ORIGINAL ARTICLE

DIAGNOSTIC ACCURACY OF MRI IN PREOPERATIVE ASSESSMENT OF PERIANAL FISTULAE

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Background: Perianal fistulae are challenging anorectal conditions characterized by abnormal tracts between the anal canal or rectum and the perianal skin. Accurate preoperative diagnosis is essential to map the fistula, prevent recurrence, and minimize complications. MRI has emerged as a non-invasive and highly sensitive modality for evaluating perianal fistulae. This study aimed to assess the diagnostic accuracy of MRI in preoperative evaluation, using surgical findings as the gold standard. **Methods:** This cross-sectional validation study was conducted at the Department of Diagnostic Radiology, Ayub Teaching Hospital, Abbottabad, over two years. Patients with clinical suspicion of perianal fistula underwent MRI using a 1.5 Tesla scanner. Standard imaging protocols included T1-weighted, STIR, and T2-weighted sequences. Surgical findings were recorded as the gold standard for comparison to calculate the validity parameters. **Results:** Most of the participants, 107/157 (68.2%), were male with a mean age of 53.47±13.02 years and a mean BMI of 24.45±3.19. MRI demonstrated high sensitivity (95.89%), specificity (81.82%), PPV (98.59%), NPV (60%), and an overall diagnostic accuracy of 95.2%. It accurately identified fistulous tracts, internal and external openings, and secondary extensions. MRI findings correlated strongly with surgical observations (p<0.001). **Conclusions:** MRI is a highly accurate, non-invasive imaging tool for precise anatomical mapping of primary and secondary fistulous tracts and abscesses, aiding in precise preoperative assessment and planning. Integrating MRI into diagnostic workflows is especially beneficial in resource-constrained settings by alleviating the economic and emotional burden associated with repeated surgeries and postoperative complications caused by incomplete preoperative assessment.

Keywords: Perianal fistula; Anal fistula; Magnetic resonance imaging; Preoperative assessment; Diagnostic accuracy; Surgical correlation

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INTRODUCTION

Perianal fistulae, abnormal tracts that form between the anal canal or rectum and the skin surrounding the anus, have been a significant clinical problem, with their occurrence documented as far back as the time of Hippocrates.[1,2] These fistulae are often associated with considerable pain, recurrent infections, and, in severe cases, systemic complications.[3] In addition to being physically upsetting, perianal fistulae, which mostly affect males in their 3rd to 5th decades present a recurring problem for surgeons because they frequently recur, even after surgery.[4]

The complexity of the fistulous tract, its physical connection to the sphincter muscles, and the possibility of additional tracts or abscesses highlight how crucial it is to make an accurate diagnosis and provide effective care to reduce problems such as fecal incontinence and recurrence.[2-4] Clinical examination, prompting, and surgical exploration have always been the mainstays of diagnosis; nevertheless, these methods have significant drawbacks, particularly in terms of precise localization of the internal opening and monitoring of subsequent expansions of the fistula.[4,5] Preoperative evaluation of perianal fistulas has benefited greatly from the use of magnetic resonance imaging (MRI) in recent years.

Fistulous pathways, their structural interactions with surrounding tissues, and accompanying abscesses can all be observed in detail with the enhanced soft tissue contrast resolution of MRI. The high sensitivity and specificity of MRI in identifying and categorizing fistulas, especially in complicated cases, has been repeatedly demonstrated in international studies.[6-10] However, the function of MRI in identifying perianal fistulas in indigenous populations, such as in Pakistan, remains understudied, despite its proven utility. Given the unique clinical and demographic characteristics observed in this group, the lack of current region-specific data on the diagnostic performance of MRI highlights the need for further research.

By evaluating the diagnostic accuracy of MRI in the preoperative evaluation of perianal fistulas using surgical findings as a reference standard, this

study seeks to fill this gap. This study aims to evaluate the extent to which MRI can facilitate surgical planning and help reduce the risks of recurrence, complications, and the need for additional treatments by comparing MRI data with intraoperative observations. By comparing the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy of MRI with surgical findings (the reference standard), it is specifically intended to ascertain the diagnostic accuracy of MRI.

