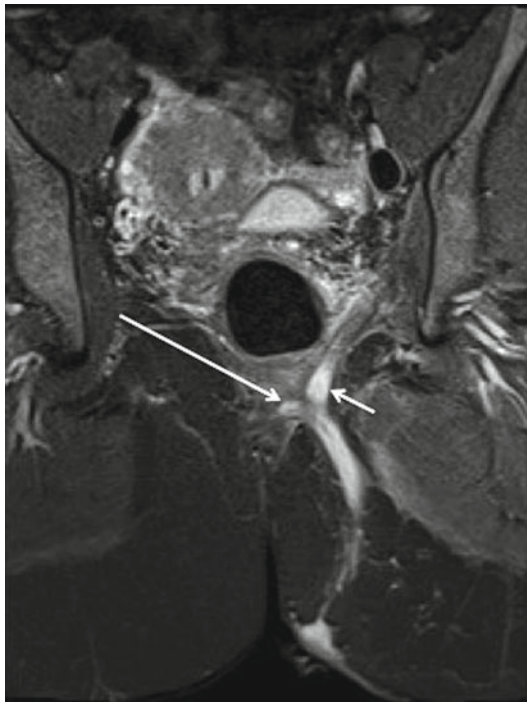

Fig. 18.5 Coronal STIR MRI in a patient with a suprasphincteric fistula. The primary track is arching over the puborectalis (*long arrow*). There is also a small cranial extension off the apex of the track (*short arrow*) into the roof of the left ischioanal fossa

Fig. 18.6 Coronal STIR MRI in a man with an extrasphincteric fistula. Note that the primary fistula track has a rectal opening (*long arrow*) above the level of the levator plates (rectum = *short arrow*)

precise angulation of the track with respect to the surrounding musculature [15].

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 most often compressed and can be very difficult to see. In many cases an intelligent deduction must be made as to where the internal opening is likely to be. This is best achieved by looking to where there is maximal intersphincteric sepsis, since the internal opening is likely to lie adjacent or very close to this. The intersphincteric space and longitudinal layer are often seen as a low intensity ring lying between the internal and external sphincter. The internal sphincter is hyperintense on both T2-weighted fast spin echo and STIR sequences.

Extensions

The major advantage of MRI is the ease with which it can image any extensions associated with the primary track. Like tracks, extensions are manifest as hyperintense regions on T2-weighted and STIR imaging and also enhance further if intravenous contrast is given. Again, collateral inflammation can be present to variable extent. The commonest type of extension is one that arises from the apex of a transsphincteric track and extends into the roof of the ischioanal fossa (Fig. 18.7).

The major benefit of preoperative MRI is that it can alert the surgeon to extensions that would otherwise be missed during EUA. This is especially the case when extensions are either contralateral to the primary track or when they are several centimetres away from it (Fig. 18.8). It is especially important to image supralevator extensions (Fig. 18.9) since these are not only particularly difficult for the surgeon to detect, but they also pose specific difficulties with treatment. Horseshoe extensions spread to either side of the internal opening and are recognised on MRI by their unique configuration (Fig. 18.10). Horseshoes may be intersphincteric, ischioanal or supralevator. Complex extensions are especially common in patients with recurrent fistula-in-ano or those who have Crohn's disease.

Fig. 18.7 Coronal STIR MRI in a patient with bilateral transsphincteric fistulas (*short arrows*). There is an extension (*long arrow*) from the apex of the left fistula into the roof of the left ischioanal fossa

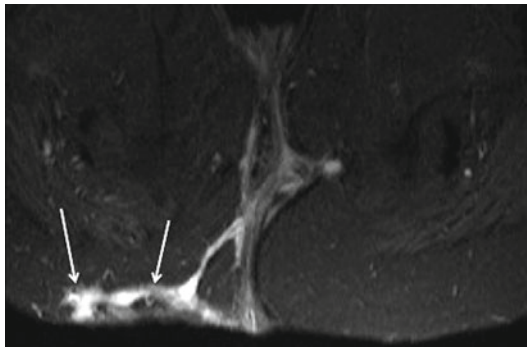

Fig. 18.8 Axial STIR MRI in a patient with extensions (*arrows*) into the right buttock, several cm from the anus

Effect of Preoperative MRI on Surgery and Clinical Outcome

Over the last decade, imaging, notably MRI, has revolutionised the treatment of patients with fistula-in-ano. As stated in the sections above, this is because MRI can preoperatively classify fistulas with high accuracy while also alerting the surgeon to disease that would otherwise have been missed. While there are reports of the technique dating from 1989 [16], it was not until the description by Lunniss and co-workers [13] that the true potential of MRI was appreciated fully. Lunniss imaged 16 patients with cryptoglandular fistula-in-ano and compared the classification achieved by MRI with that obtained at subsequent EUA. MRI proved correct in 14 of the 16 cases (88 %), immediately suggesting that it was by far the most accurate preoperative assessment yet available. However, the remaining two patients, in whom MRI had suggested disease in

