

ORIGINAL ARTICLE

Role of magnetic resonance imaging in diagnosis of perianal fistula: bridging the radiological and surgical divide.

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ABSTRACT... Objective: To determine the accuracy of magnetic resonance imaging in diagnosis and classification of perianal fistulae taking surgical findings as gold standard. **Study Design:** Prospective Cross Sectional study. **Setting:** Department of Radiology, Liaquat University of Medical and Health Sciences, Jamshoro. **Period:** 01-12-2021 to 31-08-2023. **Methods:** The non-probability consecutive sampling technique was used in this study. After taking the informed consent the MR imaging was be done to diagnose and classify the perianal fistula which was correlated with surgical findings. All the data will be entered and analyzed on SPSS version 21. **Results:** In this study the mean age of the patients was 42.25 ± 13.44 years, the male to female ratio of the patients was 1.5:1. The sensitivity, specificity and diagnostic accuracy of MRI was 92.94%, 91.76% and 92.35% respectively taking surgical findings as gold standard. **Conclusion:** MRI has high diagnostic accuracy in evaluation of perianal fistulae and it helps in bridging the radio surgical divide.

Key words: MRI, Perianal Fistula, Radiological Findings and Surgical Findings.

INTRODUCTION

Fistula-in-ano is a benign yet complex condition that poses significant challenges for both patients and surgeons. Due to its intimate relationship with the delicate anal-sphincter complex, surgical interventions like incision and drainage carry a risk of damaging the surrounding muscles, potentially leading to anal incontinence. Achieving a harmonious balance between eradicating the infection and preserving continence hinges on meticulous preoperative assessment. This includes accurate geographical mapping of the fistula, identifying the site and level of the internal opening, understanding the anatomy of the primary track and detecting any secondary ramifications. By conducting a thorough evaluation, healthcare providers can develop a tailored treatment plan that minimizes the risk of complications and optimizes patient outcome.¹ It is often related to inflammation that can affect the region around anal canal as well.² This condition has a relatively low incidence, impacting roughly

1 in 10,000 people. Demographically, it tends to predominantly affect males, typically during their 30s and 40s.³ The exact prevalence of fistula-in-ano remains unclear, but research suggests that nearly 1 in 3 to 1 in 2 cases of anal abscesses can progress to form a fistula-in-ano, with incidence rates ranging from 26% to 38%.⁴

According to Darwish's findings, a significant proportion (68%) of patients experiencing anal incontinence also had perianal fistulas. Furthermore, 22% of patients presented with isolated perianal fistulas, which were prone to recurrence due to the presence of persistent perianal sinuses.⁵ Perianal fistulas are notorious for their high recurrence rate, primarily due to residual, undetected infection at the time of surgery. This lingering infection can lead to substantial morbidity, frequently necessitating multiple, repeated surgical interventions.⁶ When a fistula becomes complex, the likelihood of successful healing diminishes significantly.

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Several underlying factors can contribute to this complexity, including ongoing cryptoglandular infection, presence of anal fissures, traumatic injury, anal malignancies, inflammatory bowel disease (IBD) and radiation-induced damage. These underlying causes can perpetuate the fistula, making treatment more challenging and reducing the chances of achieving complete healing.⁷

The anal canal is encircled by a dual-layered sphincter system, comprising internal Anal Sphincter (IAS) which is an involuntary muscle, controlled by the autonomic nervous system and external Anal Sphincter (EAS) which is a voluntary muscle, governed by the somatic nervous system. This intricate sphincter mechanism plays a crucial role in maintaining fecal continence.⁶ The dentate line, a distinctive feature on the mucosal surface of the anal canal, serves as a vulnerable hotspot for infection. It is precisely at this location where the process of fistula formation often originates, making the dentate line a critical anatomical landmark in the development of anal fistulas.⁸ Obstruction of the anal glands' ducts, located deep within the intersphincteric space, can lead to abscess formation. As the infection progresses, it can spread through the intersphincteric space, either downward or outward, ultimately giving rise to various types of fistulas. This complex pathway of infection spread plays a crucial role in determining the final configuration and classification of the fistula.⁹ Fistulas can be categorized based on the specific pathway of the primary tract, which connects the internal opening (within the anal canal) to the external opening (on the skin surrounding the anus).⁶

