

Evaluation of MRI in diagnosis and classification of perianal fistulas: a prospective study

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ABSTRACT

Background Perianal fistula is a frequently encountered anorectal disorder characterized by an abnormal tract connecting the anal canal to the perianal skin. Precise preoperative evaluation is critical for effective surgical treatment, complete tract identification, and reduction of postoperative recurrence. Clinical examination alone may not adequately define the extent or complexity of fistulous disease. Magnetic Resonance Imaging has become the preferred imaging modality because of its superior soft-tissue resolution and multiplanar imaging capability.

Objective To assess the diagnostic accuracy of MRI in the detection and classification of perianal fistulas and to compare MRI findings with intraoperative surgical findings.

Materials and Methods This prospective observational study included 35 patients with clinically suspected perianal fistula. All patients underwent MRI pelvis followed by surgical exploration. MRI findings were evaluated for fistula type, internal opening, secondary extensions, and associated abscess formation. Fistulas were classified according to the Parks classification system, and imaging findings were correlated with operative findings, considered the gold standard. Diagnostic accuracy was assessed using standard statistical measures.

Results MRI demonstrated excellent diagnostic performance in evaluating perianal fistulas. Of the 35 cases studied, MRI findings correlated with surgical findings in 32 cases, while 3 cases were identified as false positives. No false negative cases were observed, resulting in a sensitivity of 100% and a positive predictive value of 91.4%. Intersphincteric fistulas were the most common type identified, followed by transsphincteric fistulas. MRI accurately delineated primary tracts, internal openings, secondary tracts, and associated abscesses in the majority of cases.

Conclusion MRI is a highly sensitive and dependable imaging modality for the diagnosis and classification of perianal fistulas. Its ability to provide precise anatomical mapping and detailed assessment of disease extent makes it invaluable for preoperative planning. Strong correlation with surgical findings highlights its important role in optimizing surgical management, reducing recurrence, and improving clinical outcomes.

Keywords: Perianal fistula, MRI fistulogram, Parks classification, preoperative imaging, surgical correlation, diagnostic accuracy.

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INTRODUCTION

Perianal fistula is a chronic abnormal communication between the anal canal and the perianal skin and represents a common anorectal disorder encountered in clinical practice. It most commonly arises as a sequela of cryptoglandular infection involving the anal glands located at the level of the dentate line [1]. Obstruction

of these glands leads to bacterial infection and formation of an anorectal abscess, which, if inadequately treated, may progress to formation of a persistent fistulous tract connecting the anal canal to the perianal skin [1,2].

Perianal fistulas are associated with significant morbidity and have a considerable impact on patient

quality of life. Patients typically present with pain, swelling, recurrent purulent discharge, and irritation in the perianal region. The disease often follows a chronic relapsing course, and recurrent inflammation may lead to fibrosis and scarring, complicating management and increasing the risk of recurrence [1,3].

A detailed understanding of anal canal anatomy is essential for accurate evaluation and management of perianal fistulas. The anal canal, measuring approximately 3–4 cm in length, is surrounded by the internal and external anal sphincters. The intersphincteric space between these muscles serves as a potential pathway for the spread of infection. Infection originating in the anal glands may extend into adjacent spaces such as the ischioanal fossa and supralelevator region, resulting in complex fistulous tracts [2,4].

The majority of perianal fistulas are of cryptoglandular origin; however, other etiologies such as Crohn's disease, tuberculosis, trauma, prior anorectal surgery, and malignancy may also contribute to fistula formation [1,11]. The pathophysiology involves a sequence of gland obstruction, infection, abscess formation, and eventual development of a fibrous tract. In many cases, secondary extensions, branching tracts, and horseshoe configurations may develop, often associated with abscess formation, increasing disease complexity [4,6].

Accurate classification of perianal fistulas is crucial for appropriate management. The Parks classification system is the most widely used and categorizes fistulas based on their relationship with the anal sphincter complex into intersphincteric, transsphincteric, suprasphincteric, and extrasphincteric types [5]. Proper classification is essential for surgical planning, as incorrect assessment may lead to inadequate treatment, recurrence, or sphincter injury resulting in incontinence [5].

Clinical examination remains the initial step in diagnosis; however, it has limitations in accurately determining the extent and complexity of fistulous tracts, particularly in recurrent and complex cases. Hidden tracts, secondary extensions, and deep-seated abscesses may be missed, leading to incomplete treatment and recurrence [13].

