International Journal of Medicine and Medical Research

ISSN 2413-6077, e-ISSN 2414-9985
Journal homepage: https://ijmr.com.ua/
Volume 12, No. 1. 2026
Article's History: Received: 28.12.2025; Revised: 22.04.2026; Accepted: 26.05.2026; Published: 29.05.2026.

UDC616.351-007.253-073.8-089
DOI: 10.63341/ijmmr/1.2026.44

# Evaluation of anorectal fistula using an MRI fistulogram and its correlation with intraoperative findings

**Mansuri Vahab***
Senior Resident
Gujarat Medical Education & Research Society Medical College
380060, Sola, Ahmedabad, India
https://orcid.org/0009-0006-6174-7564

**Sachin G Shatagar**
Associate Professor
Al-Ameen Medical College and Hospital
586108, Athani Rd., Bijapur, India
https://orcid.org/0009-0003-2202-2008

**Syed Athaulla**
Junior Consultantt
Sparsh Hospital
560035, Sarjapur Rd., Bengaluru, India
https://orcid.org/0009-0001-1160-8252

**Sayed Husain**
Senior Resident
Gulbarga Institute of Medical Sciences Hospital
585105, Sedam Rd., Kalaburagi, India
https://orcid.org/0009-0000-7859-8821

**Reefa Naz**
Senior Resident
Ganesh Rao Medical College
575029, Neermarga, Mangaluru, India
https://orcid.org/0009-0001-2710-3523

**Abstract.** Despite magnetic resonance imaging being the preferred modality for the preoperative assessment of *fistula-in-ano*, evidence from direct MRI-intraoperative correlation remains essential to confirm that internal openings, secondary tracts, and abscesses are accurately mapped, thereby preventing missed disease and recurrence. This study aimed to evaluate the correlation between magnetic resonance imaging findings and intraoperative observations in patients with anorectal fistulas. This prospective study was conducted at Al Amin Medical College and Hospital, including 50 patients with clinically suspected or previously diagnosed perianal fistula who underwent magnetic resonance imaging on a 1.5 Tesla scanner using T1-, T2-, short inversion recovery, and diffusion-weighted imaging sequences. Findings were analysed for fistula classification, tract location, internal openings, abscesses, and contrast enhancement. Surgical exploration findings were compared with magnetic resonance imaging results to assess correlation. The most affected age

**Suggest Citation:**
Vahab M, Shatagar SG, Athaulla S, Husain S, Naz R. Evaluation of anorectal fistula using an MRI fistulogram and its correlation with intraoperative findings. Int J Med Med Res. 2026;12(1):44–54. DOI: 10.63341/ijmmr/1.2026.43

*Corresponding author (*drvahabmansuri@gmail.com*)

groups were 31-50 years, with a male predominance (66%). Intersphincteric (42%) and transsphincteric (36%) fistulas were the most common. Magnetic resonance imaging showed single internal and external openings in 86% of patients. Associated abscesses were detected in 20%, and contrast enhancement was noted in 46%. Magnetic resonance imaging demonstrated 100% sensitivity and specificity for internal openings, 90% sensitivity for abscesses, and 76.5% sensitivity for secondary tracts. Magnetic resonance imaging findings correlated with intraoperative findings in 86% of cases. Magnetic resonance imaging is a highly effective tool for evaluating *fistula-in-ano*, showing strong concordance with surgical findings. Its routine use can significantly enhance surgical planning and reduce recurrence rates

**Keywords:** preoperative imaging; surgical correlation; perianal fistula; perianal abscess; internal opening

## Introduction

The relevance of this study arises from the high prevalence of *fistula-in-ano* and the complexity of its surgical management. Achieving a lasting result requires complete removal of the primary tract and secondary branches while preserving the function of the anal sphincter, which remains a clinical challenge. Standard examination often underestimates the complexity of the fistula, especially in cases of recurrence or deep extension. This increases the risk of persistence and repeat interventions. Therefore, improving preoperative diagnosis and accurate mapping of fistula tracts is critical for optimising surgical management and reducing the incidence of complications. Magnetic resonance imaging (MRI) has been increasingly refined as the principal imaging tool for perianal fistulas, supported by studies evaluating the added value of functional sequences, protocol optimisation, and comparisons with operative findings.

In the study by D.K. Boruah *et al.* [1], diffusion-weighted imaging (DWI) was investigated as an adjunct to conventional MRI for perianal fistula assessment. The authors emphasised that combining diffusion information with standard anatomical sequences can improve confidence in detecting inflammatory components and distinguishing active disease from less active tracts, supporting an approach in which DWI complements high-resolution T2-weighted imaging rather than replacing it. In the study by L. Soydan [2], DWI and apparent diffusion coefficient measurements were explored for assessing fistula "activity". This study highlighted the clinical value of functional imaging in characterising inflammatory burden, suggesting that diffusion metrics may help stratify disease activity when morphology alone is insufficient, which is particularly relevant when determining the timing of surgery or evaluating suspected persistent inflammation after treatment.

Protocol refinement has also focused on post-contrast imaging and the advantages of modern 3D acquisitions in complex disease. In the study by K.V. Abdulla *et al.* [3], contrastenhanced 3D T1-weighted sequences were compared with conventional 2D postcontrast imaging for perianal fistula evaluation. Their research demonstrated that 3D techniques can enhance the visualisation of surgically critical targets such as internal openings and ramifications, and highlighted the practical importance of acquisition efficiency and image conspicuity when assessing complex branching anatomy. In the study by A.H. Madany *et al.* [4], MRI was presented as central to defining fistula relationships to the sphincter complex, demonstrating its role in outlining extensions and identifying associated sepsis that may not be evident clinically. This study also highlighted a recurring problem in practice: even when MRI is performed, variability in reporting structure and completeness may limit its translation into consistent surgical decision-making across institutions.

