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Research Article

DIAGNOSTIC ACCURACY OF MR FISTULOGRAM IN THE EVALUATION OF PERIANAL FISTULAS: CORRELATION WITH SURGICAL FINDINGS

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ABSTRACT

Background: Perianal fistulas are complex anorectal disorders characterized by abnormal tracts between the anal canal and perianal skin, often with secondary extensions and hidden openings. Accurate preoperative mapping is crucial for successful surgical treatment and to prevent recurrence. While MRI fistulography is emerging as the gold standard imaging modality, its diagnostic accuracy must be validated against intraoperative findings.

Aim: To evaluate the diagnostic accuracy of MR fistulogram in detecting the anatomical details of perianal fistulas, and to correlate its findings with surgical observations.

Methods: This prospective observational study was conducted on 70 patients with clinically diagnosed perianal fistulas at Rabindranath Tagore Medical College, Udaipur, between January 2024 and July 2025. All patients underwent preoperative MR fistulography followed by definitive surgical management. MRI findings were assessed for external and internal openings, secondary tracts, abscesses, and classified according to Parks and St. James's systems. Surgical findings served as the reference standard. Diagnostic parameters such as sensitivity, specificity, and kappa agreement were calculated.

Results: The majority of patients were males (82.8%) with a mean age of 35.6 years. Intersphincteric fistulas were most common (75.7%). MR fistulogram showed high sensitivity and specificity for detecting internal openings (85.2% and 100%, respectively) and external openings (85.7% and 100%, respectively). MRI identified more abscesses (22.8%) than surgical exploration (12.8%), with moderate agreement ($\kappa = 0.47$). Almost perfect agreement was observed for St. James grading ($\kappa = 0.94$) and internal openings ($\kappa = 0.82$), while external openings showed substantial agreement ($\kappa = 0.72$).

Conclusion: MR fistulography is a highly accurate, non-invasive modality for evaluating perianal fistulas. It demonstrates strong concordance with surgical findings for key anatomical features, especially internal and external openings and fistula grading. MRI should be routinely incorporated into the preoperative workup of both simple and complex perianal fistulas to improve surgical outcomes and reduce recurrence rates.

Keywords: *Perianal fistula, MR fistulogram, Fistula-in-ano, Surgical correlation, Abscess detection.*

INTRODUCTION

Perianal (anorectal) fistulas are abnormal tracts between the anal canal and perianal skin, usually arising as a complication of anorectal abscesses or cryptoglandular infection [1]. They are relatively uncommon (around 1 in 10,000 people) but carry a high recurrence rate and significant morbidity if not fully treated [2]. Fistulas often involve multiple secondary branches and deep extensions through the sphincter complex. The chronic inflammation can lead to persistent discharge, pain, and even fecal incontinence, especially if internal openings or hidden tracts are missed during therapy

[3]. Because of this complexity, precise anatomical mapping is crucial: failure to identify all fistula components often causes surgical failure or recurrence [4].

Limitations of Conventional Assessment

Clinical examination—using digital rectal exam or examination under anesthesia (EUA)—is the traditional first step, but it has well-known limitations. Pain, swelling and scarring can obscure fistula anatomy, and blind probing of tracts may miss secondary branches [5]. In fact, even under anesthesia up to 10% of fistulas are misclassified, with missed internal openings or extensions being common causes of recurrence [6]. Other methods like contrast fistulography and endoanal ultrasound have been used, but these can fail due to technical issues (e.g. incomplete contrast filling) and provide limited views of the entire pelvis [7]. As a result, surgeons increasingly rely on advanced imaging to fully delineate fistula anatomy before intervention.

Role of MR Fistulography

Magnetic Resonance Imaging (MRI), and specifically MR fistulography protocols, have emerged as the gold-standard for preoperative fistula evaluation [8]. MRI offers unparalleled soft-tissue contrast and multiplanar capability without ionizing radiation [9]. High-resolution MRI can trace the entire fistula course, accurately showing the relationship of primary and secondary tracts to the internal and external sphincters [10]. It also excels at detecting associated abscesses or supralevator extensions, and at locating both external and internal openings that are often clinically occult. Crucially, MRI findings are reported using standardized grading systems (e.g. the Parks anatomical classification and the St. James's University Hospital MRI grades), which correlate with surgical approaches. For example, the Parks system classifies fistulas as intersphincteric, transsphincteric, suprasphincteric or extrasphincteric based on sphincter involvement [11], and MRI can distinguish these types preoperatively. By mapping fistula anatomy in detail, MR fistulograms guide surgeons in choosing the least invasive yet effective operation (fistulotomy, seton placement, LIFT procedure, etc.) thereby optimizing cure rates and preserving continence [12].