MATERIAL AND METHODS

This study was a cross-sectional validation study conducted over two years, from April 1, 2023, to March 31, 2025 at the Department of Diagnostic Radiology, Ayub Teaching Hospital, Abbottabad. The primary objective was to determine the diagnostic accuracy of MRI in the preoperative assessment of perianal fistulae by taking surgical findings as reference standard. The total sample size of 157 was calculated using sensitivity specificity sample size calculator taking sensitivity and specificity of MRI to diagnose anal fistula to be 95.56% and 80% respectively and a prevalence of anal fistula to be 38%, with confidence interval of 95%, desired precision of 8%.[11]

Patients included in the study were adults aged ≥18 years, presenting with clinical symptoms of perianal fistulae, such as perianal discharge and visible perianal openings, with a disease duration of over six months. Both male and female patients were eligible for inclusion. Exclusion criteria included patients who had previously undergone surgery for perianal fistulae, those with contraindications to contrast agents (e.g., acute or chronic renal failure), patients suffering from claustrophobia or with metallic implants (such as pacemakers), and individuals who were unfit for surgery or refused to undergo surgical procedures. Patients were referred for MR fistulogram after clinical examination by the surgeons. They surgical notes would just describe the clinical history of pus discharge, visible external opening and duration of symptoms. The surgery was done after the MRI report in all cases and correlation with surgical findings was done prospectively. The radiologists were blinded to the surgical findings of the patient.

The department used a Canon 1. 5 Tesla MRI scanner with a phased array body coil to perform MRI imaging on all eligible patients. Short tau inversion recovery (STIR) sequences, T2-weighted fast spin echo (T2W FSE), and T1-weighted fast spin echo (T1W FSE) were among the standard imaging procedures used. Images were obtained with the long axis of the anal canal aligned in the transverse and coronal planes. To provide sufficient spatial resolution, a slice thickness of 4 mm and an inter-slice gap of 0.4 mm were used in all patients. Diagnosis of abscesses and secondary tracts was aided by these imaging features, which allowed for in-depth evaluation of the perianal area, including the levator plate and the entire perineum. Throughout the study, ethical issues were closely respected and adhered to as per the Declaration of Helsinki.

All participants provided informed consent before being enrolled, and to protect the privacy and comfort of patients undergoing MRI treatments, a chaperone was present especially with female patients. Each patient underwent surgery, performed by consultant surgeons, after MRI. Internal and external openings of the major fistulous canal, as well as possible secondary expansions or abscesses, were carefully noted in the operative notes during the procedure. Using a self-developed structured pro-forma, a team member was responsible for monitoring the clinical course of each patient and methodically collecting MRI and surgical findings data.

The data collected was analyzed using SPSS version 27. Mean and standard deviation were calculated for continuous variables such as age and BMI, while categorical variables such as gender, residence, presence of abscess and secondary tracts were expressed as frequencies and percentages. The validity parameters were calculated using a 2x2 contingency table between MRI and surgical findings. Additionally, the results were stratified by age and gender to assess the effect of these variables on the diagnostic performance of MRI.

RESULTS

This study included a total of 157 participants who presented for MR fistulography with suspicion of peri-anal fistula and then were followed for surgery. The sociodemographic and clinic parameters of these patients are presented in table 1.

Table 1 presents demographic and clinical characteristics of the study participants. It includes data on gender (107/ 68.2% male), residence (80/ 51% rural), and socioeconomic class (63/ 40.1% middle class). It also summarizes MRI findings, such as the location of external and internal openings (e.g., 87/ 55.4% at 6-8 o'clock for external openings), internal opening level (138/ 87.9% at a high site), and MRI classifications (79/ 50.3% at Grade 1 for St. James's grade). Most participants (94/ 59.9%) had openings ≤ 3 cm away from the anus. The mean age was 53.47±13.02 years and mean BMI of 24.45±3.19.

Table 2 shows a crosstabulation of perianal MRI and surgery findings, with the distribution of negative and positive results in each category. The Pearson's Chi-square test *p*-value of <0.001 was obtained, indicating a statistically significant

association between MRI findings and surgical outcomes. Validity parameters were calculated from this table, giving the following values: Sensitivity: 95.89%, Specificity: 81.82%, PPV: 98.59%, NPV: 60%, and Diagnostic Accuracy: 95.2%.