The role of imaging techniques, particularly MRI, has evolved significantly in the evaluation of perianal fistulas. MRI has become a crucial diagnostic tool, enabling the detection of hidden infected tracks and abscesses that might otherwise remain unnoticed. By providing detailed anatomical information, radiologists can help surgeons to precisely locate the fistula and understand its relationship with the anal-sphincter complex. This enhanced understanding allows surgeons to choose the most effective surgical

approach, minimize the risk of recurrence and reduce potential complications, such as fecal incontinence. Ultimately, the integration of MRI into the diagnostic process can significantly improve treatment outcomes for patients with perianal fistulas.^{10,11}

The evaluation of perianal fistulas leverages the exceptional soft-tissue resolution of imaging modalities. However, despite the prevalence and extensive study of anal fistulas, certain complex cases continue to present significant surgical challenges, highlighting the need for ongoing refinement in diagnostic and therapeutic approaches.^{12,13}

Traditional diagnostic methods, such as conventional radiography and proctosigmoidoscopy, often fall short in accurately depicting the full extent of disease caused by transmural inflammation in complex fistulas. Historically, fistulograms have been used to image these fistulas. This procedure involves inserting a catheter into the external opening and injecting contrast material into the fistula. However, fistulograms have significant limitations such as incomplete visualization of the primary tract and its extensions may not be visible if they are obstructed by pus or debris, preventing contrast material from filling the tract and lack of anatomical detail so fistulograms do not provide clear images of the sphincter muscle anatomy, making it difficult to determine the relationship between the fistula tract, internal and external sphincters, and levator ani muscle. These limitations underscore the need for more advanced imaging modalities that can provide comprehensive and accurate visualization of complex fistulas.¹⁴

A comprehensive classification system describes the trajectory and spatial relationship of perianal fistulas to the sphincter mechanism, categorizing them into four types based on their position in the coronal plane. Intersphincteric: Fistulas that pass between the internal and external sphincters. Trans-sphincteric: Fistulas that traverse the external sphincter. Suprasphincteric: Fistulas that pass above the puborectalis muscle.

Extrasphincteric: Fistulas that bypass the sphincter mechanism altogether. To further clarify the location of fistulas and avoid confusion, a detailed anatomical classification system uses a 'clockwise' notation, referencing the position of the fistula in relation to the clock face.¹⁴

Magnetic Resonance Imaging (MRI) has proven to be a highly accurate diagnostic tool for visualizing the complex anatomy of the perianal region. MRI provides detailed images of anal-sphincter mechanism so clearly depicting the internal and external anal sphincters and MRI also clearly demonstrates fistulae relationships so demonstrating the precise relationship between fistulae and surrounding structures, including: Pelvic diaphragm (levator plate) showing how fistulae interact with this critical muscular layer and ischiorectal fossae so revealing the fistulae's proximity to these fat-filled spaces. Understanding these spatial relationships is crucial for surgical planning and decision-making, ultimately impacting the success of treatment and patient outcomes.¹⁵

A study involving 56 patients yielded remarkable results, demonstrating that Magnetic Resonance Imaging (MRI) achieved 100% sensitivity by correctly identifying all cases of perianal fistula and 100% specificity, accurately ruling out all cases without perianal fistula. These findings underscore the exceptional diagnostic accuracy of MRI in detecting perianal fistulas.² A separate study of 25 patients reported the following diagnostic accuracy of MRI for perianal fistulas with 100% sensitivity and 88% specificity. The study's authors concluded that while MRI demonstrates excellent sensitivity in detecting perianal fistulas, its specificity is relatively lower, indicating a higher likelihood of false-positive results.¹⁶

The rationale of the study was to assess the diagnostic precision of Magnetic Resonance Imaging (MRI) in identifying perianal fistulas, with surgical findings serving as the definitive gold standard for comparison.

