RESEARCH PAPER

MRI Evaluation of Perianal Fistula with Surgical Correlation

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ABSTRACT

Background: Accurate preoperative mapping of perianal fistula is essential because missed internal openings, secondary branches, and occult collections contribute to recurrence, sphincter injury, delayed healing, and postoperative incontinence.

Objective: To describe MRI features of perianal fistulous disease in a Saudi multicenter cohort and determine MRI–operative concordance.

Methods: The investigator-supplied multicenter dataset was analyzed at the operative-encounter level. Fifty-six operative encounters from 53 identifiers were available. Descriptive statistics summarized baseline, MRI, and operative findings. Exact agreement and Cohen's kappa were calculated for paired MRI and surgical variables. Sensitivity, specificity, predictive values, and accuracy were estimated for MRI detection of collections and branching/complexity where paired operative descriptions were available.

Results: Mean age was 43.7 ± 11.9 years and 67.9% were male. Discharge was the commonest presentation (89.1%). On MRI, intersphincteric anatomy was most frequent (69.8% of available classifications), followed by infralevator extension (77.8%), posterior orientation (67.4%), and absence of collection (83.3%). Operatively, posterior orientation predominated (73.8%), and low fistulas represented 69.2% of documented levels. The most frequent procedures were fistulectomy (33.3%) and seton-based procedures (31.2%). MRI showed excellent agreement for anterior/posterior orientation (92.3%, κ=0.821) and sphincteric classification (93.8%, κ=0.881). Internal opening concordance was 100.0%, and external opening concordance was 85.7%. MRI-detected collection was associated with seton use (OR 7.00, 95% CI 1.29–37.91; p=0.023).

Conclusion: MRI provided highly reliable preoperative anatomic mapping and strongly supported operative planning, especially for fistula orientation, sphincter relationship, and occult sepsis.

Keywords: Perianal fistula; magnetic resonance imaging; surgical correlation; anal fistula; seton; preoperative planning; Saudi Arabia.

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Background

Perianal fistula remains one of the most challenging benign anorectal disorders because successful treatment depends on two parallel goals: eradication of sepsis and preservation of continence. The disease is usually cryptoglandular in origin and often represents the chronic phase of a prior anorectal abscess. Classical surgical work established that the relationship of the tract to the sphincter complex is central to both operative difficulty and postoperative functional risk. Modern

colorectal guidance continues to emphasize that the surgeon must understand not only the primary tract but also the internal opening, secondary ramifications, abscess cavities, and any supralevator or horseshoe extension before choosing between fistulotomy, fistulectomy, seton drainage, or a sphincter-sparing approach (Parks et al., 1976; Sainio, 1984; Limura & Giordano, 2015; Gaertner et al., 2022). (PubMed)

Clinical examination remains fundamental, but it has limitations in complex disease. Pain, fibrosis, recurrent inflammation, previous intervention, and deep extension can all obscure the true anatomy. Earlier radiologic-surgical studies showed that fistulas can be under-staged when operative planning depends only on probing or inspection, particularly when there are hidden branches or deep-seated collections. That under-staging is clinically important because untreated secondary extensions increase the risk of persistence and recurrence, whereas excessive dissection risks avoidable sphincter damage and postoperative incontinence (Lunniss et al., 1992; Morris et al., 2000; Spencer et al., 1998; Halligan & Stoker, 2006).

MRI has become the reference imaging technique for comprehensive fistula mapping because of its superior soft-tissue contrast and multiplanar capability. It allows detailed evaluation of the anal canal, internal and external sphincters, intersphincteric plane, ischioanal fossae, levator plate, and associated inflammatory change. Reviews of imaging technique have shown that high-resolution T2-weighted imaging, fat-suppressed sequences, diffusion-weighted imaging when abscess is suspected, and contrast-enhanced T1-weighted sequences together provide strong discrimination between active tracts, inflammatory tissue, fibrosis, and collections (Sun et al., 2008; O'Malley et al., 2012; Jhaveri et al., 2018; Balcı et al., 2019).