A closely related area of investigation is the evaluation of perianal sepsis, especially abscesses that influence the urgency and extent of surgical intervention. In the study by P. Aggarwal *et al.* [5], DWI was assessed for detecting and characterising perianal abscesses, with comparison to contrast-enhanced MRI. This line of research supports the notion that diffusion-based approaches can be clinically useful for evaluating sepsis and may be particularly relevant when gadolinium administration is undesirable, while also emphasising the need to ensure that subtle secondary extensions are not missed when protocols are simplified. In the study by N.P. Narsingh *et al.* [6], preoperative MRI findings were compared with intraoperative observations in patients with anorectal fistula. Large-cohort studies have further examined how different MRI sequence combinations perform in depicting fistula characteristics and surgically relevant landmarks. In the study by Q. Tao *et al.* [7], multi-phase contrast-enhanced fat-suppressed 3D T1-weighted imaging (VIBE-based) was compared with fat-suppressed T2-weighted imaging combined with DWI in anal fistula evaluation. This research illustrates a continuing unresolved issue: the optimal balance between contrastenhanced anatomical detail and diffusion-based assessment, and whether specific sequence strategies can consistently improve the depiction of internal openings and secondary tracts across readers and institutions.

Technique innovation has also been explored to improve tract conspicuity and accessibility in different practice settings. In the study by U.K. Basavaraju *et al.* [8], magnetic resonance fistulography using percutaneous instillation of aqueous jelly was described as a method to enhance tract delineation. This approach highlights ongoing efforts to improve the visualisation of fine tracts and openings, but it also raises practical questions about standardisation, reproducibility, and comparative benefit compared with optimised conventional MRI protocols. Finally, comparative modality studies continue to inform diagnostic pathways. In the study by A.Ö. Cantürk *et al.* [9], contrast-enhanced endoanal ultrasound was compared with MRI for preoperative fistula mapping. Such research supports the concept

of complementary imaging, with ultrasound offering targeted evaluation in selected contexts, while MRI provides broader multiplanar mapping; however, it also underscores a persistent gap: how to choose the most efficient and accurate preoperative strategy across varied resource environments while maintaining reliable detection of internal openings, secondary tracts, and occult sepsis.

Taken together, recent literature establishes MRI as the primary modality for the preoperative evaluation of *fistula-in-ano*, while also revealing unresolved issues such as variability in detecting secondary extensions, heterogeneity in protocol selection (contrastenhanced versus diffusion-centred strategies), and the need for local validation of MRI reporting against operative findings using standardised classifications and clearly defined anatomical endpoints. Therefore, this study was conducted to evaluate MRI fistulogram findings in anorectal fistula, focusing on fistula classification, tract course, internal opening localisation, secondary extensions, and associated abscesses, and to compare these findings with intraoperative observations.

## Materials and Methods

This prospective cohort study was conducted in the Department of Radiodiagnosis, Al-Ameen Medical College and Hospital, Vijayapura (Bijapur), Karnataka, India, over a two-year period from 2023 to 2025. The study protocol was finalised before participant recruitment. Ethical approval was obtained from the Institutional/Local Ethics Committee of Al-Ameen Medical College and Hospital (IEC Approval No.: IEC/AMMC/2023/045, dated 11 April 2023). Written informed consent was obtained from all participants prior to enrolment. The study was conducted in accordance with the ethical principles of the World Medical Association Declaration of Helsinki [10]. Reporting and methodological transparency were aligned with internationally accepted guidance for observational studies [11].

A total of 50 consecutive patients aged ≥18 years who were clinically suspected or previously diagnosed with a perianal fistula were included. Patients were excluded if they had any non-MRI-compatible implants or devices, significant claustrophobia/MRI-related anxiety, or did not complete follow-up required for surgical correlation. Each participant underwent a standardised clinical assessment including history taking, physical examination (including local perianal examination), and baseline laboratory investigations as per institutional practice. MRI was performed on a 1.5 Tesla scanner using a four-channel phased-array body coil. Imaging planes were planned with reference to the anal canal axis to optimise depiction of the sphincter complex and fistula course. The protocol included axial T1-weighted imaging, coronal T2-weighted imaging, short tau inversion recovery (STIR) imaging, and DWI acquired using b-values of 0, 500, 1,000, and 1,500 s/mm$^2$. In cases where presacral or higher extension was suspected clinically or on initial images, additional sagittal T1-weighted sequences were obtained. Intravenous gadolinium contrast and endorectal coils were not used in this study. The MRI protocol used for fistulography is presented in Table 1. Disease severity was categorised using the St James's University Hospital MRI grading system [12].

**Table 1.** MRI protocol used for fistulography

| MRI sequences | Non-contrast scans | | Non-contrast fatsuppressed scans | | Contrast-enhanced fatsuppressed scans |
|---|---|---|---|---|---|
| | T1W FSE | T2W FSE | FS T1W FSE | FS T2W FSE | FS T1W FSE with 3D reconstruction |
| **Imaging plane** | Axial and coronal | Sagittal, axial, coronal | Axial and coronal | Sagittal, axial, coronal | Sagittal, axial, coronal |
| **TR/ TE** (ms) | 633 / 11 | 5,040 / 113 | 766 / 11 | 6,320 / 116 | 500 / 11 |
| **FOV** | 345 × 345 | 346 × 346 | 347 × 347 | 347 × 347 | 300 × 300 |
| **Section thickness** (mm) | 6 mm | 6 mm | 6 mm | 6 mm | 6 mm |
| **Matrix** | 512*512 | 512*512 | 512*512 | 512*512 | 512*512 |

**Note:** FSE – fast spin echo; T1W/T2W – T1-weighted/T2-weighted; FS – fat suppressed; TR – repetition time; TE – echo time; FOV – field of view
**Source:** compiled by authors

All MRI examinations were interpreted by a radiologist experienced in pelvic MRI. The radiologist documented the fistula type and classification (based on its relationship to the sphincter complex), the location of the internal opening (including its position relative to the anal canal), and the presence of secondary tracts/ramifications and abscesses/collections. Imaging features suggestive of active inflammation were assessed using STIR signal and diffusion restriction patterns. Findings were recorded in a structured format to facilitate comparison with operative findings. Surgical intervention was performed in most cases within one week following MRI, with a median interval of one day between imaging and surgery. Intraoperative findings were documented by the operating surgeon, in-

cluding the fistula course, internal opening site, presence of secondary tracts, and associated abscesses. MRI findings were compared with intraoperative observations (reference standard) to assess diagnostic concordance for internal opening localisation, secondary tract detection, and abscess identification. Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics (Version 26). Continuous variables were summarised using the mean and standard deviation or range, where appropriate, while categorical variables were presented as frequencies and percentages. Associations between categorical variables were evaluated using the chi-squared test. A p-value $< 0.05$ was considered statistically significant, whereas $p < 0.001$ was considered highly significant where applicable.