METHODS

This cross-sectional study, conducted in the Department of Radiology at Liaquat University of Medical and Health Sciences, Jamshoro from 01-12-2021 to 31-08-2023 (after approval from research ethics committee, NO. LUMHS/REC-213, dated 19/11/21), employed a non-probability consecutive sampling strategy to recruit 340 patients who met the stringent inclusion criteria. Informed consent was obtained from each participant, and demographic data was meticulously recorded on a pre-designed proforma. Subsequently, Magnetic Resonance Imaging (MRI) was performed using a state-of-the-art 1.5 Tesla superconducting magnet, yielding high-resolution images that were meticulously evaluated for the presence of primary fistulous tracts, internal openings, and their spatial relationships to the sphincters, as well as secondary extensions, abscesses, and collections. The radiological diagnosis of fistula was confirmed by the presence of hyperintense tubular structures on T2-weighted images (T2WI), while abscesses manifested as fluid-filled cavities with characteristic signal intensities. A single consultant radiologist interpreted the images, and the findings were subsequently validated through surgical intervention. To evaluate the diagnostic effectiveness of MRI, researchers calculated a range of performance metrics, including, sensitivity, specificity, positive Predictive Value (PPV), negative Predictive Value (NPV) and diagnostic Accuracy. Surgical findings served as the reference standard for comparison. The study also explored potential associations between MRI performance and demographic factors, such as: gender, age and body mass index (BMI). Statistical analysis was performed using the Chi-Square test, with a significance threshold of $p < 0.05$.

RESULTS

The comprehensive diagnostic evaluation of Magnetic Resonance (MR) imaging for perianal fistula detection yielded exceptionally promising results, demonstrating a remarkably high sensitivity of 92.94% and specificity of 91.76%, which unequivocally indicates its outstanding ability to accurately identify and exclude perianal fistulas in clinical settings (Table-I). Notably, the

positive predictive value (PPV) of 91.86% and negative predictive value (NPV) of 92.86% further underscore the reliability and diagnostic precision of MR imaging in confirming or ruling out perianal fistulas, thereby minimizing false positives and negatives. These impressive metrics collectively contributed to an overall diagnostic accuracy of 92.35%, a testament to MR imaging's exceptional performance in detecting perianal fistulas. Consequently, this study validates MR imaging as a dependable, accurate, and highly sensitive diagnostic tool for perianal fistula detection, providing clinicians with a valuable resource for informed decision-making and effective patient management. Figure-1 is showing coronal section of T2WI STIR sequence of pelvis showing Transphincteric fistula on left side having external opening at 6 o'clock position and internal opening at 3 o'clock position. Figure-2 is showing axial section of T2WI STIR sequence of pelvis showing Transphincteric fistula on left side having external opening at 2 o'clock position and internal opening at 3 o'clock position along with small abscess formation near external opening and this abscess is extending anteriorly around 12 o'clock position.

MRI	Surgery		Total
	Positive	Negative	
Positive	158	14	172
Negative	12	156	168
Total	170	170	340
Sensitivity	92.94%		
Specificity	91.76%		
Positive Predictive Value	91.86%		
Negative Predictive Value	92.86%		
Diagnostic Accuracy	92.35%		

Table-I. Comparison of MRI with surgical finding

DISCUSSION

This study demonstrated the high effectiveness of MRI in diagnosing peri-anal fistulas, with a sensitivity of 92.94%, specificity of 91.76%, positive predictive value (PPV) of 91.86%, negative predictive value (NPV) of 92.86%, and diagnostic accuracy of 92.35%. These results closely align with a previous study of 25 patients, which reported sensitivity and specificity rates of

100% and 88%, respectively, further confirming MRI's reliability as a diagnostic tool for peri-anal fistulas.¹⁶ Researchers conducted a comparative study on 42 patients with suspected anal fistulas, evaluating digital rectal examination, dynamic contrast-enhanced MR imaging, and surgical exploration. The findings indicated that MRI was more accurate, demonstrating 97% sensitivity and 100% specificity in detecting fistulas, thereby establishing its superiority over digital rectal examination, even when combined with surgical exploration.¹⁰