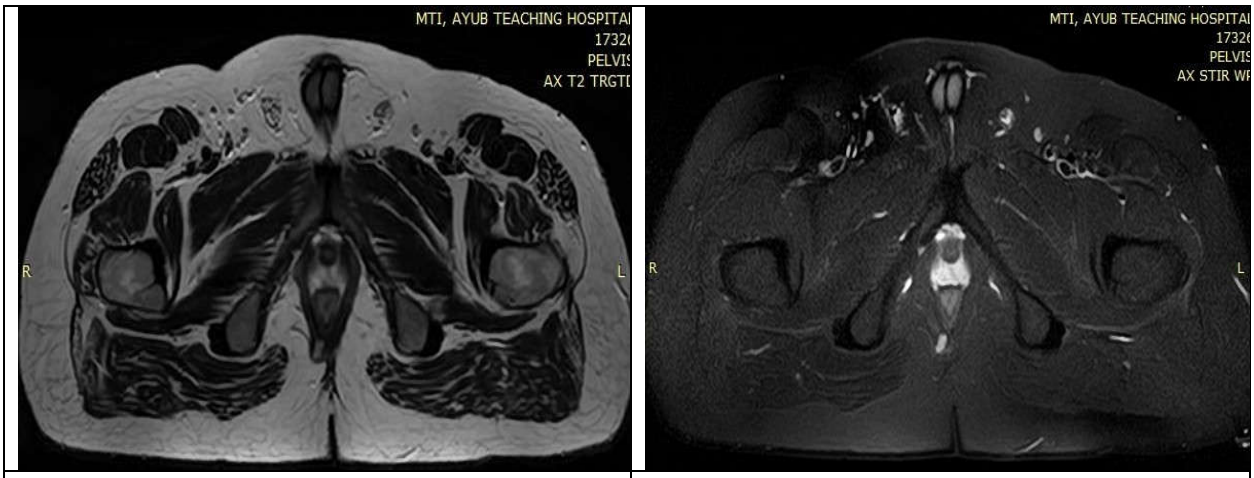
Figure 1 is a grid of the T2W and STIR images showing a high-signal-intensity tract in the perianal region on the right side with internal opening at the 7 o'clock position in images A and B, respectively. Similarly, the skin (external) opening can be seen at 7 o'clock in images C and D, respectively.

Table-1: socio-demographic and clinical characteristics of study participants

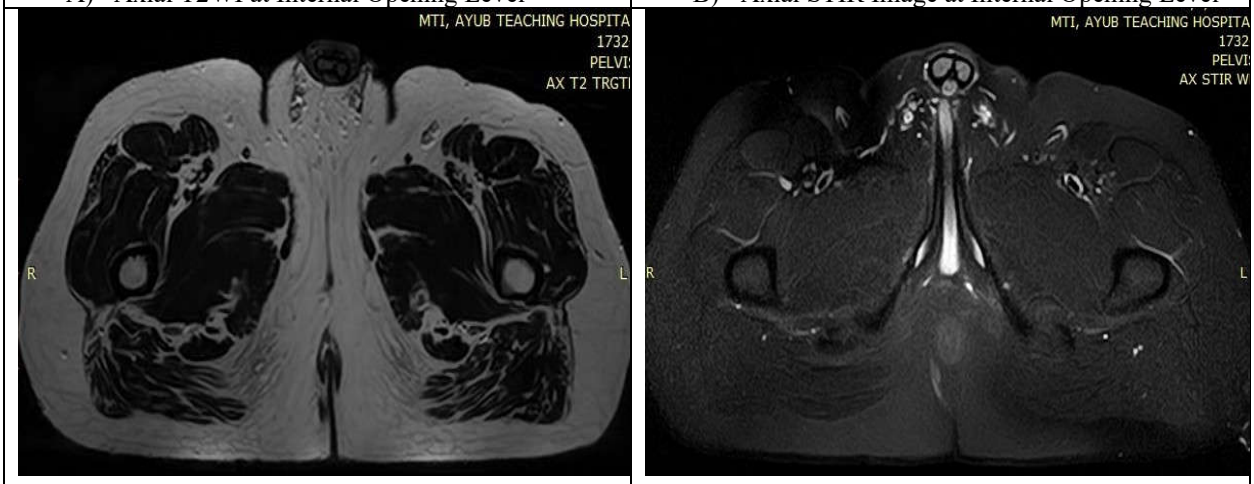
Category	Subcategory	Count (%)
Gender	Female	50 (31.8%)
	Male	107 (68.2%)
Residence	Rural	80 (51.0%)
	Urban	77 (49.0%)
Socioeconomic Class	High	49 (31.2%)
	Low	45 (28.7%)
	Middle	63 (40.1%)
MRI site of external opening	No External opening site-MRI	10 (6.4%)
	12-2 o'clock	16 (10.2%)
	3-5 o'clock	32 (20.4%)
	6-8 o'clock	87 (55.4%)
	9-11 o'clock	12 (7.6%)
External opening location	N/A	11 (7.0%)
	≤ 3 cm away from anus	94 (59.9%)
	> 3 cm away from anus	52 (33.1%)
MRI site of internal openings	N/A	15 (9.6%)
	12-2 o'clock	27 (17.2%)
	3-5 o'clock	20 (12.7%)
	6-8 o'clock	79 (50.3%)
	9-11 o'clock	16 (10.2%)
MRI Internal opening level	High site	138(87.9%)
	Low site	4 (2.5%)
	N/A	15 (9.5%)
MRI St. James's grade	N/A	15 (9.6%)
	Grade 1	79 (50.3%)
	Grade 2	15 (9.6%)
	Grade 3	33 (21.0%)
	Grade 4	15 (9.6%)
MRI Park's classification	N/A	15 (9.6%)
	Intersphincteric	90 (57.3%)
	Suprasphincteric	1 (0.6%)
	Transsphincteric	51 (32.5%)
MRI secondary tract	No	135 (86.0%)
	Yes	22 (14%)
Abscess	No Abscess	138 (87.9%)
	Intersphincteric	13 (8.3%)
	Perianal region	5 (3.2%)
	Supralevator	1 (0.6%)
Continuous Parameters	Mean ± SD	Min - Max
Age (Years)	53.47 ± 13.02	25 - 69
Weight (Kg)	65 ± 14.46	50.4 - 94
Height (cm)	163.40 ± 9.08	150 - 179
BMI (Kg/m^2)	24.45 ± 3.19	18.6 - 29.9