## Results

A total of 50 patients with clinically suspected or previously diagnosed *fistula-in-ano* were evaluated using MRI fistulography, and imaging findings were correlated with intraoperative observations whenever surgery was performed. The cohort demonstrated a typical epidemiological profile for *fistula-in-ano*, with a predominance in mid-adulthood and a higher frequency in males. However, beyond demographic patterns, the results highlighted a clinically important finding: patients diagnosed with clinically uncomplicated disease based on initial clinical examination may in fact have more extensive lesions, abscesses, or secondary branches. In this context, MRI plays a key role in preoperative detection.

The age distribution showed a clear concentration in the middle decades of life. Patients aged 31-40 years (34%) and 41-50 years (32%) together comprised nearly two-thirds of the cohort, indicating that the disease burden peaked in the third to fifth decades. Fewer patients were observed at the extremes of age (<30 years and >60 years), implying relatively lower disease occurrence in younger and older groups. This distribution is relevant because mid-adulthood is often associated with delayed presentation after recurrent perianal sepsis, increasing the likelihood of tract maturation, branching, or occult collections that benefit from detailed imaging. A male predominance was observed (66% male, 34% female). While this confirms that *fistula-in-ano* was more frequent among men in this cohort, subsequent analyses showed that sex did not significantly influence key MRI indicators such as contrast enhancement or grade distribution. Thus, sex appeared more reflective of disease occurrence than of disease activity or complexity in those affected.

Clinical inspection showed that single internal and external openings were present in 86% of patients, implying that most patients presented with a single dominant pathway rather than multiple external exits. This finding can create an impression of clinically uncomplicated disease; however, MRI grading demonstrates that a substantial proportion already exhibit transsphincteric or more complex patterns, reinforcing the need for imaging even when clinical examination suggests a straightforward tract. The distribution of openings and the predominance of single openings are illustrated in Figure 1, which supports the observation that most cases did not present with multiple cutaneous exit points.

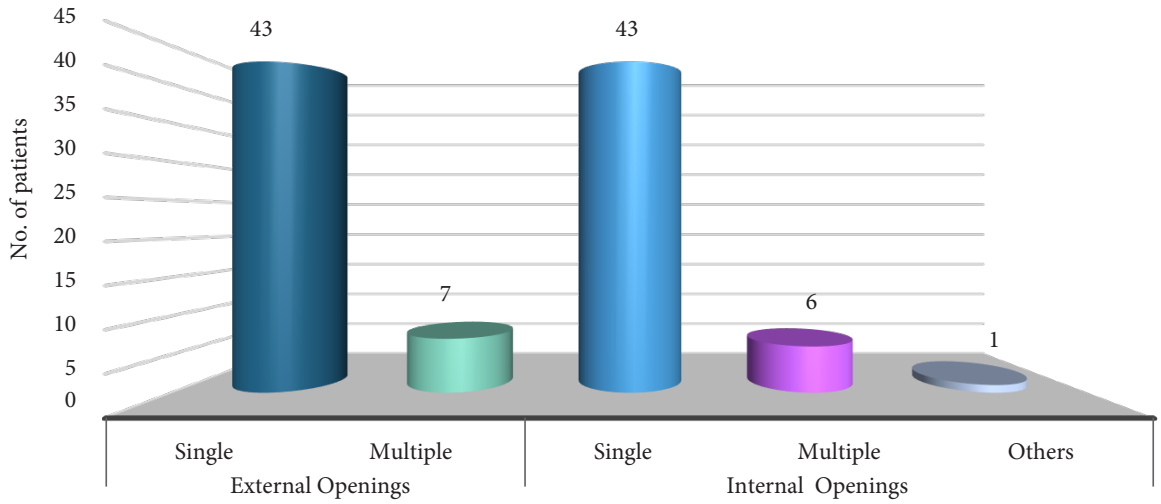


**Figure 1.** Distribution of fistula openings

**Source:** compiled by authors

The location of external openings demonstrated a strong posterior tendency. Most external openings were located at the 4-6 o'clock positions (58.1%), indicating posterior quadrant predominance (Fig. 2). This pattern is clinically meaningful because posterior tracts may extend deeply and curve around sphincteric planes, and they may be associated with concealed sepsis that is not readily apparent on digital rectal examination. Although multiple openings were infrequent, they tended to occur in association with more advanced disease, consistent with the clinical concept that multiple external openings frequently represent branching, chronicity, or recurrent sepsis rather than early uncomplicated fistula.

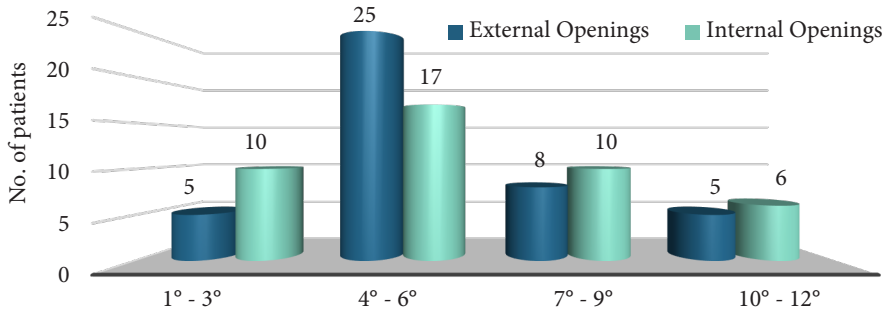


**Figure 2.** Clock-face distribution of fistula openings

**Source:** compiled by authors

Regarding tract anatomy, intersphincteric fistulas were the most common subtype (42%), confirming that the intersphincteric plane remains the dominant route of spread in many patients. From an operative standpoint, intersphincteric disease is often amenable to sphincteraparing techniques, and MRI mapping helps define tract location, height, and internal opening position. However, the cohort also included a considerable proportion of tracts extending beyond the intersphincteric plane, indicating that a meaningful fraction of patients already had transsphincteric or higher-grade disease. This mixture of simple and complex patterns underscores why reliance on clinical impression alone can result in underestimation of disease extent. MRI detected associated abscesses in 20% of patients (Fig. 3). This is a key clinical finding because undrained abscesses and missed septic foci are major contributors to persistent symptoms and postoperative recurrence. Abscess detection on MRI therefore provides direct, actionable information for operative planning, prompting careful drainage and exploration for related extensions.

