Magnetic resonance imaging template to standardize reporting of anal fistulas

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Abstract
Anal fistula (AF) is a common referral to colorectal surgeons. Management remains challenging and sometimes controversial. Magnetic resonance imaging (MRI) is commonly performed in initial workup for AF. However, reports often lack key information for guiding treatment strategies. It has been shown that with structured radiology reports, there is less missing information. We present a structured MRI template report including 8 key descriptors of anal fistulas, whose effectiveness and acceptability are being assessed in a cross-sectional study (NCT04541238).

Keyword Anal fistulas · Anal fistula imaging · Endoanal ultrasonography · Pelvic magnetic resonance imaging

Introduction
Management of anal fistulas (AF) can be challenging for colorectal surgeons. Although fistulotomy is considered the gold-standard treatment for simple fistulas, repeated procedures are often required in complex cases. A thorough characterization of AF by clinical examination and imaging is pivotal in selecting the most appropriate treatment [1]. Profound technical variations exist in the surgical management of AF, making it difficult to reproduce and compare treatment outcomes among centers [2].

Magnetic resonance imaging (MRI) and endoanal ultrasonography (EAUS) are the most frequently used diagnostic modalities for preoperative assessment and follow-up [3, 4]. MRI has a broad field of view that well characterizes both sphincter anatomy and the perianal/perirectal regions (i.e., ischiorectal fossae and suprarelevator space). Administration of intravenous contrast medium helps to discriminate between scars and recurrent AF. Nevertheless, AF are often incompletely characterized in MRI reports thus challenging decision-making processes. Structured radiology reports have been shown to reduce missing information [5]. We sought to improve MRI reporting by developing a structured template to include the presence of 8 key descriptors of AF.

MRI scanning technique

Technique for anal fistula imaging

Pelvic MRI for the diagnosis of AF is conducted with body matrix or endorectal coils. The latter, however, are seldom used in the current practice as they are poorly tolerated. Moreover, endorectal coils have a limited field of view that reduces their usefulness in the diagnosis of inflammatory lesions spreading beyond the sphincters.

MRI planes are determined along the long axis of the anal canal, which results in acquiring oblique, axial, and coronal planes. The sagittal fast spin-echo T2-weighted sequence is usually conducted initially to acquire proper orientation and
visualize the entire pelvis and anal canal. On the basis of this plane, further scanning is planned, i.e., axial and coronal planes. The MRI protocol used by the authors is presented in Table 1.

**MRI anatomy of the anal canal**

The internal anal sphincter (IAS) and external anal sphincter (EAS), the levator ani muscle, including its lowest part (i.e., the puborectalis [PR] muscle) as well as the ischiorectal fossae and supraprlevator space are generally assessed in the axial plane and, additionally, in coronal and sagittal planes in various sequences. In many patients, the discrimination between individual sphincters in time spin-echo (TSE) T1-weighted and fat saturation (FS) T1-weighted sequences can be difficult. In short tau inversion recovery/turbo inversion recovery magnitude (STIR/TIRM) sequences, the EAS and PR are difficult to identify. Conversely, the sphincters are easily visible in T2-weighted images and on postcontrast FS T1-weighted images. The IAS has slightly higher signal intensity than the EAS and PR. The intersphincteric space, seen in FS T1- and T2-weighted images, produces a high signal. MRI is superior to EAUS in reproducing very good images of fat tissue in the ischiorectal fossae and supraplevator space [2]. This directly translates into optimal characterization of all pathologies affecting these regions.

**MRI classification of anal fistulas**

There are two basic AF classification systems: the Parks classification from 1976 [6] and the Morris MRI grading system from 2000 [7]. Both systems take into account the course of AF in relation to the anal sphincters.

The Parks classification distinguishes four types of fistulas based on their course in relation to the EAS:

- Intersphincteric AF accounts for 45% of tracts. It penetrates the IAS and runs in the intersphincteric space to its external perianal opening (although it can have a blind subcutaneous ending).
- Transsphincteric AF accounts for 30% of tracts. It penetrates the IAS and then EAS at various levels and runs through the ischiorectal fossa to its external skin opening (it can be blind or end subcutaneously or in the ischiorectal fossa).
- Suprasphincteric AF accounts for 20% of tracts. It penetrates the IAS. At first, it runs upwards in the intersphincteric space to the supraplevator space, crosses the PR, and bends downwards in the ischiorectal fossa to terminate in its external perianal opening (it can be blind or end subcutaneously or in the ischiorectal fossa).
- Extrasphincteric AF accounts for 5% of tracts. It opens internally to the rectum (although it can be blind, i.e., does not penetrate the rectal wall) as a complication of pelvic inflammation, trauma or surgery. It has a peripheral course outside of the sphincters in the ischiorectal fossa down to its external skin opening (it can also end blindly subcutaneously or in the ischiorectal fossa).

The Morris classification extends the Parks classification to incorporate accompanying abscesses, usually residual or incompletely emptied, and extensions. It has five grades:

- **Grade 1**: Simple linear intersphincteric fistula (as above in the Parks classification).
- **Grade 2**: Intersphincteric fistula with intersphincteric abscess and secondary fistulous tract.
- **Grade 3**: Transsphincteric fistula (as above in the Parks classification).
- **Grade 4**: Transsphincteric fistula with an abscess and secondary tract within the ischioanal or ischiorectal fossa. Abscesses can develop at any part of the fistula or its extension, but below the levator ani level.
- **Grade 5**: Supralevator and translevator disease (incorporates suprasphincteric and extrasphincteric fistulas from the Parks classification), i.e., all fistulas above the levator ani.