Rationale for This Study

Despite the acknowledged value of MRI, its diagnostic accuracy must be confirmed against the true intraoperative findings. Incomplete MRI assessment could lead to hidden tracts or openings being overlooked. Several recent studies note that MRI provides a "surgical roadmap" for fistula surgery [13], but prospective validation is still needed. In particular, it is important to know how reliably MR fistulograms detect every external and internal opening, secondary tract or abscess, and correctly assign Parks and St. James grades, as compared with surgical exploration. Accurate preoperative MRI should translate into better surgical outcomes: an operation that is too aggressive can injure sphincters (causing incontinence), while too conservative a surgery can leave residual fistula tissue and lead to recurrence [14]. Therefore, the current study was undertaken to correlate MR fistulography findings with intraoperative anatomy. Demonstrating high sensitivity and specificity of MRI for these key features would strengthen its role in fistula management, ensuring that radiological mapping truly benefits patient care.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective, hospital-based observational study conducted in the Department of General Surgery at Rabindranath Tagore Medical College, Udaipur, Rajasthan, between January 2024 and July 2025. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrollment.

Study Population

A total of 70 consecutive patients with a clinical diagnosis of perianal fistula were included. Both male and female patients of all age groups were eligible.

Inclusion Criteria

- Patients admitted with clinically diagnosed perianal fistula.
- Patients who underwent preoperative MR fistulography followed by surgical exploration.

Exclusion Criteria

- Patients with metallic implants or pacemakers.
- Patients with contraindications to MRI (e.g., renal failure, gadolinium allergy, claustrophobia).

Data Collection

Detailed demographic and clinical data were obtained, including age, sex, presenting symptoms, duration of illness, and comorbidities. Local examination included digital rectal examination (DRE) and proctoscopy for assessment of external and internal openings.

MR Fistulography Protocol

All patients underwent MR fistulography using a 1.5 Tesla MRI scanner. Gadolinium-DTPA contrast was administered at a dose of 0.1 mmol/kg. Images were acquired in axial, coronal, sagittal, and oblique planes to delineate the fistula anatomy. The following features were assessed:

- Number and position of external openings.
- Number and position of internal openings.

- Course and length of fistulous tract.
- Presence of secondary tracts or abscesses.
- Classification according to Parks and St. James's University Hospital MRI systems. Findings were documented using standardized proformas with diagrammatic representation of fistula anatomy.

Surgical Procedure and Reference Standard

All patients subsequently underwent surgery under regional or general anesthesia. The operative findings served as the reference standard. Intraoperative evaluation included:

- Identification and location of external and internal openings.
- Course and grade of fistulous tract.
- Presence of abscess cavities or secondary extensions.

Procedures such as fistulotomy or fistulectomy were performed depending on fistula complexity. Outcome Measures

The diagnostic accuracy of MR fistulogram was evaluated in relation to surgical findings for:

1) External openings.
2) Internal openings.
3) Secondary tracts and abscesses.
4) Parks and St. James classification. Statistical Analysis

Data were analyzed using SPSS version 16. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy of MR fistulography were calculated using 2×2 contingency tables. Agreement between MRI and surgical findings was assessed using the Cohen's Kappa (κ) coefficient, interpreted as poor (<0.20), fair (0.21–0.40), moderate (0.41–0.60), substantial (0.61–0.80), or almost perfect (>0.81). A p value <0.05 was considered statistically significant.

RESULTS

Demographic and Clinical Characteristics

Seventy patients were included in the study, with age ranging from 16 to 74 years. More than half of the cohort (57.1%) were aged 21–40 years, and the mean age was 35.6 years. A marked male predominance was observed (82.8%), yielding a male-to-female ratio of 4.8:1. Perianal discharge was the most frequent presenting symptom (88.5%), followed by perineal pain (50%) and swelling (34.3%). Fever and pruritus were uncommon. The detailed demographic and clinical profile is summarized in Table 1.