Table-2: Cross-tabulation of Perianal MRI and Surgery Findings

Cross tabulation		Surgical Findings		Total	*p*-value
		Negative	Positive		
		N (%)	N (%)	N (%)	
MRI Findings	Negative	9 (81.8%)	6 (4.1%)	15 (9.6%)	<0.001
	Positive	2 (18.2%)	140 (95.9%)	142 (90.4%)	
Total		11 (100.0%)	146 (100.0%)	157 (100.0%)	



A) Axial T2WI at Internal Opening Level | B) Axial STIR Image at Internal Opening Level



C) Axial T2WI at External Opening Level | D) Axial STIR Image at External Opening Level

Figure-1: T2W and STIR Images at the level of Internal and External Opening of the Fistulous Track

DISCUSSION

Perianal fistulas are a notable concern within anorectal disorders, with an estimated prevalence of approximately 1.69 per 10,000 individuals in Europe.[12] Accurate preoperative diagnosis is crucial, as incomplete identification of fistulous tracts can lead to recurrence rates ranging from 7– 21%, depending on the type of fistula and surgical procedure employed.[13] The results of this study highlight the utility of MRI as a reliable, non-invasive imaging modality for delineating fistulous pathways, identifying internal and external openings, and detecting secondary pathways or abscesses.

Such comprehensive preoperative assessment significantly improves surgical planning and reduces recurrence rates, highlighting the central role of MRI in the clinical management of perianal fistulas. Recent studies continue to affirm the high diagnostic accuracy of MRI in the preoperative evaluation of perianal fistula. The diagnostic performance of MRI observed in this study is in close agreement with the results of recent global studies. For example, Baysal *et al*. (2023) reported a sensitivity of 90% and specificity of 85%, while Ahmed *et al*. (2023) observed similar measurements, with a sensitivity of 93% and a specificity of 92%.[3,14] Aly *et al*. (2024) reported slightly higher sensitivity (100%) but comparable specificity (85.71%) and accuracy (98.36%), which is comparable to our study.[15] MR fistulography can effectively delineate fistulous pathways and associated abscesses, thereby providing surgeons with an accurate roadmap for intervention [16]. These results are consistent with previous research, such as the 2016 study by Ishfaq *et al*., which demonstrated the sensitivity and specificity of MRI at 92.94% and 91.76%, respectively.[17] These studies corroborate the high diagnostic accuracy of MRI in different contexts. The improved specificity observed in the present study likely reflects recent advances in MRI technology, particularly the use of multi-element

body coils and fat suppression sequences, which allow superior visualization of perianal structures.[6]

Additionally, emerging developments in MRI protocols merit consideration. Studies have demonstrated that combining diffusion-weighted MRI (DW-MRI) with post-contrast T1 and STIR sequences significantly improved diagnostic sensitivity and accuracy, approaching nearly 100%.[16,18] The value of MRI as a reliable preoperative technique is further supported by comparative research. A recent study found that MRI and surgical findings were highly concordant, with a kappa correlation of 0.89 for primary channels and 0.94 for subsidiary tracts.[19] These results support the accuracy of MRI in defining fistulous anatomy and are consistent with our results.