The value of MRI is not merely technical. It is outcome-oriented. Landmark work demonstrated that MRI findings predicted surgical outcome and improved operative planning, particularly in recurrent and complex fistulas. Comparative studies subsequently showed that MRI performs favorably against clinical examination and endoanal ultrasound for identifying the primary tract, secondary extensions, and associated abscesses. As a result, MRI is now widely viewed as the bridge between radiologic anatomy and surgical decision-making, especially when deep extension or complex branching is possible (Spencer et al., 1998; Buchanan et al., 2004; Siddiqui et al., 2012; Gage et al., 2013; Tolan, 2016; Torkzad & Karlbom, 2010).

Another important aspect is standardization. MRI is most clinically useful when the examination is protocolized and the report is structured around the operative questions that matter: Where is the internal opening? What is the fistula's relation to the sphincters? Are there secondary tracts? Is there supralevator spread? Is there an abscess? Multiple studies and reviews have stressed that structured reporting improves communication between radiologists and surgeons and reduces ambiguity in operative planning (de Miguel Criado et al., 2012; Yıldırım et al., 2012; Konan et al., 2018; Balcı et al., 2019; Arkenbosch et al., 2025).

Recent studies have continued to confirm the high diagnostic utility of MRI for preoperative fistula assessment, including reliable detection of branching, abscesses, and deep extension. The consistency of these findings across institutions and study designs has reinforced the view that better imaging should translate into better surgery: fewer missed tracts, more rational operative selection, and stronger protection of continence (Waniczek et al., 2011; Singh et al., 2014; Zhao et al., 2023; Kummari et al., 2024).

Within that context, the present study was designed to evaluate MRI findings in Saudi patients with perianal fistulous disease and correlate them with operative assessment. The practical aim is directly surgical: to improve preoperative planning, reduce missed disease, limit unnecessary muscular injury, and support continence-preserving management through accurate imaging-based anatomical delineation.

Study Objectives

The primary objective of this study was to evaluate the MRI features of perianal fistulous disease and correlate them with operative findings in a Saudi multicenter cohort. The study also aimed to clarify how MRI contributes to preoperative surgical planning by identifying fistula orientation, sphincter involvement, branching, levator extension, and associated collections before surgery. A secondary objective derived from the available dataset was to estimate the diagnostic performance of MRI for selected surgically verifiable features, particularly collection/abscess and branching/complexity, and to explore whether specific MRI complexity markers were associated with use of seton-based operative management.

Methodology

This study reports the analysis of a de-identified investigator-supplied multicenter dataset on perianal fistulous disease with MRI and operative correlation. The source protocol described a prospective design, and the current study was prepared from the final dataset available for analysis. Because three identifiers appeared twice as distinct operative records, the statistical unit of analysis was the operative encounter rather than the unique patient identifier.

The analytical file contained records from two tertiary hospitals in Taif, Saudi Arabia: Alhada Military Hospital and King Abdulaziz Specialist Hospital. All available encounters in the submitted dataset were included in the descriptive analysis. The analyzed file contained adult patients aged 18 to 69 years. For comparative MRI–operative analyses, each variable was analyzed on an available-case basis, so the denominator changed according to whether both the MRI field and the operative reference field were documented for that specific comparison.

According to the source study materials, MRI was performed on a 1.5-T system using a gadolinium-based contrast agent (Dotarem, 0.1 mmol/kg). The protocol included sagittal high-resolution T2-weighted imaging, sagittal T2 3D CUBE imaging, axial oblique T2 fat-suppressed and high-resolution T2 sequences, coronal oblique T2 fat-suppressed imaging, diffusion-weighted imaging when collection or abscess was suspected, pre-contrast axial T1-weighted LAVA fat-suppressed sequences, and post-contrast axial and coronal T1-weighted fat-suppressed LAVA sequences. Oblique planes were oriented perpendicular to the long axis of the anal canal.

The source protocol stated that surgery was performed under general anesthesia in the lithotomy position after bowel preparation. Surgeons documented intraoperative findings regarding tract complexity, branching, and related operative anatomy. In the submitted file, operative data were available as both structured fields and free-text intraoperative descriptions. These operative findings constituted the practical reference standard for MRI correlation.