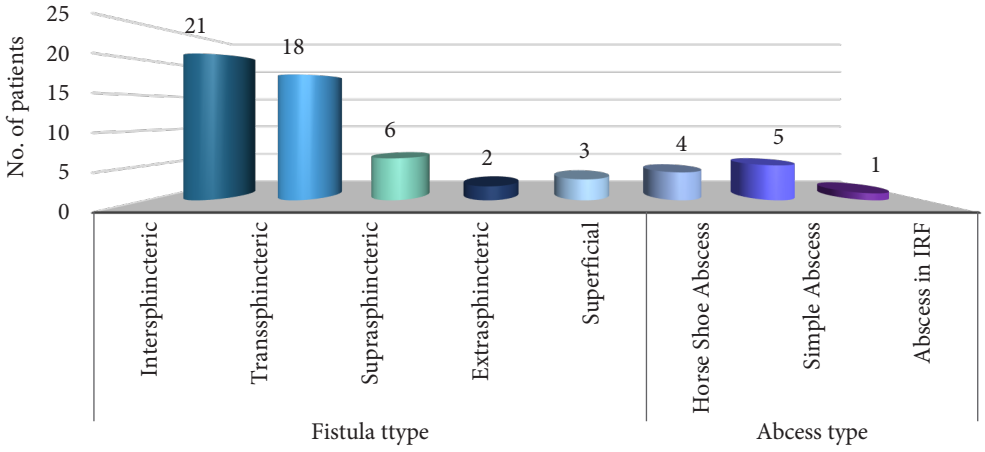


**Figure 3.** Types of fistula tracts and associated abscesses on MRI

**Source:** compiled by authors

Inflammatory activity was assessed using contrast enhancement, which was present in 46% of cases and absent in 54%. Enhancement is clinically relevant because it often reflects active inflammation or granulation tissue and may signal ongoing disease activity rather than inactive fibrotic tracts. The demographic breakdown of enhancement showed a statistically significant association between age and enhancement (p = 0.0456, Table 2). The 31-40-year group demonstrated the highest relative proportion of enhancing disease, suggesting that patients in this age band were more likely to present with active inflammatory fistulas rather than quiescent chronic tracts. In contrast, older age groups showed relatively more non-enhancing disease, which may reflect chronic fibrosis or less active inflammation. Importantly, no significant sex-based difference in enhancement was found (p = 0.9141, Table 2), reinforcing that inflammatory activity on MRI was not dependent on sex within this cohort.

**Table 2.** Contrast enhancement findings by demographics

| Demographics | | Present (n, %) | Absent (n, %) | p-value |
|---|---|---|---|---|
| Sex | Male | 15 (30.0) | 18 (36.0) | X = 0.1163 |
| | Female | 8 (16.0) | 9 (18.0) | p = 0.9141 |

Continued Table 2

| Demographics | | Present (n, %) | Absent (n, %) | p-value |
|---|---|---|---|---|
| Age | <30 | 2 (4.0) | 4 (8.0) | X = 9.709 **p = 0.0456*** |
| | 31-40 | 13 (26.0) | 4 (8.0) | |
| | 41-50 | 5 (10.0) | 11 (22.0) | |
| | 51-60 | 2 (4.0) | 5 (10.0) | |
| | >60 | 1 (2.0) | 3 (6.0) | |

**Note:** *p < 0.05 was considered statistically significant. The chi-squared test was used to assess the association between demographic variables and contrast enhancement findings
**Source:** compiled by authors

Disease severity was categorised using the St James's University Hospital MRI grading system [12]. Grade I (34%) and Grade III (26%) were the most prevalent grades (Table 3). This distribution is clinically important: Grade I reflects uncomplicated intersphincteric disease, whereas Grade III reflects transsphincteric involvement, representing a step-up in anatomical complexity and potential surgical risk. The relatively high proportion of Grade III cases indicates that a substantial subset of patients had fistulas that traverse sphincteric structures, making accurate mapping essential to avoid iatrogenic sphincter injury and to plan appropriate sphincter-preserving approaches.

**Table 3.** MRI classification of fistula tracts (St James's classification)

| Grade | Frequency (n = 50) | Percentage (%) |
|---|---|---|
| **I** | 17 | 34.0 |
| **II** | 9 | 18.0 |
| **III** | 13 | 26.0 |
| **IV** | 7 | 14.0 |
| **V** | 4 | 8.0 |

**Source:** compiled by authors

No statistically significant association was found between St James's grade and age (p = 0.4347) or between grade and sex (p = 0.3006) (Table 4). In other words, neither age group nor sex reliably predicted fistula complexity on MRI. This is clinically relevant because it supports the use of MRI across all demographic categories rather than limiting imaging to selected groups. In contrast, a strong association between grade and contrast enhancement was identified (p < 0.0001). This finding indicates that more complex fistulas were more likely to demonstrate enhancement, aligning with the concept that advanced disease often carries a greater inflammatory burden, larger tract volume, recurrent infection, and more frequent secondary sepsis.