It must be noted that neither classification system includes all key information that should be available in an

| Parameters               | T2 TSE | T2 TSE | T2 TSE | T2w TIRM | T2 TIRM | T1 TSE FS | T1 TSE FS CM |
|--------------------------|--------|--------|--------|----------|---------|-----------|-------------|
| Imaging planes           | Oblique axial | Sagittal | Oblique coronal | Oblique axial | Oblique coronal | Oblique axial | Oblique axial |
| TR/TE (msec)             | 3020/10 | 5010/100 | 3800/100 | 4190/60 | 5340/60 | 545/10 | 545/10 |
| FOV (cm)                 | 260    | 250    | 250    | 290     | 380     | 260     | 260        |
| Section thickness (mm)   | 4      | 4      | 4      | 4       | 4       | 4       | 4          |
| Intersection gap (mm)    | 0.8×0.8×4.0 | 0.8×0.8×4.0 | 0.8×0.8×4.0 | 0.9×0.9×4.0 | 1.2×1.2×4.0 | 1.0×1.0×4.0 | 1.0×1.0×4.0 |
| Matrix                   | 320×256 | 320×256 | 320×256 | 320×256 | 320×256 | 320×256 | 320×256 |
| Averages                 | 1      | 1      | 1      | 2       | 1       | 1       | 1          |

*FOV field of view, TIRM turbo inversion recovery magnitude, TSE time spin echo*
3. Height. This is of major importance for surgical plan-
ning. A low fistula traverses ≤ 1/3 of the EAS (i.e., the
level at which only distal EAS is visible on axial MRI
scans), whereas a high fistula traverses > 1/3 of the EAS
(i.e., the level at which the IAS is visible medially to the
EAS).
4. Cross-sectional diameter of the AF tract.
5. Description of any residual abscess, according to the
Corman classification [10].
6. Description of any secondary extensions and deter-
mination of the number and location of branches. Sec-
ondary tracts are present in 5–15% of AF and may
affect any level of the fistulous tract, but usually occur
in the ischiorectal fossa, intersphincteric space and,
more rarely, in the supralevaltor space. If the extension
involves at least a half of the anal circumference (anteriorly,
posteriorly, or laterally) is defined ‘horseshoe’ tract.
These extensions are well visible in the axial planes.
7. Number, location, and patency of the internal opening.
Information about the location (height and site based on
a clock dial) of the internal opening is significant for the
surgeon since failure of its removal will cause a recur-
rence. The assessment of patency or obstruction of the
internal orifice is not always possible in MRI (nor it is in
EAUS), which must be noted in an MRI scan report. The
visualization of the external outlet is difficult on MRI
and for this reason it is not included in the template.
8. Morphological condition of anal sphincters (A. regu-
lar; B. defect; C. thinning; D. scar; E. atrophy) with
information concerning the level of the anal canal at
which abnormalities are located as well as the clock dial
description and percentage of sphincter circumference
(size) involved.

In suspected postoperative recurrence, MRI is very help-
ful in differentiating active tract from inactive fistula and
fibrotic scar which are hypointense in all sequences and do
not undergo postcontrast enhancement.

The template does deliberately not include the follow-
ing three types of AF due to their different etiology and
management:

- Subcutaneous fistulas that in our practice are identified
  very rarely. Their etiology can be associated with puru-
  lent perianal conditions, which are not necessarily associ-
  ated with anal crypt infection. In MRI, they are typically
  found medially to the IAS in the epithelial layer (i.e., do
  not penetrate the IAS) [11].
- Rectovaginal fistulas that usually develop due to an
  obstetric trauma. Axial and sagittal planes of contrast-
  enhanced MRI can detect even narrow (1–2 mm) fistulas,
  which are the most difficult to diagnose.
- Rectoperineal fistulas, with an etiology usually associ-
  ated with perineal trauma or childbirth.

The proposed MRI template can also be used in Crohn’s
disease to report a complete morphological image of the fis-
tulous tracts. AF in Crohn’s are usually discussed separately
due to their complex course, different etiology and ther-
apeutic management. Such tracts do not originate from crypt
infection but rather result from transmural spread of chronic
granulomatous inflammation [12]. Approximately, 50% of
these AF are high transsphincteric or high intersphincteric,
and suprasphincteric tracts. They usually have horseshoe and
supralevaltor extensions that make them likely to recur and
challenging to treat. MRI may also visualize abnormal sig-
als of the anal sphincters due to post-inflammatory changes
associated to disorders of ano-rectal sensation or fecal incon-
tinence. In patients treated with biological therapy, MRI is
used for monitoring patient response to treatment.

Conclusions

The proposed MRI template for the report of AF may be
an effective and efficient way to improve characterization,
direct management and thence appropriate follow-up of
patients with AF, by making key descriptors available to
surgeons. To test these hypotheses, we designed a study
(NCT04541238) [13] to evaluate (1) the feasibility, accept-
ability, and effectiveness of the MRI template, (2) the repro-
ducibility and the interobserver agreement in detecting AF
descriptors, and (3) the efficacy of the template in enhancing
the surgical decision planning as compared to standard MRI
reporting. Based on the results of this study, the subsequent
Step is to seek consensus among key opinion leaders in the
Fig. 1 A novel magnetic resonance imaging template for a uniform description of anal fistula
Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest

Ethical approval All procedures performed in the study involving human participants were in accordance with the ethical standards of the Trust and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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