Differences in diagnostic performance may be caused by variations in imaging equipment, protocol uniformity, and patient demographics (e.g., the current study included participants from diverse socio-demographics (for example, the current study included participants from a range of socioeconomic backgrounds and rural-urban locations). Notably, sensitivity values of current study were higher than those found in some earlier studies. This might be because used modern imaging equipment (1.5 Tesla MRI with phased-array coils) and standardized imaging techniques were used in this study.

The study's findings further support the use of MRI in assessing complicated fistulas. Results of the current study reflect the remarkable concordance between MRI and surgical findings reported in difficult cases like Grade 4 fistulas. The usefulness of MRI in identifying secondary tracts and abscesses was also highlighted by another recent study, especially in individuals with fistulas linked to Crohn's disease.[20] These results support the use of MRI in directing surgical planning and reducing problems following surgery.

Further evidence from the literature demonstrates the high diagnostic performance of MRI in a number of parameters, including the identification of the primary tract with 97.73% sensitivity and 83.33% specificity, the detection of abscesses with 88.89% sensitivity and 95.12% specificity, the location of the internal opening with 95.45% sensitivity, and the identification of secondary branches with 92.86% sensitivity and 94.44% specificity.[21] These results are consistent with the excellent diagnostic accuracy of our study, which showed that MRI was useful in mapping fistulous pathways, finding associated abscesses or secondary expansions, and locating internal and external openings.

An important finding of the present study is the relatively low NPV of 60%, despite the excellent sensitivity (95.89%), specificity (81.82%), and positive predictive value (98.59%) of MRI. The high PPV indicates that a positive MRI finding is highly reliable and can confidently guide surgical planning. However, the lower NPV suggests that a negative MRI result should be interpreted with caution, as approximately 40% of patients with a negative MRI may still have a fistulous tract that is subsequently identified during surgery. This finding may partly be explained by the high prevalence of perianal fistulae in the study population, which tends to increase PPV while reducing NPV.

From a clinical perspective, a negative MR fistulogram should not be considered sufficient to exclude peri-anal fistula in patients with persistent symptoms or strong clinical suspicion.[22] In such cases, surgeons should integrate MRI findings with clinical examination, examination under anaesthesia, and intraoperative assessment before ruling out a fistula. The relatively low NPV therefore reinforces the role of MRI as an adjunct rather than a standalone diagnostic tool. The ESGAR consensus statement also highlights the agreement on the use of MRI for the initial evaluation of perianal diseases.[22] While MRI is highly effective for confirming and mapping fistulous disease, negative findings should be interpreted within the broader clinical context to avoid missed diagnoses, delayed treatment, and potential recurrence arising from undetected fistulous tracts.

When combined, our results highlight the importance of MRI to improve preoperative planning and reduce the risk of recurrence, particularly in complicated or recurrent patients. MRI thus has the potential to assist the surgeons with accurate mapping of fistulous anatomy thereby developing case specific targeted surgical approach to reduce the incidence of fecal incontinence and other associated complications. This study fills a major vacuum in the literature about the Hazara community by offering region-specific statistics on MRI's diagnostic accuracy.

CONCLUSIONS

This study confirms that MRI is a reliable method for pre-operative evaluation of perianal fistulae. MRI is a very accurate non-invasive imaging modality having a sensitivity, specificity, and diagnostic accuracy of 95.89%, 81.82%, and 95.2%, respectively. It helps with accurate preoperative evaluation and planning by providing detailed anatomical mapping of primary and secondary fistulous tracts and abscesses.

RECOMMENDATIONS:

Future research should explore the cost-effective strategies for incorporating MRI into routine clinical practice as we did not evaluate the cost-effectiveness of MRI, a critical factor for advocating its widespread adoption in low-resource environments. Continued

research is necessary to overcome barriers to accessibility and cost, ensuring that advanced diagnostic tools are available to all patients in need.

AUTHORS' CONTRIBUTION

HM, TA, AF: Conceptualization of study design, literature search, write-up, proofreading, and approval of the final manuscript. FA: Data Collection, Data analysis, data interpretation, proofreading, and approval of the final manuscript. HJ: Data Collection, Data analysis, data interpretation, proofreading, and approval of the final manuscript.

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