**Table 4.** Correlation of St James's grade with sex, contrast enhancement, and age

| Grade | Male (n, %) | Female (n, %) | Present (n, %) | Absent (n, %) | <30 (n, %) | 31-40 (n, %) | 41-50 (n, %) | 51-60 (n, %) | >60 (n, %) |
|---|---|---|---|---|---|---|---|---|---|
| | Sex | | Contrast | | Age | | | | |
| **I** | 11 (22.0) | 6 (12.0) | 2 (4.0) | 15 (30.0) | 2 (4.0) | 3 (6.0) | 7 (14.0) | 3 (6.0) | 2 (4.0) |
| **II** | 4 (8.0) | 5 (10.0) | 8 (16.0) | 1 (2.0) | 0 (0.0) | 5 (10.0) | 2 (4.0) | 1 (2.0) | 1 (2.0) |
| **III** | 10 (20.0) | 3 (6.0) | 3 (6.0) | 10 (20.0) | 3 (6.0) | 2 (4.0) | 6 (12.0) | 1 (2.0) | 1 (2.0) |
| **IV** | 4 (8.0) | 3 (6.0) | 7 (14.0) | 0 (0.0) | 0 (0.0) | 5 (10.0) | 1 (2.0) | 1 (2.0) | 0 (0.0) |
| **V** | 4 (8.0) | 0 (0.0) | 3 (6.0) | 1 (2.0) | 0 (0.0) | 1 (2.0) | 1 (2.0) | 1 (2.0) | 1 (2.0) |
| **p-value** | X = 4.873; p = 0.3006 | | X = 27.01; p < 0.0001* | | X = 16.26; p = 0.4347 | | | | |

**Note:** *p < 0.05 was considered statistically significant
**Source:** compiled by authors

Complexity-related features increased with grade. Among Grade II-V fistulas, 20% had associated abscesses and 26% demonstrated secondary tracts (Table 5). The absence of abscesses in Grade I cases supports the interpretation that uncomplicated intersphincteric fistulas are less likely to harbour established sepsis, whereas higher grades require careful evaluation for collections. Secondary tracts were most frequently seen in Grade III fistulas, suggesting that once the tract extends transsphincterically, the opportunity for lateral or superior extension increases, making Grade III an important "transition" category between simple and complex disease.

**Table 5.** Correlation of fistula severity with abscess and tract presence

| Grade | Abscess present (n, %) | Secondary tract present (n, %) |
|---|---|---|
| I | 0 (0.0) | 2 (4.0) |
| II | 2 (4.0) | 3 (6.0) |
| III | 3 (6.0) | 4 (8.0) |
| IV | 3 (6.0) | 2 (4.0) |
| V | 2 (4.0) | 2 (4.0) |

**Source:** compiled by authors

MRI demonstrated 100% sensitivity and 100% specificity for detecting internal openings, which indicates their reliable identification without false-positive results. This is of great practical importance, since an undetected internal opening is the main cause of recurrence. For abscesses, MRI showed 90% sensitivity and 100% specificity (Table 6), indicating high reliability of the method and a low rate of missed collections. For secondary tracts, the sensitivity was 76.5% with a specificity of 100%: the branches detected by MRI were reliable, but some small or intermittently patent secondary tracts could only be identified intraoperatively, which emphasises the complementary role of surgical exploration. Although ideal values (100%) are rare, they are possible in the absence of misclassification, especially with small samples. At the same time, 95% confidence intervals remain wide, particularly for specificity, due to the limited number of true negative cases (e.g. 7 TN), which necessitates cautious generalisation of the results despite the high observed efficacy.

**Table 6.** Diagnostic accuracy of MRI for fistula evaluation

| Feature | TP | FP | FN | TN | Sensitivity (%) | Specificity (%) | Positive predictive value (%) | Negative predictive value (%) |
|---|---|---|---|---|---|---|---|---|
| Secondary tracts | 13 | 0 | 4 | 33 | 76.5 | 100.0 | 100.0 | 89.2 |
| Abscess detection | 9 | 0 | 1 | 40 | 90.0 | 100.0 | 100.0 | 97.6 |
| Internal openings | 43 | 0 | 0 | 7 | 100.0 | 100.0 | 100.0 | 100.0 |

**Note:** TP – true positive; FP – false positive; FN – false negative; TN – true negative
**Source:** compiled by authors

Grade-wise concordance between MRI and surgery remained strong (Table 7), indicating that MRI grading generally aligned well with operative findings across the severity spectrum. Minor reductions in specificity at certain grades likely reflected borderline interpretative findings or the inherent difficulty of distinguishing subtle extensions in early disease, whereas more complex grades tended to show clearer imaging patterns and strong surgical agreement.

**Table 7.** MRI and surgical concordance by fistula grade

| Grade | MRI detected (n, %) | Surgical concordant (n, %) | Not operated (n, %) | TP | FP | FN | TN | Sensitivity (%) | Specificity (%) |
|---|---|---|---|---|---|---|---|---|---|
| I | 17 (34.0) | 13 (26.0) | 1 (2.0) | 13 | 4 | 0 | 33 | 100 | 89.2 |
| II | 9 (18.0) | 9 (18.0) | 0 (0.0) | 9 | 0 | 0 | 41 | 100 | 100 |
| III | 13 (26.0) | 12 (24.0) | 1 (2.0) | 12 | 1 | 0 | 37 | 100 | 97.4 |
| IV | 7 (14.0) | 7 (14.0) | 0 (0.0) | 7 | 0 | 0 | 43 | 100 | 100 |
| V | 4 (8.0) | 3 (6.0) | 1 (2.0) | 3 | 1 | 0 | 45 | 100 | 97.8 |

**Note:** TP – true positive; FP – false positive; FN – false negative; TN – true negative
**Source:** compiled by authors

In this cohort, *fistula-in-ano* predominantly affected middle-aged adults and occurred more frequently in males. While many patients appeared to have single-opening disease, MRI demonstrated a meaningful burden of higher-grade fistulas, abscesses, and secondary extensions that could alter surgical strategy. Contrast enhancement was significantly related to age and strongly associated with higher MRI grades, supporting its value as a marker of active and complex disease. Overall, MRI fistulography showed excellent performance for internal opening identification and abscess detection and provided reliable preoperative mapping to guide surgery and reduce the risk of missed disease.