Imaging therefore plays a crucial role in the evaluation of perianal fistulas. Conventional imaging modalities such as fistulography, computed tomography (CT), and endoanal ultrasonography have been used; however, these techniques have limitations in accurately delineating complex fistulous anatomy. Fistulography provides limited visualization of secondary tracts, CT

has poor soft tissue contrast, and endoanal ultrasound is operator-dependent and less effective in evaluating complex disease [2,9].

Magnetic Resonance Imaging (MRI) has emerged as the imaging modality of choice for evaluation of perianal fistulas due to its excellent soft tissue contrast and multiplanar imaging capability. MRI allows precise visualization of the primary tract, internal opening, secondary extensions, and associated abscesses. It also provides detailed information regarding the relationship of the fistula to the sphincter complex, which is essential for accurate classification and surgical planning [3,4,7].

Advanced MRI sequences such as T2-weighted imaging, fat-suppressed sequences, diffusion-weighted imaging (DWI), and contrast-enhanced imaging further improve detection of active inflammation, abscess formation, and disease extent. Diffusion-weighted imaging has been shown to be particularly useful in identifying active fistulous tracts and abscesses by demonstrating areas of restricted diffusion [6,10].

Several studies have demonstrated that MRI has high diagnostic accuracy and shows strong correlation with surgical findings in the evaluation of perianal fistulas. MRI-based assessment improves preoperative mapping, facilitates appropriate surgical planning, and reduces recurrence rates by ensuring complete identification of fistulous tracts and associated complications [8,17,19].

Despite advancements in imaging, accurate preoperative assessment remains a challenge, particularly in complex fistulas. Failure to identify secondary tracts or associated abscesses may lead to incomplete surgical treatment and recurrence. Therefore, reliable imaging is essential for optimal management.

In view of these considerations, the present prospective study was undertaken to evaluate the role of MRI in the diagnosis and classification of perianal fistulas and to correlate MRI findings with intraoperative surgical findings. The study aims to assess the diagnostic accuracy of MRI and its usefulness in guiding surgical management and improving patient outcomes.

MATERIALS AND METHODS

Study Design

This study was a prospective observational study conducted to evaluate the diagnostic accuracy of Magnetic Resonance Imaging (MRI) in the detection and classification of perianal fistulas and to correlate MRI findings with intraoperative surgical findings. The study aimed to assess the effectiveness of MRI as

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a preoperative imaging modality in the evaluation of fistula-in-ano.

Study Area

The study was conducted at the Department of Radiology in collaboration with the Department of Surgery at:

1. Fortis Escorts Hospital, Malviya Nagar, Jaipur (1.5 Tesla MRI system, GE Healthcare)
2. Santokba Durlabhji Memorial Hospital, Rambagh, Jaipur (3 Tesla MRI system, GE Healthcare)

Study Period

The study was carried out over a period of 8 months from August 2025 to March 2026.

Study Population

A total of 35 patients clinically suspected of perianal fistula were included in the study. All patients underwent MRI evaluation followed by surgical intervention. Surgical findings were considered as the gold standard for comparison.

Sample Size

The sample size was calculated using the standard formula for proportions:

$$n = Z^2 \times p \times (1 - p) / d^2$$

Where:

Z = 1.96 (95% confidence level)

p = 0.9 (expected sensitivity)

d = 0.1 (precision)

The calculated sample size was 35 patients. After considering feasibility and patient availability, 35 patients were included in the final study.

Inclusion Criteria

- ❖ Patients aged between 18–60 years
- ❖ Patients clinically suspected or diagnosed with perianal fistula
- ❖ Patients undergoing both MRI evaluation and surgical treatment

Exclusion Criteria

- ❖ Patients below 18 years of age
- ❖ Patients with prior surgery for perianal fistula
- ❖ Patients with Crohn's disease or inflammatory bowel disease
- ❖ Patients with contraindications to MRI (e.g., pacemaker, metallic implants)

MRI Protocol

MRI of the pelvis was performed using 1.5 Tesla and 3 Tesla scanners. Standard imaging protocol included:

- ❖ T1-weighted sequences
- ❖ T2-weighted sequences (axial, coronal, sagittal)
- ❖ Fat-suppressed sequences (STIR/SPAIR)

- ❖ Post-contrast T1-weighted sequences (when required)
- ❖ Diffusion-weighted imaging (DWI) with ADC maps

T2-weighted and fat-suppressed sequences were used to identify hyperintense fluid-filled tracts and abscesses. Post-contrast imaging helped in detecting active inflammation and abscess cavities. Diffusion-weighted imaging was used to assess inflammatory activity.