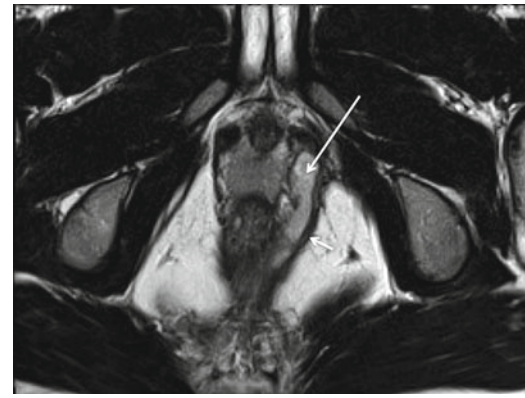

Fig. 18.9 Axial T2-weighted MRI in a patient with a left-sided supralevator extension (*long arrow*). Note the extension is supralevator because it lies medial to the left levator plate (*short arrow*)

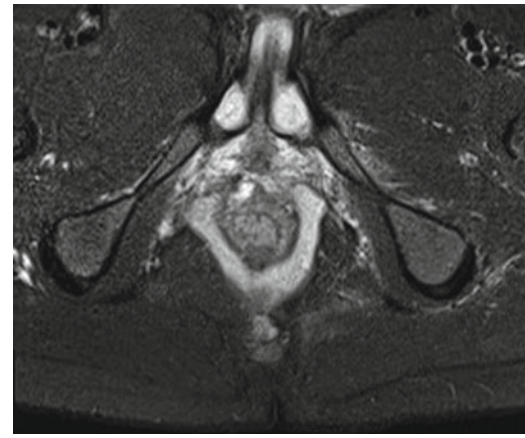

Fig. 18.10 Axial STIR MRI in a patient with a typical horseshoe extension wrapping around both posterior quadrants of the anus

the face of a normal EUA, represented some months later with disease at the site initially indicated by MRI. The clear implication was that EUA had missed disease that had been detected by MRI. This led the authors to conclude, 'MRI is the most accurate method for determining the presence and course of anal fistulae' [13].

Lunniss' work was rapidly confirmed by others working in the field and subsequently elaborated on. For example, Spencer and colleagues independently classified 37 patients into those with simple or complex fistulas on the basis of MRI and EUA and found that imaging was the better predictor of outcome, with positive and negative predictive values of 73 % versus 57 % and 87 % versus 64 % for MRI and surgery, respectively [17]. This study implied clearly that MRI and clinical outcome were closely related and again raised the possibility that preoperative MRI could help identify features that caused post-operative recurrence. Beets-Tan and colleagues extended this hypothesis by investigating the therapeutic impact of preoperative MRI; the MRI findings in 56 patients were revealed to the operating surgeon after they had completed an initial EUA [9]. MRI provided important additional information that precipitated further surgery in 12 of the 56 patients (21 %), mostly in those with recurrent fistulas or Crohn's disease [9]. Buchanan and co-workers hypothesised that the therapeutic impact and thus beneficial effect of preoperative MRI would be greatest in patients with recurrent fistulas, since these had the most chance of harbouring occult infection while simultaneously being the most difficult to evaluate clinically [10]. After an initial EUA, they revealed the findings of preoperative MRI in 71 patients with recurrent fistulas and left any further surgery performed in the light of the MRI findings to the discretion of the operating surgeon. The clinical course of each patient was then followed subsequently. They found that post-operative recurrence was only 16 % for surgeons who always acted when MRI suggested they had missed areas of sepsis, whereas recurrence was 57 % for those surgeons who always chose to ignore imaging, believing their own assessment to be superior [10]. Furthermore, of the 16 patients who needed further unplanned surgery, MRI initially correctly predicted the site of this disease in all cases [10].

Ever since Lunniss' work suggested that EUA might be an imperfect reference standard with which to judge MRI [13], comparative studies have been plagued by the lack of a genuine reference standard. It is now well recognised that surgical findings at EUA are sometimes incorrect. In particular, false-negative diagnoses 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 the results of at least two modalities was necessary in order to arrive at a correct classification [18]. 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 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 [6]. The authors found that digital evaluation correctly classified 61 % of primary tracks, AES 81 % and MR imaging 90 % [6]. While endosonography was particularly adept at predicting the site of the internal opening correctly, achieving this in 91 %, MRI was even better at 97 % and was superior to endosonography in all assessments investigated by the authors [6]. While endosonography is certainly a useful tool for investigating fistula-in-ano, it cannot compete with MRI for detection of extensions, which is undoubtedly the most important role for preoperative imaging. MRI is also more generally available and less operator dependent.