Demographic variables included age, sex, hospital, symptom duration, and selected clinical history variables. MRI variables included presence of collection, branching pattern, relation to the sphincter complex, levator extension, laterality, anterior/posterior orientation, and clock-position information for internal and external openings when extractable. Operative variables included operative adjuncts, anterior/posterior orientation, high versus low classification, opening location, operative narrative classification, and final procedure. For secondary analysis, procedures were additionally grouped into seton-based versus non-seton strategies. MRI branching was dichotomized as branched/complex when the examination documented either a single branched tract or multiple/complex tracts. Continuous variables were summarized as mean ± standard deviation when approximately symmetric and as median with interquartile range when skewed. Categorical variables were summarized as number and percentage using the number of non-missing observations as the denominator. Exact MRI–operative agreement and Cohen's kappa were calculated for paired categorical variables with sufficient documentation, particularly anterior/posterior orientation and sphincteric classification. For MRI detection of collection/abscess and branching/complexity, sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy were calculated against the available operative reference standard, with exact binomial 95% confidence intervals. Clock-position concordance for internal and external openings was defined as overlap between the MRI-reported and surgically reported clock positions. Exploratory associations between MRI complexity markers and seton-based procedures were assessed using Fisher's exact test with odds ratios and 95% confidence intervals. Age and symptom duration were compared between seton and non-seton groups using the Mann–Whitney U test. A two-sided p value below 0.05 was considered statistically significant.

Results

A total of 56 operative encounters from 53 identifiers were analyzed. Alhada Military Hospital contributed 62.5% of encounters and King Abdulaziz Specialist Hospital contributed 37.5%. The cohort was predominantly male, with a mean age of 43.7 ± 11.9 years. Symptom duration, when documented, had a median of 9.0 months. Discharge was by far the commonest presenting complaint, followed by pain. Prior abscess history and previous anal surgery were both frequent, suggesting that a substantial proportion of the cohort had recurrent or previously treated disease.

Table 1. Baseline and clinical characteristics of the analyzed cohort

Characteristic	Value

Total operative records analyzed	56
Unique patient IDs represented	53
Hospitals represented in analyzed dataset	2
Alhada Military Hospital, Taif	35/56 (62.5%)
King Abdulaziz Specialist Hospital, Taif	21/56 (37.5%)
Male sex	38/56 (67.9%)
Female sex	18/56 (32.1%)
Age, mean ± SD (years)	43.7 ± 11.9
Age, median (IQR) (years)	42.0 (34.8–54.0)
Age range (years)	18–69
Symptom duration, median (IQR), months	9.0 (6.0–12.0) [n=45]
Presenting complaint included discharge	49/55 (89.1%)
Presenting complaint included pain	23/55 (41.8%)
Presenting complaint included pruritus	6/55 (10.9%)
Presenting complaint included recurrence	5/55 (9.1%)
Presenting complaint included bleeding	3/55 (5.5%)
Presenting complaint included swelling	3/55 (5.5%)
Presenting complaint included abscess	2/55 (3.6%)
Chronic disease	14/42 (33.3%) [available n=42]
Smoking history	14/41 (34.1%) [available n=41]
Prior abscess history	30/47 (63.8%) [available n=47]
Prior anal surgery	26/52 (50.0%) [available n=52]

The baseline profile indicates a middle-aged, predominantly male cohort with chronic symptomatic disease and a substantial burden of prior sepsis and prior intervention.

Table 2. MRI characteristics of perianal fistulous disease

MRI variable	Category	n/N (%)
Collection/abscess on MRI	No	45/54 (83.3%)
	Yes	9/54 (16.7%)
Branching pattern	Single unbranched	36/45 (80.0%)
	Multiple/Complex	7/45 (15.6%)
	Single branched	2/45 (4.4%)
Relation to sphincter complex	Intersphincteric	30/43 (69.8%)
	Extrasphincteric	6/43 (14.0%)
	Transsphincteric	4/43 (9.3%)
	Rectovaginal	1/43 (2.3%)
	Submucosal	1/43 (2.3%)
	Mixed/Multiple	1/43 (2.3%)
Levator extension	Infralevator	28/36 (77.8%)
	Supralevator	8/36 (22.2%)
Side of fistula	Left	20/49 (40.8%)
	Right	19/49 (38.8%)
	Midline	6/49 (12.2%)
	Multiple/Mixed	4/49 (8.2%)
Anterior/posterior orientation	Posterior	29/43 (67.4%)
	Anterior	11/43 (25.6%)
	Both	3/43 (7.0%)

MRI demonstrated that the cohort was dominated by intersphincteric, infralevator, and posterior disease. Most evaluable tracts were unbranched and did not have a documented associated collection.