Data Collection

Data collected included:

- ✓ Patient demographic details
- ✓ Clinical presentation
- ✓ MRI findings (type of fistula, internal opening, secondary tracts, abscess)
- ✓ Surgical findings

Fistulas were classified according to the Parks classification system based on MRI findings.

Methodology

All eligible patients underwent MRI pelvis using standard protocol. MRI findings were analyzed to identify the primary tract, internal opening, secondary extensions, and associated abscesses. Based on these findings, fistulas were classified according to Parks classification.

Subsequently, all patients underwent surgical intervention. Intraoperative findings were documented and compared with MRI findings.

Statistical Analysis

Statistical analysis was performed using SPSS software. Diagnostic performance of MRI was evaluated using:

- Sensitivity
- Specificity
- Positive Predictive Value (PPV)
- Negative Predictive Value (NPV)
- Accuracy

Agreement between MRI and surgical findings was assessed. Surgical findings were considered as the reference standard.

RESULTS

A total of **35 patients** clinically suspected of perianal fistula were included in the present study. All patients underwent MRI evaluation followed by surgical intervention. MRI findings were compared with intraoperative findings, which were considered the gold standard.

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4.1 Distribution of Fistula Types

Based on MRI findings and Parks classification, the majority of fistulas were **intersphincteric**, followed by **transsphincteric** fistulas. A smaller proportion of cases showed complex fistulas with associated secondary tracts and abscess formation.

Table 4.1 – Distribution of Fistula Types (MRI)

Fistula Type	Number of Patients (n)	Percentage (%)
Intersphincteric	24	68.6%
Transsphincteric	8	22.9%
Complex	3	8.5%
Total	35	100%

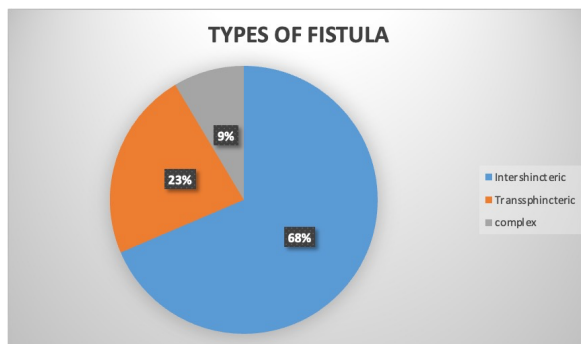


Fig 4.1- Types of Fistula.

4.2 Comparison of MRI Findings with Surgical Findings

MRI findings were compared with intraoperative surgical findings to assess diagnostic accuracy.

Table 4.2 – Comparison of MRI with Surgical Findings

MRI Findings	Surgery Positive	Surgery Negative	Total
Positive	32 (TP)	3 (FP)	35
Negative	0 (FN)	0 (TN)	0
Total	32	3	35

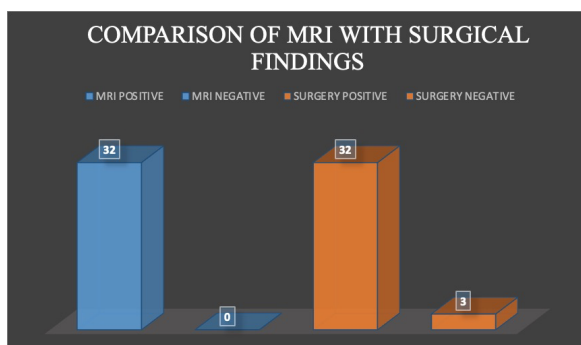
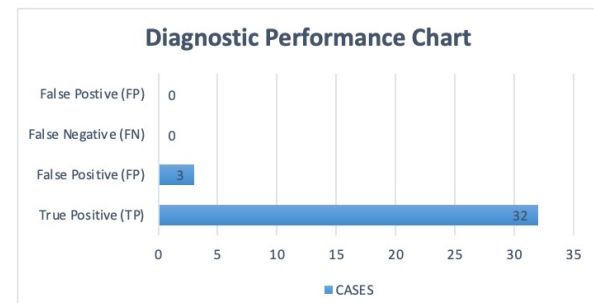


Fig 4.2- Comparative Analysis Between MRI & Surgical Findings.