Differential Diagnosis of Perianal Sepsis

Not all perianal sepsis is caused by fistula-in-ano. For example, acne conglobata, hidradenitis suppurativa, pilonidal sinus, actinomycosis,

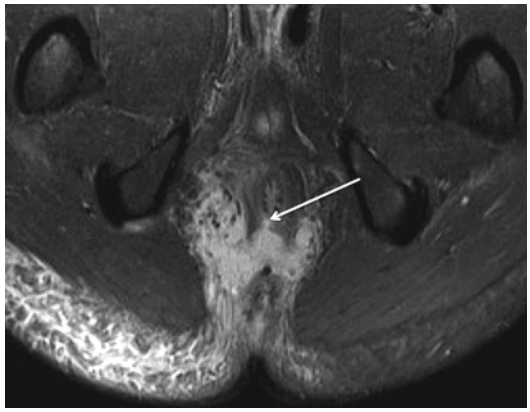

Fig. 18.11 Axial STIR image in a patient with an acute perianal abscess. Note that there is a communication with the intersphincteric plane posteriorly at 6 o'clock (*arrow*), suggesting that the abscess is due to cryptoglandular infection and that the patient may subsequently develop a fistula

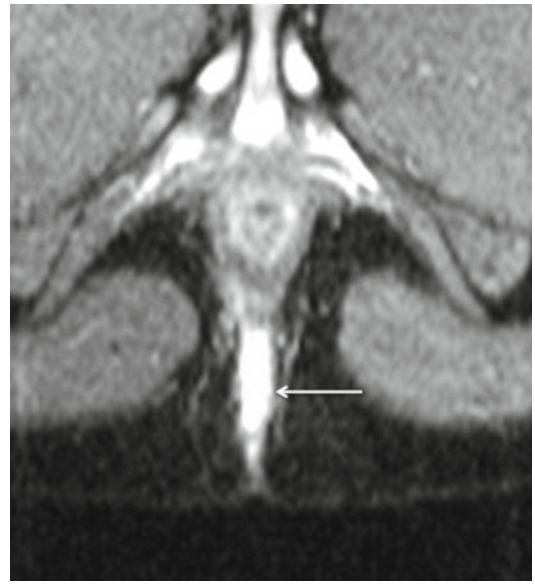

Fig. 18.12 Axial STIR MRI in a patient with pilonidal sinus. There is posterior sepsis (*arrow*) but this stops at the posterior margin of the external sphincter and does not enter the intersphincteric plane

tuberculosis, proctitis, human immunodeficiency virus, lymphoma and anal and rectal carcinoma may all cause perianal infection. While clinical examination is often conclusive, this is not always the case and imaging may help with differential diagnosis. 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 (Fig. 18.11). 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. For example, a study comparing patients with pilonidal sinus (Fig. 18.12) 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 [19].

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 patients, and 30–40 % will experience anal disease at some time [18, 20]. The MRI examination can be extended cranially to encompass the small bowel where 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 otherwise.

Which Patients Should Be Imaged?

While most patients with fistula-in-ano are simple to both diagnose and treat, a proportion will benefit from detailed and accurate preoperative investigation. Where there is easy access to MRI, it could be argued that all patients should be imaged preoperatively. For example, while the therapeutic impact of preoperative MRI is undoubted in patients with complex disease [9, 10], it has been estimated that the therapeutic impact of MR imaging is 10 % in patients presenting for the first time with seemingly simple fistulas [21]. However, where access to imaging is more restricted, the clinician and radiologist will need to select those patients who are most likely to benefit. Since there is now overwhelming evidence that MRI alters surgical therapy and improves clinical outcome in patients with

recurrent disease, MRI should be routine in such cases. Patients presenting for the first time with a fistula that appears complex on clinical examination should also be referred, as should patients with known Crohn's disease since the preponderance of complex fistulas is increased in this situation.

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 particularly risks post-operative incontinence, even when the fistula itself is simple and has no extensions. Faced with such a dilemma, rather than incising the fistula, the surgeon may choose to pass a seton through the track in order to provide drainage. The patient can then be imaged post-operatively in order to assess the potential extent of sphincter division by visualising 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. Setons may also be placed at EUA when the surgeon is uncertain about the relationship between the track and the sphincter and then imaged post-operatively in order to answer this question if imaging has not been performed preoperatively.

The benefit of MRI is not restricted to surgical assessment. The advent of monoclonal antibody to human tumour necrosis factor alpha has impacted dramatically upon the medical management of patients whose fistulas are due to Crohn's disease, especially those with chronic disease. However, therapy is contraindicated if an abscess is present and MRI may be used to search for this. Indeed, MRI may be used to monitor therapy since it seems that fistulas may persist in the face of clinical findings that suggest remission. For example, MRI studies in patients whose external opening has closed have revealed that underlying sepsis is often still present, indicating a need for continuing therapy [22].

Conclusion

In those patients with fistula-in-ano who have a high likelihood of complex disease, the evidence that preoperative MRI influences the surgical approach and extent of exploration and improves ultimate outcome is now overwhelming. We hope that this chapter will stimulate both surgeons to ask for this service and for radiologists to provide it. Doing so will reduce the incidence of recurrent fistula-in-ano and the misery this causes.

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