Table 1. Demographic and clinical profile of patients

Variable	Category	n (%)
Age (years)	11–20	2 (2.9)
	21–30	20 (28.6)
	31–40	20 (28.6)
	41–50	12 (17.1)
	51–60	9 (12.9)
	>60	7 (10.0)
Sex	Male	58 (82.8)
	Female	12 (17.2)
Symptoms	Perianal discharge	62 (88.5)
	Pain in perineum	35 (50.0)
	Swelling	24 (34.3)
	Pain on defecation	20 (28.5)
	Fever	4 (5.7)
	Pruritus	2 (2.9)

Distribution of Fistula Types

The anatomical distribution of fistulas was evaluated using both the Parks classification and the St. James MRI grading system. The majority of the patients (75.7%) had intersphincteric fistulas, followed by transsphincteric types (17.1%). Based on MRI grading, Grade I (simple intersph.) was the most frequent (70%), while higher complexity grades (IV and V) accounted for 5.7% of cases. The distribution is presented in Table 2.

Table 2. Distribution of perianal fistulas by Parks and St. James classification

Classification System	Category	n (%)
Parks Classification	Intersphincteric	53 (75.7)
	Transsphincteric	12 (17.1)
	Suprasphincteric	0 (0)
	Extrasphincteric	0 (0)

	Double	5 (7.1)
St. James Classification	Grade I (Simple intersph.)	49 (70)
	Grade II (Intersph.+abscess)	4 (5.7)
	Grade III (Transsphincteric)	8 (11.4)
	Grade IV (Transsph.+abscess)	4 (5.7)
	Grade V (Supralevator)	0 (0)

Diagnostic Accuracy of MRI in Detecting External Openings

When compared with operative findings, MRI correctly identified external openings in most patients. It achieved a sensitivity of 85.7%, specificity of 100%, and overall diagnostic accuracy of 88.6%. The detailed comparison of external openings detected by MRI versus surgery is provided in Table 3.

Table 3. Comparison of number of external openings between MRI and operative findings

No. of external openings	MRI findings n (%)	Operative findings n (%)
0	8 (11.4)	0 (0)
1	58 (82.8)	66 (94.2)
2	4 (5.7)	2 (2.85)
3	0 (0)	2 (2.85)
Total	70 (100)	70 (100)

Diagnostic Accuracy of MRI in Identifying Internal Openings

MRI also demonstrated high diagnostic performance for internal openings, with sensitivity of 85.2%, specificity of 100%, and an overall accuracy of 88.2%. The comparative distribution of internal openings on MRI and surgery is shown in fig1.

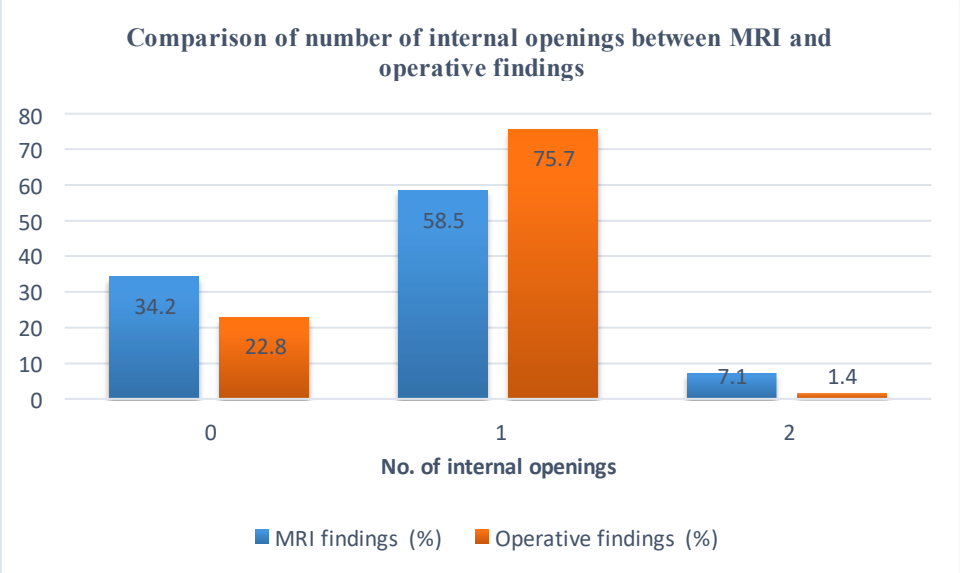

Fig1. Comparison of number of internal openings between MRI and operative findings

Correlation of MRI with Operative Findings

MRI detected abscesses in 16 patients (22.8%) compared with 9 patients (12.8%) identified intraoperatively. This yielded a sensitivity of 77.7%, specificity of 85.2%, and accuracy of 84.3%. Agreement between MRI and surgery for abscess detection was moderate ($\kappa = 0.47$). The comparative data are presented in Table 5.

