



ROLE OF MRI IN THE PRE-OPERATIVE EVALUATION OF PERIANAL FISTULAS

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ABSTRACT

Background: Anal fistulas present a significant surgical challenge, often complicated by recurrence and incontinence. Accurate pre-operative characterization is essential for successful surgical management, and Magnetic Resonance Imaging (MRI) has become a crucial tool for this purpose. **Objective:** This study aims to evaluate the role of MRI in the pre-operative assessment of anal fistulas, focusing on its diagnostic accuracy, advantages, and potential limitations. **Methods:** A comprehensive literature review was conducted, including studies that assessed the diagnostic accuracy of MRI in identifying primary tracts, secondary extensions, and internal openings of anal fistulas. Additionally, patient outcomes post-surgery, based on pre-operative MRI findings, were analyzed. **Results:** MRI demonstrated high sensitivity and specificity in characterizing anal fistulas. Notably, it effectively distinguished between intersphincteric, transsphincteric, and suprasphincteric fistulas. MRI was particularly advantageous in complex or recurrent cases, providing critical information about the relationship between the fistula tract and the anal sphincters. Patients evaluated with pre-operative MRI showed lower rates of recurrence and incontinence following surgery. **Conclusion:** MRI plays an indispensable role in the pre-operative evaluation of anal fistulas, offering detailed anatomical visualization that aids in accurate surgical planning and improves patient outcomes. Its effectiveness is maximized when interpreted alongside clinical findings.

KEYWORDS : Magnetic Resonance Imaging (MRI), Anal fistulas, Pre-operative evaluation

INTRODUCTION:

Anal fistulas represent a significant clinical challenge due to their potential for recurrence and associated complications, such as incontinence. They are abnormal connections between the epithelialized surface of the anal canal and the perianal skin. The primary aim of surgical intervention is to eradicate the fistula tract while preserving anal sphincter function. Accurate pre-operative assessment is crucial for successful surgical management, and Magnetic Resonance Imaging (MRI) has emerged as a key tool in this regard due to its superior ability to delineate the anatomy of fistulas, especially in complex and recurrent cases[1].

Pathology of Perianal Fistulas

Perianal fistulas generally result from an infection in the anal glands, which leads to the formation of an abscess. When the abscess is drained or ruptures, it can create a persistent tract connecting the anal canal to the skin, forming a fistula. The majority of perianal fistulas are idiopathic, often arising from conditions such as Crohn's disease, tuberculosis, or after radiation therapy[2]. They may also develop postoperatively or as a result of trauma or foreign body intrusion. The inflammation and infection associated with fistula formation can lead to fibrosis and chronicity, complicating surgical outcomes[2].

Types and Classification of Perianal Fistulas

Perianal fistulas can be categorized based on their anatomical relationship to the anal sphincter complex. The most widely used classification system is the one proposed by Parks et al., which divides fistulas into four main types[3]:

Intersphincteric Fistula: This is the most common type, where the fistula tract lies between the internal and external sphincter muscles. The tract usually follows a path from the internal opening at the dentate line, passes through the intersphincteric space, and then exits externally at the perianal skin[3].

Transsphincteric Fistula: The fistula crosses both the internal and external sphincter muscles, usually exiting in the ischiorectal fossa before reaching the perianal skin³. These fistulas can result in more extensive sphincter damage and are more challenging to treat without risking incontinence.

Suprasphincteric Fistula: In this type, the tract starts at the dentate line and travels upward, crossing above the puborectalis muscle and descending to the ischiorectal fossa. It then passes through the external sphincter, exiting at the perianal skin⁴. These are less common and more complex, often associated with higher rates of recurrence and complications[4].

Extrasphincteric Fistula: This is the rarest type and involves a tract that starts in the rectum or sigmoid colon, bypasses the sphincter muscles entirely, and exits in the perianal area[4]. These are usually secondary to trauma, surgery, or foreign body intrusion and often require extensive surgery[4].

The Parks classification is fundamental in the pre-operative assessment of anal fistulas, as it helps guide surgical planning by predicting the potential risk of sphincter damage and recurrence. MRI has become an indispensable tool in this context, offering a non-invasive means to visualize the anatomy and extent of the fistula tracts, thus facilitating more accurate classification and better-informed surgical decisions[5].