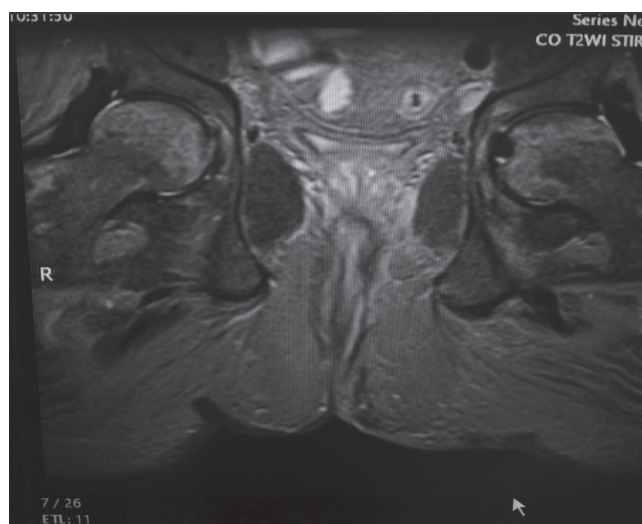


Figure-1. Transphincteric fistula

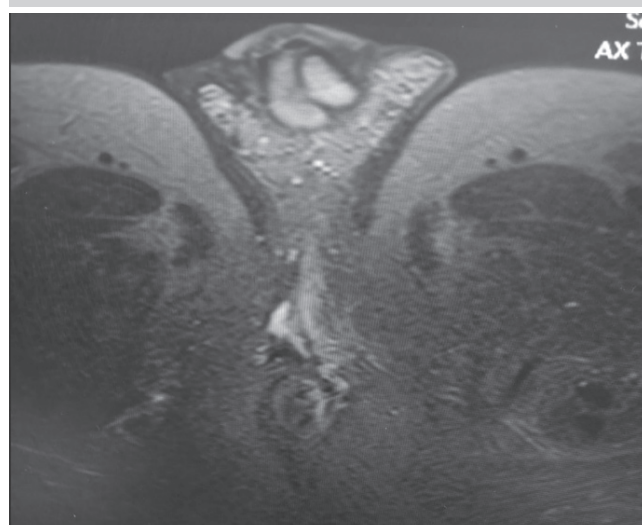


Figure-2. Transphincteric fistula with abscess

Researchers conducted an in-depth study to assess the diagnostic accuracy of Magnetic Resonance Imaging (MRI) in identifying primary fistulating tracts and abscesses, and the findings

were remarkably positive. The study revealed that MRI yielded a perfect sensitivity of 100% and a specificity of 86% for detecting primary fistulating tracts, while also demonstrating impressive sensitivity and specificity rates of 96% and 97%, respectively, for identifying abscesses, thus underscoring MRI's invaluable role as a diagnostic tool in accurately diagnosing and differentiating between these complex conditions.¹⁷ A study conducted by Imaadur Rehman et al. corroborated previous findings, revealing that Magnetic Resonance Imaging (MRI) exhibited remarkable diagnostic efficacy in identifying the type and extent of peri-anal fistulas, with a sensitivity of 90%, specificity of 100%, and overall diagnostic accuracy of 90%, further solidifying MRI's role as a reliable diagnostic modality.¹⁸

Magnetic Resonance Imaging (MRI) showed high diagnostic utility in two separate studies. One study found MRI to be highly effective in correctly detecting and grading primary tracts, achieving 95.56% sensitivity and 80% specificity. Another study revealed MRI's sensitivity and specificity for detecting abscesses to be 87.50% and 95.24%, respectively.¹⁹

The results of our study demonstrate consistency with the findings of Regina G. H. Beets-Tan et al., who conducted a comprehensive evaluation of MRI's diagnostic performance in detecting peri-anal fistula-related conditions. Specifically, their study revealed impressive sensitivity and specificity rates for MRI in identifying fistula tracts (100%, 86%), abscesses (96%, 97%), horseshoe fistulas (100%, 100%), and internal openings (96%, 90%), thereby underscoring the diagnostic utility of MRI in this clinical context.²⁰

CONCLUSION

Our study conclusively demonstrates that Magnetic Resonance (MR) imaging is a reliable and accurate diagnostic modality for detecting perianal fistulas, exhibiting high sensitivity and specificity when correlated with surgical findings, the gold standard.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

1	Ameet Jesrani: Proposed topic, study design, methodology, manuscript writing, statistical analysis.
2	Seema Nayab: Methodology, writing, study design.
3	Riaz Hussain Awan: Literature review.
4	Marya Shaikh: References, quality insurer.
5	Sara Waqar: Literature review, quality insurer.
6	Sorath Mangi: References, quality insurer.