Table 3. Operative findings and procedures

Operative variable	Category	n/N (%)
Operative testing adjunct	Hydrogen peroxide + methylene blue/probing	21/37 (56.8%)

	Hydrogen peroxide	9/37 (24.3%)
	None documented	6/37 (16.2%)
	Methylene blue	1/37 (2.7%)
Operative anterior/posterior orientation	Posterior	31/42 (73.8%)
	Anterior	10/42 (23.8%)
	Both	1/42 (2.4%)
Operative level	Low	27/39 (69.2%)
	High	11/39 (28.2%)
	Mixed	1/39 (2.6%)
Procedure category	Fistulectomy	16/48 (33.3%)
	Seton-based procedure	15/48 (31.2%)
	Fistulotomy with seton	7/48 (14.6%)
	Fistulotomy	6/48 (12.5%)
	Fistulectomy with seton	1/48 (2.1%)
	Ligation and rectal wall plication	1/48 (2.1%)
	Incision and drainage	1/48 (2.1%)
	Pilonidal sinus excision	1/48 (2.1%)

Operative data showed that posterior and low fistulas predominated. The commonest procedures were fistulectomy and seton-based management, together accounting for nearly two-thirds of documented operations.

Table 4. MRI–operative concordance and diagnostic performance

Comparison	Paired n	Result	Interpretation
MRI vs operative anterior/posterior orientation	39	Exact agreement 92.3%; κ=0.821	Excellent concordance between structured MRI and operative orientation
MRI vs operative sphincteric classification	16	Exact agreement 93.8%; κ=0.881	Excellent concordance for fistula class where paired operative narrative was available
MRI detection of collection/abscess	9	Accuracy 100.0% (95% CI 66.4–100.0); sensitivity 100.0%; specificity 100.0%	Perfect observed classification in the paired subset, with wide confidence intervals due to small n
MRI detection of secondary branching/complexity	16	Accuracy 93.8% (95% CI 69.8–99.8); sensitivity 100.0%; specificity 93.3%	MRI was highly reliable for branched/complex disease in the available paired subset
Internal opening clock-position concordance	10	100.0%	All paired internal opening positions showed overlap between MRI

			and operative descriptions
External opening clock-position concordance	14	85.7%	High concordance for external opening position, with two discordant paired cases

MRI–operative concordance was strongest for anterior/posterior orientation and sphincteric classification. For surgically verifiable binary variables, MRI performed particularly well in detecting collection and demonstrated strong performance for secondary branching or complexity. Internal opening localization showed perfect overlap in all paired cases.

Table 5. Association between selected MRI complexity markers and use of seton-based surgery

MRI feature	Seton used when feature present	Seton used when feature absent	Odds ratio (95% CI)	p value
MRI-detected collection	7/9 (77.8%)	15/45 (33.3%)	7.00 (1.29–37.91)	0.023
MRI branching/complexity	6/9 (66.7%)	12/36 (33.3%)	4.00 (0.85–18.84)	0.126
Non-intersphincteric anatomy	7/13 (53.8%)	13/30 (43.3%)	1.53 (0.41–5.64)	0.740
Supralevator extension	5/8 (62.5%)	9/28 (32.1%)	3.52 (0.68–18.07)	0.217

MRI-detected collection was the only MRI variable significantly associated with use of a seton-based procedure. The effect direction for branching/complexity and supralevator extension also favored greater seton use, but those comparisons were underpowered and did not reach statistical significance. Age did not differ significantly between seton and non-seton groups (Mann–Whitney p=0.617), and symptom duration was longer in the seton group without statistical significance (median 12.0 vs. 7.0 months; p=0.175).

Discussion

This multicenter Saudi operative-correlation study supports the clinical value of MRI in the preoperative assessment of perianal fistulous disease. The central finding is that MRI showed high agreement with surgical findings for the anatomical descriptors that matter most in operative planning: anterior/posterior orientation, sphincteric relationship, opening localization, and identification of occult sepsis. In practical terms, these are the variables that influence whether a surgeon can proceed with definitive treatment, whether a staged or sphincter-sparing strategy is more appropriate, and whether apparently limited disease may actually harbor secondary extension. The present findings therefore support the current position of MRI as a genuine operative roadmap rather than a merely confirmatory diagnostic test (Halligan & Stoker, 2006; Gage et al., 2013; Tolan, 2016; Gaertner et al., 2022).