## Discussion

*Fistula-in-ano* is anatomically heterogeneous, ranging from simple intersphincteric tracts to complex disease with secondary extensions, horseshoe components, supralevator spread, and abscess formation. Because recurrence is most commonly driven by failure to identify the true internal opening and occult secondary pathways, preoperative delineation of fistula anatomy is essential for selecting an

appropriate operative approach and for minimising avoidable sphincter injury. Although clinical examination and examination under anaesthesia remain important, these approaches may under-recognise deep intersphincteric extensions, high transsphincteric tracts, or small collections – particularly in recurrent or scarred disease – thereby creating a rationale for MRI-based mapping.

MRI is currently regarded as the most informative imaging modality for perianal fistulas because it depicts the sphincter complex and fistulous tracts with high soft-tissue contrast in multiple planes. This aligns with the observations of G.N. Buchanan *et al*. [13] and I.J. Beckingham *et al.* [14], who emphasised MRI's ability to define tract course, internal openings, and associated inflammation in a manner that is directly actionable for surgeons. MRI also supports the planning of sphincter-sparing strategies by clarifying the relationship of the tract to the internal and external sphincters, which is often difficult to establish confidently with clinical assessment alone. The present findings, showing substantial agreement between MRI and operative assessment for key anatomical targets, therefore align with the expected global trend rather than diverging from it. The clinically decisive advantage of MRI lies in revealing disease elements that change surgical management, including secondary tracts, horseshoe extensions, and abscesses. High concordance for these components has been reported in large operative-correlation cohorts. For example, D. Vo *et al*. [15] documented very high agreement between MRI and intraoperative findings across a large patient series, with particularly strong performance for internal opening localisation and abscess detection. The present study similarly demonstrated meaningful MRI-operative alignment for these endpoints, supporting the concept that MRI functions as a "surgical roadmap" rather than merely a diagnostic test. In addition, the distribution of occult disease elements detected in the present cohort is comparable to findings from regional cohorts. H.R. Jat *et al.* [16] reported similar frequencies of secondary tracts and abscesses in a 50-patient study, supporting the reproducibility of MRI-based detection in routine practice settings.

At the same time, some performance differences relative to the larger literature warrant explanation to provide a balanced interpretation. Secondary tract sensitivity in the present cohort was lower than in some high-volume studies, including those of D. Vo *et al*. [15] and prospective series discussed by P. Garg *et al*. [17]. Several factors could account for this discrepancy without contradicting MRI's overall utility. First, patient mix strongly influences secondary tract prevalence and detectability; cohorts enriched with recurrent disease or highercomplexity fistulas tend to yield higher rates of ramifications and therefore may report higher apparent detection, while more typical mixed outpatient cohorts may include fewer complex branches. Second, MRI protocol design affects conspicuity: studies that routinely incorporate contrast-enhanced fat-suppressed T1-weighted sequences, 3D acquisitions, or tailored high-resolution approaches may better depict fine ramifications than conventional noncontrast protocols. This is consistent with observations by I.J. Beckingham *et al.* [14], who noted that contrast can help distinguish active inflammation from fibrosis, and with later study by B.A. Kumar *et al.* [18], who reported improved depiction of specific complex features using enhanced sequences. Third, sample size may contribute; smaller cohorts inherently produce wider variability in sensitivity estimates compared with multi-hundred-patient datasets, making modest differences plausible even when imaging quality is high. The potential incremental value of diffusion-based techniques in improving tract conspicuity has also been highlighted. S.M. Abd-Elwahab *et al*. [19] reported improved diagnostic performance when MR fistulography was combined with DWI, supporting the view that advanced sequences may be particularly helpful for subtle secondary branches or complex inflammatory disease.

The present article also supported the practical value of structured MRI-based grading for standardised communication. The St James's University Hospital MRI classification [12] is widely used because it summarises sphincter involvement and the presence of complications in a manner that is useful for surgical planning. H. Sarda *et al.* [20] reported strong agreement between St James's grading and operative assessment, particularly in higher grades where clinical evaluation is least reliable, while B.A. Kumar *et al.* [18] similarly reported statistically significant MRI-surgical correlation in complex fistulas. The observed agreement in the present cohort reinforces the utility of structured classification for aligning radiological description with operative decision-making. However, discrepancies may still occur in advanced disease, where fibrosis, oedema, and postoperative scarring can obscure subtle branches or where operative assessment may underestimate deep extensions that are better appreciated on multiplanar imaging. These limitations highlight the need for structured reporting and systematic surgical exploration rather than suggesting any fundamental weakness of MRI.

Comparative evidence also clarified why MRI is consistently preferred over alternative modalities for complex disease. Studies by S.M. Hussain *et al*. [21] and A.G. Maier *et al*. [22] have reported MRI superiority over endoanal ultrasound for defining the full tract course, sphincter relationships, and deep extensions, while N. Tripathi *et al.* [23] noted that conventional fistulography may miss internal openings and ramifications, limiting its usefulness in surgical planning. Reports such as S.S. Patil & R.S. Tathode [24] further emphasised that MRI-guided mapping can assist in selecting the appropriate operative pathway in higher-grade fistulas, especially where abscess drainage or identification of hidden extensions alters the surgical plan. Together, this body of studies supports the interpretation that MRI's advantage lies not only in detection but also in reproducible anatomical mapping across planes and compartments. Methodological considerations must also be acknowledged when interpreting concordance. Single-radiologist interpretation may introduce observer bias, and

lack of surgeon blinding to MRI findings may inflate agreement because operative exploration can be guided by preoperative imaging. These limitations have been recognised in operative-correlation designs, including those discussed by D. Vo *et al.* [15] and H. Sarda *et al.* [20]. Additionally, timing between imaging and surgery can affect detection of collections if sepsis evolves between assessments, particularly for small abscesses. Such factors help explain why concordance rates vary across studies even when MRI is widely accepted as the most informative modality.