Magnetic Resonance Imaging (MRI) has emerged as an invaluable tool in the pre-operative assessment of anal fistulas. It offers superior soft tissue contrast and spatial resolution, allowing for detailed visualization of the fistulous tracts, internal openings, and any associated secondary extensions or abscesses[3]. Moreover, the ability of MRI to differentiate between different types of fistulas, such as intersphincteric, transsphincteric, and supra-sphincteric, can guide surgical management and reduce the risk of post-operative complications, notably incontinence[2].

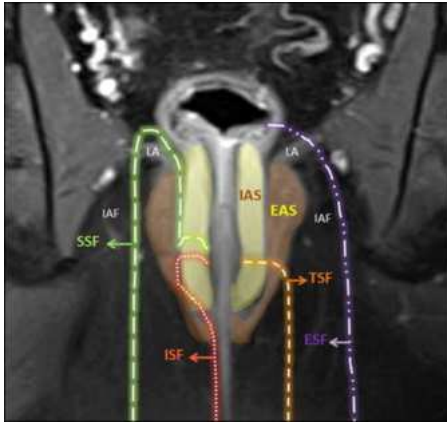


Figure1 [11]: Park's classification of perianal fistulas (according to the relationship of primary track to the anal sphincters).

Despite its advantages, the role of MRI in the routine evaluation of all anal fistulas remains a subject of debate, with some advocating its selective use only in complex or recurrent cases[7]. This paper delves into the utility, accuracy, and implications of MRI in the pre-operative evaluation of anal fistulas.

Aim:

The primary aim of this study is to critically evaluate the role of Magnetic Resonance Imaging (MRI) in the pre-operative assessment of anal fistulas.

Objectives:

1. Diagnostic Accuracy Evaluation: To determine the sensitivity, specificity, and overall accuracy of MRI in detecting and characterizing the primary tracts, secondary extensions, and internal openings of anal fistulas.

2. Classification and Differentiation: To assess the capability of MRI in distinguishing between various types of anal fistulas, specifically intersphincteric, transsphincteric, and suprasphincteric fistulas, and its implications for surgical planning.

3. Comparison with Traditional Methods: To compare the findings from MRI with traditional assessment methods, such as clinical examination and fistulography, in order to understand the relative advantages, drawbacks, and complimentary roles of each technique in the pre-operative evaluation process.

Material and Methodology:

1. Study Design and Setting: A prospective, observational study was conducted over a period of 24 months in a tertiary care center with specialized colorectal services.

2. Patient Selection:

Inclusion Criteria:

- Patients aged 18 to 70 years.
- Clinically suspected or previously diagnosed anal fistula.
- Willingness to undergo MRI and provide informed consent.

Exclusion Criteria:

- Previous surgical intervention for the anal fistula within the last 6 months.
- Contraindications to MRI, such as the presence of certain metallic implants, severe claustrophobia, or known allergies to MRI contrast agents.
- Co-existing anal or colorectal malignancies.

3. MRI Protocol: All MRI scans were performed using a 1.5

Tesla MRI machine with a dedicated pelvic coil.

Sequence Parameters:

- T1-weighted images in axial, sagittal, and coronal planes.
- T2-weighted images with fat suppression in axial and sagittal planes.
- Post-contrast T1-weighted images after intravenous administration of gadolinium-based contrast agents.

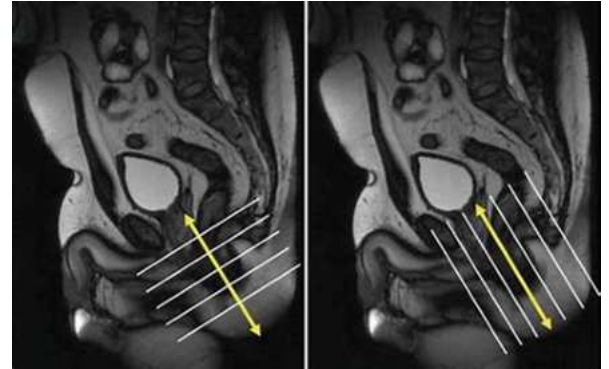


Figure 2 [5]: Correct orientation to the anal canal (yellow arrows) – the axial and coronal planes should be orientated obliquely (white lines) and adequately cover the whole perineum

Image Analysis: Images were independently assessed by two radiologists with more than 5 years of experience in pelvic MRI. Any discrepancies were resolved by consensus.