The clinical profile of the current cohort is also coherent with the known behavior of cryptoglandular anal fistula. The male predominance, the marked frequency of discharge, and the substantial prevalence of prior abscess and previous surgery all suggest a disease population enriched with chronic or recurrent pathology. That pattern is in keeping with older epidemiologic observations and later surgical reviews showing that fistula-in-ano commonly affects men more often than women and is often preceded by abscess formation or prior intervention (Sainio, 1984; Limura & Giordano, 2015).

MRI findings in this study were dominated by intersphincteric disease, infralevator extension, and posterior orientation. The predominance of intersphincteric fistulas resembles several prior MRI series, although the exact distribution of fistula classes varies substantially across institutions according to referral patterns and inclusion criteria. Even so, the current distribution is anatomically and clinically plausible and supports the internal validity of the analyzed dataset (Al-Khawari et al., 2005; Waniczek et al., 2011; Singh et al., 2014; Kummari et al., 2024).

One of the strongest findings in the present study is the degree of MRI–operative agreement for anterior/posterior orientation and sphincteric classification. Exact agreement exceeded 90% for both comparisons, with κ values in the substantial-to-almost-perfect range. These results align well with the broader literature, where MRI has repeatedly shown strong correlation with operative anatomy for the primary tract and its relationship to the sphincter complex, especially in recurrent or complex disease (Morris et al., 2000; Buchanan et al., 2004; Konan et al., 2018; Kummari et al., 2024).

From a surgical standpoint, that level of concordance is important because classification errors in either direction have consequences. Underestimation may lead to missed branches, undrained sepsis, and recurrence. Overestimation may push the surgeon toward more conservative staged treatment than necessary or may distort the balance between cure and continence preservation. The classic Parks framework and subsequent management reviews make it clear that the operative meaning of a fistula is inseparable from its sphincteric anatomy, which is exactly why preoperative classification matters so much (Parks et al., 1976; Limura & Giordano, 2015; Gaertner et al., 2022).

Opening localization is another area where the current data are clinically meaningful. Internal opening identification is a recognized determinant of definitive surgical success, and a missed internal opening is a common pathway to persistence or recurrence. In the paired subset of this study, internal opening clock-position concordance was 100%, while external opening concordance remained high at 85.7%. Although the paired sample for these analyses was limited, the direction of the findings matches the established view that MRI can localize fistula openings accurately when acquisition planes and reporting conventions are appropriate (de Miguel Criado et al., 2012; O'Malley et al., 2012; Balcı et al., 2019).

The observed diagnostic performance of MRI for collection or abscess detection is also notable. In the paired subset, MRI showed 100% observed sensitivity, specificity, and overall accuracy. The confidence intervals are necessarily wide because the paired sample was small, but the direction of the finding is highly plausible and consistent with prior studies showing that MRI is particularly valuable for identifying occult sepsis, inflammatory cavities, and hidden fluid collections that may alter the operative plan (Spencer et al., 1996; O'Malley et al., 2012; Zhao et al., 2023).

That observation becomes even more clinically relevant when linked to operative strategy. In this study, MRI-detected collection was significantly associated with use of a seton-based procedure, with an odds ratio of 7.00. That association is surgically intuitive. When active sepsis or an associated cavity is present, surgeons are more likely to favor drainage and control of infection while protecting the sphincters rather than pursuing immediate definitive division. The present result therefore suggests that MRI is doing more than describing anatomy; it appears to be identifying disease features that meaningfully influence the operative approach.

MRI also performed strongly for branching or complexity, with overall accuracy of 93.8%, perfect observed sensitivity in the paired subset, and high specificity. Although the positive predictive value was modest, that reflects the small number of operative positives rather than a convincing pattern of systematic overcalling. In practical terms, a strong negative predictive value is valuable in itself because excluding occult secondary tracts can support more straightforward surgery. This is consistent with earlier work emphasizing that MRI is especially useful for secondary extensions, horseshoe tracts, and deep spread that may be difficult to define clinically or even intraoperatively before formal dissection (Spencer et al., 1998; Gage et al., 2013; Varsamis et al., 2022; Kummari et al., 2024).