Thus, MRI provides dependable preoperative anatomical mapping for *fistula-in-ano*, with strong alignment to operative findings for primary tract characterisation and internal opening localisation. Differences from some larger or contrast-enhanced series were most apparent in secondary tract depiction and can be reasonably attributed to protocol differences, case mix, and study design rather than to inconsistency with the broader evidence base. These findings support the continued routine use of MRI for operative planning and underscore the value of standardised MRI protocols and structured reporting. A clear implication is that optimising sequence selection – particularly through selective incorporation of advanced diffusion-based or contrast-enhanced techniques where appropriate – and improving reporting consistency may further enhance detection of subtle secondary extensions and small collections, thereby strengthening surgical precision and reducing recurrence risk.

## Conclusions

In this prospective cohort study of 50 patients with clinically suspected or previously diagnosed *fistula-in-ano*, MRI fistulogram provided accurate preoperative delineation of fistula anatomy. Analysis showed that intersphincteric fistulas were the most common subtype (42%). It was demonstrated that most patients presented with a single dominant pathway, as single internal and external openings were identified in 86% of cases; however, MRI identified additional surgically relevant complexity in a subset of patients, including associated abscesses (20%) and secondary tracts, which can directly influence operative strategy. MRI-surgical correlation was available in 43 patients (86%), and MRI demonstrated high diagnostic accuracy for the most critical surgical endpoint: internal opening localisation showed 100% sensitivity and 100% specificity. It was also found that abscess detection showed 90% sensitivity and 100% specificity, supporting MRI's value in identifying sepsis requiring targeted drainage. For secondary tracts, MRI demonstrated 76.5% sensitivity and 100% specificity, indicating high reliability when secondary extensions were detected, while also emphasising that very small or intermittently patent branches may still be revealed intraoperatively. Further research should focus on larger multicentre cohorts with standardised reporting and blinded image interpretation to validate diagnostic performance across different settings. Comparative evaluation of optimised MRI protocols, including diffusion-weighted and contrast-enhanced sequences, is warranted to determine whether secondary tract detection and grading accuracy can be further improved, particularly in complex and recurrent fistulas.

## Acknowledgements

None.

## Funding

This research received no financial support from any funding agency, commercial entity, or organisation.

## Conflict of Interest

The authors declare that there are no conflicts of interest related to this study.

## References

[1] Boruah DK, Hazarika K, Ahmed H, Borah KK, Borah S, Malakar S, et al. Role of diffusion-weighted imaging in the evaluation of perianal fistulae. Indian J Radiol Imaging. 2021;31(1):91–101. DOI: 10.1055/s-0041-1729673

[2] Soydan L. Evaluation of activity of perianal fistulas by diffusion-weighted imaging. Turk J Colorectal Dis. 2022;32(4):245–51. DOI: 10.4274/tjcd.galenos.2022.2021-12-15

[3] Abdulla KV, Arunachalam VK, Sherene H, Ethiraju V, Ranganathan R, Gowtham SM, et al. Comparison of contrast-enhanced 3D T1-weighted imaging with conventional 2D contrast-enhanced MRI in the evaluation of complex perianal fistulas. Indian J Radiol Imaging. 2024;34(1):95–102. DOI: 10.1055/s-0043-1775738

[4] Madany AH, Murad AF, Kabbash MM, Ahmed HM. Magnetic resonance imaging in the workup of patients with perianal fistulas. Egypt J Radiol Nucl Med. 2023;54:50. DOI: 10.1186/s43055-023-00975-5

[5] Aggarwal P, Malik R, Sarawagi R, Kumar A, Sharma J. Diffusion-weighted MRI in perianal abscess: Role and comparison with contrast-enhanced MRI. Cureus. 2024;16(4):e59035. DOI: 10.7759/cureus.59035

[6] Narsingh NP, Goswami V, Sharma R. Assessment of clinical MRI and intraoperative findings in cases of anorectal fistula. J Pharm Bioallied Sci. 2024;16(4):S3992–5. DOI: 10.4103/jpbs.jpbs_1412_24

[7] Tao Q, Tang Y, Luo Y, Li D, Lu R, Zheng Z, et al. Comparison of multi-phase contrast-enhanced T1-weighted volumetric interpolated breath-hold examination and fat-suppressed T2-weighted combined with diffusion-weighted magnetic resonance imaging in anal fistula evaluation. Quant Imaging Med Surg. 2024;14(12):8629–43. DOI: 10.21037/qims-24-490

[8] Basavaraju UK, Ravate Patil SS, Manupratap N, Tejesh B, Shamasundara ST, Reuben L. Magnetic resonance fistulography with percutaneous jelly: A novel and cost-effective technique. SA J Radiol. 2025;29(1):a3166. DOI: 10.4102/sajr.v29i1.3166