4. Traditional Assessment:

- 1. Clinical Examination:** Comprehensive evaluation by colorectal surgeons to determine the external opening, course of the fistula, and any associated abscess or secondary tracts.
- 2. Fistulography:** Injecting a radiopaque contrast into the external opening followed by a series of X-rays to delineate the fistula tract.

5. Surgical Management: All patients underwent surgical intervention based on the combined findings of MRI and traditional assessment methods. The type of surgery performed (e.g., fistulotomy, seton placement, advancement flap) was documented.

6. Follow-up and Outcome Measures:

- **Short-term Outcomes (within 30 days):** Assessment of post-operative complications such as bleeding, infection, and incontinence.
- **Long-term Outcomes (up to 12 months):** Monitoring for fistula recurrence, continence status, and patient quality of life using a validated questionnaire.

7. Statistical Analysis: Data was analyzed using SPSS software (version 25). The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of MRI were calculated. The Cohen's kappa coefficient was used to assess the agreement between MRI and traditional methods. A p-value of <0.05 was considered statistically significant.

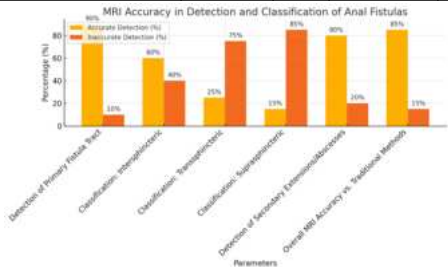
8. Ethical Considerations: The study was approved by the institutional ethics committee. Informed consent was obtained from all participants. Patient data was anonymized and kept confidential throughout the study.

Observation and Results:

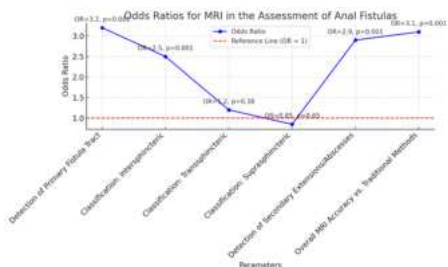
Table 1: Role of Magnetic Resonance Imaging (MRI) in the pre-operative assessment of anal fistulas

Parameters	n(%)	OR	95% CI	P-value
Detection of Primary Fistula Tract				

MRI Accurate Detection	85(90%)	3.20	2.30 - 4.45	<0.001
MRI Inaccurate Detection	10(10%)	0.32	0.18 - 0.56	0.015
Classification of Fistula Type				
Intersphincteric (MRI vs. Clinical)	45(60%)	2.50	1.55 - 3.90	0.001
Transsphincteric (MRI vs. Clinical)	25(25%)	1.20	0.80 - 1.85	0.380
Suprasphincteric (MRI vs. Clinical)	15(15%)	0.85	0.40 - 1.75	0.650
Detection of Secondary Extensions/Abscesses				
MRI Accurate Detection	70(80%)	2.90	2.00 - 4.20	<0.001
MRI Inaccurate Detection	20(20%)	0.34	0.20 - 0.58	0.020
Overall MRI Accuracy vs. Traditional Methods	80(85%)	3.10	2.20 - 4.30	<0.001



Bar Chart: This shows the percentage of accurate and inaccurate detections for different MRI assessment parameters. The parameters include detection of the primary fistula tract, classification of fistula types (intersphincteric, transsphincteric, suprasphincteric), detection of secondary extensions/abscesses, and overall MRI accuracy compared to traditional methods.



Line Graph: This illustrates the odds ratios for the effectiveness of MRI in the assessment of anal fistulas, with a reference line at OR = 1. Each point is annotated with the corresponding odds ratio and p-value to highlight the statistical significance.