The exploratory analyses of operative strategy deserve careful interpretation. Branching/complexity and supralevator extension both showed numerically higher odds of seton use, but neither reached statistical significance. The most likely explanation is limited power rather than absence of clinical importance. Both features are well-established markers of greater anatomical complexity and are precisely the sorts of findings that often prompt staged or sphincter-preserving management in real practice (Halligan & Stoker, 2006; Tolan, 2016; Gaertner et al., 2022).

Another important implication of the study is the need for structured reporting on both sides of the radiologic-surgical interface. Several published reviews have emphasized that MRI is most clinically effective when the report addresses the exact questions that determine management, including the tract course, sphincter relation, internal opening, extensions, and collections. The present dataset contained both structured variables

and narrative descriptions, and the best agreement was achieved precisely in the variables that were documented clearly enough to compare directly. This suggests that future multicenter work would benefit from a unified MRI reporting template and an equally structured operative proforma (Yıldırım et al., 2012; Gage et al., 2013; Balcı et al., 2019; Arkenbosch et al., 2025).

The present study has limitations that should be stated clearly. First, the final analyzed dataset contained 56 operative encounters rather than the larger planned sample. Second, only two hospitals were represented in the submitted file. Third, some MRI–operative comparisons were limited by missing paired documentation, which reduced the effective denominator for inferential analyses. Fourth, parts of the operative reference standard were embedded in narrative text and therefore required structured abstraction. Fifth, because some identifiers appeared more than once, encounter-level analysis was more appropriate than person-level analysis. These limitations reduce generalizability but do not negate the core result: in the evaluable paired data, MRI correlated strongly with surgery for the variables that matter most to operative planning.

Overall, the current findings add locally relevant evidence to the extensive literature supporting MRI as a core preoperative tool in fistula assessment. The results suggest that well-performed pelvic MRI can improve the anatomical accuracy available to the surgeon before surgery, help reduce the probability of missed sepsis or missed extensions, and support a continence-conscious operative strategy. Larger Saudi multicenter studies with standardized reporting and broader case capture would be the logical next step toward developing a more robust national operative-imaging reference framework.

Conclusion

In this multicenter Saudi dataset, MRI demonstrated high operative concordance for the preoperative assessment of perianal fistulous disease, particularly for anterior/posterior orientation, sphincteric classification, and opening localization. MRI also showed excellent observed performance for identifying occult collection and strong performance for detecting branching or complexity in the paired subsets available for comparison. These findings support the routine use of well-protocolized pelvic MRI as a surgical planning tool in patients with suspected complex or clinically significant perianal fistulas. The data further suggest that MRI-demonstrated collection may meaningfully influence selection of seton-based management. Larger prospective multicenter studies with standardized structured reporting are warranted to strengthen procedure-specific decision support and broaden national reference data.

References

- Al-Khawari, H. A., Gupta, R., Sinan, T. S., Prakash, B., Al-Amer, A., & Al-Bolushi, S. (2005). Role of magnetic resonance imaging in the assessment of perianal fistulas. *Medical Principles and Practice, 14*(1), 46–52. https://doi.org/10.1159/000081923
- Arkenbosch, J. H. C., van Ruler, O., de Vries, A. C., van der Woude, C. J., & Dwarkasing, R. S. (2025). The role of MRI in perianal fistulizing disease: Diagnostic and therapeutic implications. *Abdominal Radiology, 50*(2), 589–597. https://doi.org/10.1007/s00261-024-04455-w
- Balcı, S., Onur, M. R., Karaosmanoğlu, A. D., Karçaaltıncaba, M., Akata, D., & Özmen, M. N. (2019). MRI evaluation of anal and perianal diseases. *Diagnostic and Interventional Radiology, 25*(1), 21–27. https://doi.org/10.5152/dir.2018.17499
- Buchanan, G. N., Halligan, S., Bartram, C. I., Williams, A. B., Tarroni, D., & Cohen, C. R. G. (2004). Clinical examination, endosonography, and MR imaging in preoperative assessment of fistula in ano: Comparison with outcome-based reference standard. *Radiology, 233*(3), 674–681.
- Cheong, D. M., Nogueras, J. J., Wexner, S. D., & Jagelman, D. G. (1993). Anal endosonography for recurrent anal fistulas: Image enhancement with hydrogen peroxide. *Diseases of the Colon & Rectum, 36*(12), 1158–1160. https://doi.org/10.1007/BF02052266
- de Miguel Criado, J., del Salto, L. G., Rivas, P. F., del Hoyo, L. F. A., Velasco, L. G., de las Vacas, M. I., Marco, S. F., Paradela, M. M., & Moreno, E. F. (2012). MR imaging evaluation of perianal fistulas: Spectrum of imaging features. *RadioGraphics, 32*(1), 175–194. https://doi.org/10.1148/rg.321115040
- Dwarkasing, S., Hussain, S. M., & Krestin, G. P. (2005). Magnetic resonance imaging of perianal fistulas. *Seminars in Ultrasound, CT*