[9] Cantürk AÖ, Demir H, Eröz E, Körmen A, Bacak E, Gönüllü E, et al. Real-time contrast-enhanced endoanal ultrasound vs. MRI in perianal fistula: Which modality leads to better surgical mapping? Laparosc Endosc Surg Sci. 2025;32(3):105–11. DOI: 10.14744/less.2025.35555
[10] The World Medical Association. Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects [Internet]. [cited 2025 Nowember 13]. Available from: https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/
[11] von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. Lancet. 2007;370(9596):1453–7. DOI: 10.1016/S0140-6736(07)61602-X
[12] Morris J, Spencer AJ, Ambrose NS. MR imaging classification of perianal fistulas and its implications for patient management. RadioGraphics. 2000;20(3):623–35. DOI: 10.1148/radiographics.20.3.g00mc15623
[13] Buchanan GN, Halligan S, Williams AB, Cohen CRG, Tarroni D, Phillips RKS, et al. Magnetic resonance imaging for primary *fistula in ano*. Br J Surg. 2003;90(7):877–81. DOI: 10.1002/bjs.4125
[14] Beckingham IJ, Spencer JA, Ward J, Dyke GW, Adams C, Ambrose NS. Prospective evaluation of dynamic contrast enhanced magnetic resonance imaging in the evaluation of *fistula in ano*. Br J Surg. 1996;83(10):1396–8. DOI: 10.1002/bjs.1800831022
[15] Vo D, Phan C, Nguyen L, Le H, Nguyen T, Pham H. The role of magnetic resonance imaging in the preoperative evaluation of anal fistulas. Sci Rep. 2019;9:17947. DOI: 10.1038/s41598-019-54441-2
[16] Jat HR, Patel N, Barath S, Yadav P. Role of MRI in the diagnosis and pre-operative classification of perianal and anal fistulas – a cross-sectional study, Southern Rajasthan. J Evid Based Med Healthc. 2021;8(33):3156–62. DOI: 10.18410/jebmh/2021/574
[17] Garg P, Singh P, Kaur B. Magnetic Resonance Imaging (MRI): Operative findings correlation in 229 *fistula-in-ano* patients. World J Surg. 2017;41(6):1618–24. DOI: 10.1007/s00268-017-3886-x
[18] Kumar BA, K RR, Naik RR, Ponnam S. Role of MR fistulogram in preoperative assessment of anorectal fistulas and its correlation with intraoperative findings. Int J Med Pub Health. 2025;15(2):1332–9. DOI: 10.70034/ijmedph.2025.2.240
[19] Abd-Elwahab SM, Mohamed AO, Abdelhamid NA, Negm MA. Role of MR fistulography combined with diffusion-weighted magnetic resonance imaging in evaluation of perianal fistula. Egypt J Hosp Med. 2023;90(2):2945–51. DOI: 10.21608/ejhm.2023.287847
[20] Sarda H, Pandey A, Regmi S, Masood S. Magnetic resonance imaging for fistulography in perianal fistula: Clinicoradiological correlation. Int Surg J. 2022;9(9):1553–7. DOI: 10.18203/2349-2902.isj20222094
[21] Hussain SM, Stoker J, Schouten WR, Hop WC, Laméris JS. *Fistula in ano*: Endoanal sonography versus endoanal MR imaging in classification. Radiology. 1996;200(2):475–81. DOI: 10.1148/radiology.200.2.8685344
[22] Maier AG, Funovics MA, Kreuzer SH, Herbst F, Wunderlich M, Teleky BK, et al. Evaluation of perianal sepsis: Comparison of anal endosonography and magnetic resonance imaging. J Magn Reson Imaging. 2001;14(3):254–60. DOI: 10.1002/jmri.1181
[23] Tripathi N, Chavan S, Bendre M, Sharma V. Comparative study of MRI fistulogram and X-ray fistulography with operative findings: In *fistula in ano*. Int Surg J. 2019;6(5):1704–9. DOI: 10.18203/2349-2902.isj20191894
[24] Patil SS, Tathode RS. Role of MR fistulogram in preoperative assessment of anorectal fistulas and its correlation with intraoperative findings. Int J Radiol Diagn Imaging. 2020;3(1):210–4. DOI: 10.33545/26644436.2020.v3.i1c.78

# Оцінка аноректальної фістули за допомогою МРТ-фістулограми та її корекція з урахуванням інтраопераційних даних

**Мансурі Вахаб**
Старший ординатор
Медичний коледж Товариства медичної освіти та досліджень штату Гуджарат
380060, Сола, м. Ахмедабад, Індія
https://orcid.org/0009-0006-6174-7564

**Сачін Г Шатагар**
Доцент
Медичний коледж і лікарня Аль-Амін
586108, дор. Атані, м. Біджапур, Індія
https://orcid.org/0009-0003-2202-2008

**Саєд Атаулла**
Молодший консультант
Лікарня «Спарш»
560035, дор. Сарджапур, м. Бангалор, Індія
https://orcid.org/0009-0001-1160-8252

**Саєд Хусайн**
Старший ординатор
Лікарня Інституту медичних наук Гульбарги
585105, дор. Седам, м. Калабурагі, Індія
https://orcid.org/0009-0000-7859-8821

**Ріфа Наз**
Старший ординатор
Медичний коледж імені Ганеш Рао
575029, Нермарга, м. Мангалуру, Індія
https://orcid.org/0009-0001-2710-3523

**Анотація.** Незважаючи на те, що магнітно-резонансна томографія є кращим методом для передопераційної оцінки анальної фістули, дані прямої магнітно-резонансної томографії та інтраопераційної кореляції залишаються необхідними для підтвердження точного відображення внутрішніх отворів, вторинних проходів та абсцесів, щоб запобігти несвоєчасній діагностиці та рецидиву. Метою цього дослідження було оцінити кореляцію між результатами магнітно-резонансної томографії та інтраопераційними спостереженнями у пацієнтів з аноректальними фістулами. Це проспективне дослідження було проведено в Медичному коледжі та лікарні Аль-Амін з 50 пацієнтами з клінічно підозрюваною або раніше діагностованою періанальною фістулою, яким було проведено магнітно-резонансну томографію на сканері 1,5 Тесла з використанням послідовностей T1, T2, короткого відновлення інверсії та дифузійно-зваженої візуалізації. Результати були проаналізовані з метою класифікації фістул, визначення місця розташування тракту, внутрішніх отворів, абсцесів та контрастного підсилення. Результати хірургічного дослідження були порівняні з результатами магнітно-резонансної томографії для встановлення кореляції. Найбільш ураженими віковими групами були 31-50 років, з переважанням чоловіків (66 %). Найбільш поширеними були міжсфінктерні (42 %) та транссфінктерні (36 %) фістули. Магнітно-резонансна томографія показала поодинокі внутрішні та зовнішні отвори у 86 % пацієнтів. Супутні абсцеси були виявлені у 20 %, а контрастне підсилення було відзначено у 46 %. Магнітно-резонансна томографія продемонструвала 100 % чутливість і специфічність для внутрішніх отворів, 90 % чутливість для абсцесів і 76,5 % для вторинних проходів. Результати магнітно-резонансної томографії корелювали з інтраопераційними результатами в 86 % випадків. Магнітно-резонансна томографія є високоефективним інструментом для оцінки анальних фістул, демонструючи високу узгодженість з хірургічними результатами. Її регулярне використання може значно поліпшити планування хірургічного втручання та зменшити частоту рецидивів

**Ключові слова:** передопераційна візуалізація; хірургічна кореляція; періанальна фістула; періанальний абсцес; внутрішній отвір