4.3 Diagnostic Performance of MRI

MRI demonstrated high diagnostic performance in the evaluation of perianal fistulas.

- True Positive (TP) = 32
- False Positive (FP) = 3
- False Negative (FN) = 0
- True Negative (TN) = 0



Calculated Values:

- **Sensitivity** = 100%
- **Specificity** = Not applicable (no true negatives)
- **Positive Predictive Value (PPV)** = 91.4%
- **Negative Predictive Value (NPV)** = Not applicable
- **Accuracy** ≈ 91.4%

4.4 Agreement Analysis

MRI findings showed a high level of agreement with surgical findings. The majority of fistulas detected on MRI were confirmed intraoperatively. However, a small number of cases (n = 3) showed false positive findings, where MRI overestimated the presence or extent of fistulous tracts.

4.5 Summary of Findings

MRI demonstrated excellent sensitivity in detecting perianal fistulas and accurately identified the type and extent of disease in most cases. The majority of fistulas were intersphincteric in type. MRI also showed good correlation with surgical findings in identifying internal openings, secondary tracts, and associated abscesses.

DISCUSSION

The present study evaluated the diagnostic accuracy of Magnetic Resonance Imaging in detecting and classifying perianal fistulas and correlating imaging findings with surgical outcomes. Accurate preoperative assessment is essential for surgical planning, identification of fistulous tracts, internal openings, secondary extensions, and associated abscesses.

Among 35 clinically suspected cases, intersphincteric fistulas were the most common type, followed by transsphincteric fistulas, consistent with previous literature. MRI findings were concordant with surgical findings in 32 of 35 cases, with 3 false positives and no false negatives, demonstrating excellent sensitivity (100%) and a positive predictive value of 91.4%.

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MRI accurately identified the primary tract, internal opening, secondary extensions, and abscesses, providing detailed anatomical mapping essential for effective surgical management. False positive findings may be due to inflammatory changes or fibrosis mimicking active fistulous tracts on imaging. Advanced sequences such as diffusion-weighted imaging improve characterization by differentiating active inflammation from inactive fibrotic tissue.

Overall, MRI showed strong agreement with operative findings and proved to be a highly reliable imaging modality for preoperative evaluation of perianal fistulas. Its ability to accurately classify fistulas and define disease extent significantly contributes to improved surgical outcomes and reduced recurrence rates.

LIMITATIONS

The present study has certain limitations. The sample size was relatively small (35 patients), which may limit the generalizability of the findings. The study was conducted at selected centers, and results may vary across different populations and clinical settings. Additionally, true negative cases were not included, as all patients were clinically suspected of perianal fistula, which limited the calculation of specificity and negative predictive value. MRI findings may also overestimate disease extent in some cases due to inflammatory changes, leading to false positive results. Despite these limitations, the study provides valuable insights into the diagnostic role of MRI in perianal fistulas.

CONCLUSION

The present study demonstrates that Magnetic Resonance Imaging (MRI) is a highly sensitive and reliable imaging modality for the evaluation of perianal fistulas. MRI provides detailed visualization of the fistulous tract, internal opening, secondary extensions, and associated abscesses, which are essential for accurate diagnosis and classification.

In this study, MRI showed excellent correlation with surgical findings, with a high sensitivity of 100% and overall diagnostic accuracy of approximately 91.4%. The majority of fistulas were correctly identified and classified using MRI, highlighting its effectiveness in preoperative assessment. A small number of false positive cases were observed, likely due to overestimation of inflammatory changes.

MRI plays a crucial role in guiding surgical management by accurately delineating fistula anatomy and reducing the risk of incomplete treatment and recurrence. Its ability to identify complex tracts and

associated complications makes it an indispensable tool in the preoperative evaluation of fistula-in-ano.

In conclusion, MRI should be considered the imaging modality of choice for the diagnosis and classification of perianal fistulas, as it significantly improves diagnostic accuracy and contributes to better surgical outcomes.

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