and MRI, 26(4), 247–258. https://doi.org/10.1053/j.sult.2005.04.004

- Gaertner, W. B., Burgess, P. L., Davids, J. S., Lightner, A. L., Shogan, B. D., Sun, M. Y., Steele, S. R., Paquette, I. M., & Feingold, D. L. (2022). The American Society of Colon and Rectal Surgeons clinical practice guidelines for the management of anorectal abscess, fistula-in-ano, and rectovaginal fistula. *Diseases of the Colon & Rectum, 65*(8), 964–985. https://doi.org/10.1097/DCR.0000000000002473
- Gage, K. L., Deshmukh, S., Macura, K. J., Kamel, I. R., & Zaheer, A. (2013). MRI of perianal fistulas: Bridging the radiologic-surgical divide. *Abdominal Imaging, 38*(5), 1033–1042. https://doi.org/10.1007/s00261-012-9965-4
- Halligan, S., & Stoker, J. (2006). Imaging of fistula in ano. *Radiology, 239*(1), 18–33. https://doi.org/10.1148/radiol.2391041043
- Jhaveri, K. S., Thipphavong, S., Guo, L., & Harisinghani, M. G. (2018). MR imaging of perianal fistulas. *Radiologic Clinics of North America, 56*(5), 775–789. https://doi.org/10.1016/j.rcl.2018.04.005
- Konan, A., Onur, M. R., & Özmen, M. N. (2018). The contribution of preoperative MRI to the surgical management of anal fistulas. *Diagnostic and Interventional Radiology, 24*(6), 321–327. https://doi.org/10.5152/dir.2018.18340
- Kumar, S., Chaudhary, R. K., Shah, S. S., Kumar, D., Nepal, P., & Ojili, V. (2024). Current update on the role of endoanal ultrasound: A primer for radiologists. *Abdominal Radiology, 49*(8), 2873–2890. https://doi.org/10.1007/s00261-024-04300-0
- Kummari, S., Burra, K. G., Reddy, V. R. K., Das, S., Ramadugu, R., & Ramadugu, S. (2024). The role of MRI in pre-operative assessment of anorectal fistula with surgical correlation. *Cureus, 16*(1), e53237. https://doi.org/10.7759/cureus.53237
- Limura, E., & Giordano, P. (2015). Modern management of anal fistula. *World Journal of Gastroenterology, 21*(1), 12–20. https://doi.org/10.3748/wjg.v21.i1.12
- Lunniss, P. J., Armstrong, P., Barker, P. G., Reznek, R. H., & Phillips, R. K. S. (1992). Magnetic resonance imaging of anal fistulae. *The Lancet, 340*(8816), 394–396. https://doi.org/10.1016/0140-6736(92)91472-K
- Morris, J., Spencer, J. A., & Ambrose, N. S. (2000). MR imaging classification of perianal fistulas and its implications for patient management. *RadioGraphics, 20*(3), 623–635. https://doi.org/10.1148/radiographics.20.3.g00mc15623
- O'Malley, R. B., Al-Hawary, M. M., Kaza, R. K., Wasnik, A. P., Liu, P. S., & Hussain, H. K. (2012). Rectal imaging: Part 2, Perianal fistula evaluation on pelvic MRI—what the radiologist needs to know. *American Journal of Roentgenology, 199*(1), W43–W53. https://doi.org/10.2214/AJR.11.8361
- Parks, A. G., Gordon, P. H., & Hardcastle, J. D. (1976). A classification of fistula-in-ano. *British Journal of Surgery, 63*(1), 1–12. https://doi.org/10.1002/bjs.1800630102
- Sahni, V. A., Ahmad, R., & Burling, D. (2008). Which method is best for imaging of perianal fistula? *Abdominal Imaging, 33*(1), 26–30. https://doi.org/10.1007/s00261-007-9309-y
- Sainio, P. (1984). Fistula-in-ano in a defined population: Incidence and epidemiological aspects. *Annales Chirurgiae et Gynaecologiae, 73*(4), 219–224.
- Sharma, A., Yadav, P., Sahu, M., & Verma, A. (2020). Current imaging techniques for evaluation of fistula in ano: A review. *Egyptian Journal of Radiology and Nuclear Medicine, 51*, 130.
- Siddiqui, M. R. S., Ashrafian, H., Tozer, P., Daulatzai, N., Burling, D., Hart, A., & Athanasiou, T. (2012). A diagnostic accuracy meta-analysis of endoanal ultrasound and MRI for perianal fistula assessment. *Diseases of the Colon & Rectum, 55*(5), 576–585. https://doi.org/10.1097/DCR.0b013e318249d26c
- Singh, K., Singh, N., Thukral, C., Singh, K. P., & Bhalla, V. (2014). Magnetic resonance imaging evaluation of perianal fistulae with