Table 5. Correlation of abscess detection between MRI and operative findings

TLC count (cells/µl)	Abscess detected by MRI n (%)	Abscess detected intraoperatively n (%)
4000–8000	6 (8.5)	0 (0)
8001–12000	10 (14.2)	7 (10)
12001–16000	0 (0)	2 (2.8)
Total	16 (22.8)	9 (12.8)

Statistical Agreement (Kappa Coefficient)

The concordance between MRI and surgery varied by parameter. Almost perfect agreement was achieved for internal openings ($\kappa = 0.82$), substantial agreement for external openings ($\kappa = 0.72$) and St. James grading ($\kappa = 0.94$), while

abscess detection showed moderate agreement (κ = 0.47). These findings are summarized in Table 6.

Table 6. Agreement between MRI and surgical findings

Parameter	Kappa (κ)	Agreement level
External openings	0.72	Substantial
Internal openings	0.82	Almost perfect
Abscess detection	0.47	Moderate
Fistula grade (St. James)	0.94	Almost perfect

DISCUSSION

Perianal fistula remains a challenging anorectal condition, both for diagnosis and surgical management. The key to successful treatment lies in accurate preoperative mapping of the fistulous tract, including its internal and external openings, secondary extensions, and associated abscesses. Conventional tools such as digital rectal examination (DRE) and examination under anesthesia (EUA) provide valuable information but are limited in delineating complex or recurrent fistulas. Misidentification of openings or secondary tracts can result in incomplete surgery and subsequent recurrence rates as high as 20–30% [15, 16]

Magnetic resonance imaging (MRI) has emerged as the modality of choice for fistula evaluation, offering superior soft tissue resolution and multiplanar capability. Several studies have demonstrated the value of MRI in accurately classifying perianal fistulas according to Parks and St. James systems, thereby aiding surgical planning [17, 18]. Our study reinforces this evidence, demonstrating that MRI provided substantial to almost perfect agreement with operative findings in detecting internal and external openings (κ = 0.72 and κ = 0.82, respectively). Similar concordance was reported by Halligan et al., where MRI achieved 86–90% sensitivity for internal openings, correlating strongly with surgical exploration [19, 20].

The predominance of intersphincteric fistulas (>70%) in our cohort is consistent with previous epidemiological data [21]. The ability of MRI to correctly classify these fistulas is clinically significant, as management differs substantially between simple intersphincteric tracts (often amenable to fistulotomy) and higher transsphincteric varieties, where sphincter-preserving procedures are required. The distribution of cases across St. James grades in our series aligns with international reports, with Grade I being the most common [19, 22].

Detection of abscesses and secondary tracts is another domain where MRI offers added value. In our study, MRI detected abscesses in 22.8% of patients compared with 12.8% intraoperatively. This yielded only moderate agreement (κ = 0.47), reflecting the tendency of MRI to occasionally overestimate abscesses. Comparable findings were noted by Buchanan et al., where MRI over- diagnosed small abscesses but contributed significantly to reducing recurrence through preoperative awareness of sepsis pockets [23].

The diagnostic accuracy of MRI for both internal and external openings in our study (88.2% and 88.6%, respectively) highlights its reliability as a preoperative tool. This is in line with prior meta- analyses reporting pooled sensitivity of 87% and specificity of 93% for internal openings [24]. The use of Kappa statistics in our analysis further strengthens these findings, with almost perfect agreement for internal openings and almost perfect agreement for grading.

Our results thus emphasize the importance of MRI fistulography as a complementary modality to surgical evaluation. While EUA remains the gold standard, reliance on MRI improves preoperative mapping, especially in complex and recurrent cases. The moderate agreement in abscess detection underscores the need for careful intraoperative correlation, but overall, MRI significantly enhances diagnostic accuracy and surgical outcomes.

CONCLUSION

MR fistulography is a highly accurate, non-invasive imaging modality for the evaluation of perianal fistulas. In our study, it demonstrated substantial to almost perfect agreement with surgical findings for the detection of internal and external openings and for fistula grading. Although moderate concordance was observed in abscess detection, MRI offered superior preoperative delineation of tract complexity compared with clinical examination alone. These findings reinforce MRI as an essential adjunct to surgical planning, reducing the likelihood of incomplete treatment and recurrence. Routine use of MR fistulogram should be encouraged in both primary and recurrent perianal fistulas, particularly in complex disease where accurate anatomical assessment is crucial for optimal surgical outcomes.

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