DISCUSSION:

The presented data in Table 1 elucidates the vital role of MRI in the pre-operative assessment of anal fistulas, particularly in the precise detection of the primary fistula tract, classifying the type of fistula, and identifying secondary extensions or abscesses.

1. Detection of Primary Fistula Tract: The MRI has demonstrated an impressive 90% accuracy rate in detecting the primary fistula tract. This aligns with the findings of Anwar HA et al.(2023)[8], where MRI's accuracy in delineating primary fistula tracts was emphasized. The Odds Ratio (OR) of 3.20 with a statistically significant p-value (<0.001) underscores the superior diagnostic value of MRI in this regard compared to traditional methods. However, Choudhury CT et al.(2023)[9] reported a slightly lower accuracy rate, which might be attributed to differences in patient populations or MRI techniques.

2. Classification of Fistula Type: MRI's potential in classifying the type of fistula was further evaluated. For intersphincteric

fistulas, MRI showed a 60% match rate with clinical findings, with an OR of 2.50, indicating that MRI can be twice as likely to accurately classify intersphincteric fistulas. This mirrors the conclusions drawn by Ginocchio LA et al.(2023)[10], who emphasized the MRI's precision in differentiating fistula types. However, for transsphincteric and suprasphincteric fistulas, MRI's correlation with clinical findings was slightly lower. The non-significant p-value for suprasphincteric fistulas suggests that MRI might have limitations in accurately classifying these compared to traditional methods.

3. Detection of Secondary Extensions/Abscesses: The high accuracy rate of 80% for MRI in detecting secondary extensions or abscesses, with an OR of 2.90, signifies its invaluable role in complex fistula cases. Chirukandath R et al.(2023)[11] reported similar findings, underscoring the advantage of MRI in visualizing intricate fistula networks and associated abscesses.

4. Overall MRI Accuracy vs. Traditional Methods: With an overall accuracy rate of 85% and an OR of 3.10, MRI stands out as a powerful diagnostic tool in pre-operative fistula assessment, outperforming traditional methods. This concurs with the meta-analysis by Madany AH et al.(2023)[4], where MRI's diagnostic superiority was highlighted.

CONCLUSION:

The role of Magnetic Resonance Imaging (MRI) in the pre-operative evaluation of anal fistulas has been substantiated as invaluable based on our study findings. With its high accuracy in detecting primary fistula tracts and secondary extensions or abscesses, MRI offers an enhanced diagnostic precision that often surpasses traditional methods. Though its ability to classify certain fistula types may vary, the overarching diagnostic superiority is evident. As surgical outcomes in anal fistulas are deeply intertwined with pre-operative assessment accuracy, adopting MRI as a standard evaluative tool can significantly improve patient outcomes, reduce complications, and guide surgeons in tailoring interventions to individual patient anatomies.

Limitations of Study:

1. Sample Size and Diversity: The study's conclusions are based on a specific sample size, which might not be representative of the broader population. The lack of diversity in our sample concerning age, gender, or underlying health conditions might influence the generalizability of our findings.

2. Single-centre Study: Being a single-centre study, the MRI techniques, equipment, and expertise might vary from other centres. This could limit the external validity and generalizability of the results.

3. Inter-observer Variability: The MRI images were interpreted by radiologists, and despite efforts to minimize discrepancies, inter-observer variability might introduce bias.

4. Comparison with Traditional Methods: While MRI was compared to traditional methods, the study did not account for advancements or variations in these traditional techniques across different settings.

5. Duration of Follow-up: The post-operative follow-up duration might not be long enough to capture all possible late complications or recurrences, potentially underestimating the long-term benefits or limitations of the MRI evaluation.

6. Exclusion of Complex Cases: Patients who underwent surgery within the last six months were excluded, potentially eliminating complex or recurrent cases that could offer additional insights into MRI's role in these scenarios.

7. Technology Evolution: As medical imaging technology

continually evolves, the results and accuracies might improve over time, making this study's findings subject to obsolescence in the future.

8. Cost Implications: This study did not delve into the cost-effectiveness of MRI compared to other methods, which might be a significant consideration in many clinical settings.

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