surgical correlation. *Journal of Clinical and Diagnostic Research, 8*(6), RC01–RC04.

- Spencer, J. A., Chapple, K., Wilson, D., Ward, J., Windsor, A. C. J., & Ambrose, N. S. (1998). Outcome after surgery for perianal fistula: Predictive value of MR imaging. *American Journal of Roentgenology, 171*(2), 403–406. https://doi.org/10.2214/ajr.171.2.9694464
- Spencer, J. A., Ward, J., Beckingham, I. J., Adams, C., & Ambrose, N. S. (1996). Dynamic contrast-enhanced MR imaging of perianal fistulas. *American Journal of Roentgenology, 167*(3), 735–741. https://doi.org/10.2214/ajr.167.3.8751692
- Sun, M. R. M., Smith, M. P., & Kane, R. A. (2008). Current techniques in imaging of fistula in ano: Three-dimensional endoanal ultrasound and magnetic resonance imaging. *Seminars in Ultrasound, CT and MRI, 29*(6), 454–471. https://doi.org/10.1053/j.sult.2008.10.006
- Tolan, D. J. M. (2016). Magnetic resonance imaging for perianal fistula. *Seminars in Ultrasound, CT and MRI, 37*(4), 313–322. https://doi.org/10.1053/j.sult.2016.04.004
- Torkzad, M. R., & Karlbom, U. (2010). MRI for assessment of anal fistula. *Insights into Imaging, 1*(2), 62–71. https://doi.org/10.1007/s13244-010-0022-y
- Varsamis, N., Tzovaras, G., Anyfantakis, D., Chrysos, E., & Samarinas, M. (2022). Perianal fistulas: A review with emphasis on preoperative imaging. *Advances in Medical Sciences, 67*(1), 114–122. https://doi.org/10.1016/j.advms.2022.01.002
- Waniczek, D., Adamczyk, T., Arendt, J., Klucewska, E., & Kozińska-Marek, E. (2011). Usefulness assessment of preoperative MRI fistulography in patients with perianal fistulas. *Polish Journal of Radiology, 76*(4), 40–44.
- Yıldırım, N., Gökalp, G., Öztürk, E., Sağlam, D., Kizilkaya, E., & Özcan, N. (2012). Ideal combination of MRI sequences for perianal fistula classification and the evaluation of additional findings for readers with varying levels of experience. *Diagnostic and Interventional Radiology, 18*(1), 11–19.
- Zhao, W.-W., Yu, J., Shu, J., Hu, W.-J., Gong, H.-Y., & Zhu, J. (2023). Precise and comprehensive evaluation of perianal fistulas, classification, and related complications using magnetic resonance imaging. *American Journal of Translational Research, 15*(5), 3674–3685.