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Original Research Article

THE ROLE OF MAGNETIC RESONANCE IMAGING IN PREOPERATIVE EVALUATION OF PERIANAL FISTULA

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ABSTRACT

Background: Magnetic resonance imaging (MRI) has become the preferred method for examining perianal fistulas before surgery. This study aimed to evaluate how well MRI can identify different types and severities of perianal fistulas, compare these findings to what was observed during surgery, and determine if MRI can help prevent problems after surgery.

Materials and Methods: This study examined the accuracy of MR fistulography in predicting the location and extent of perianal fistulas in 110 patients. The study compared MR fistulography findings with surgical outcomes over 18 months.

Results: MRI demonstrated strong concordance with surgical findings in the evaluation of perianal fistulas. The imaging modality accurately identified primary and branched tracts, abscesses, and horseshoe components. Additionally, MRI exhibited high sensitivity (96%), specificity (83%), and positive predictive value (94.5%) for detecting internal openings. Preoperative MRI assessment was associated with a reduced risk of fistula recurrence.

Conclusion: Preoperative magnetic resonance fistulography improves diagnostic accuracy in the assessment of fistulous tract anatomy. It precisely delineates the fistula's location in relation to the anal sphincters, accurately identifies internal openings, branch tracts, abscesses, and horseshoe formations. This also contributes to a reduction in postoperative recurrence.

Keywords: Preoperative, MRI, Perianal fistula, Intersphincteric, Transsphincteric,Primary Tract.

INTRODUCTION

A perianal fistula is an abnormal channel connecting the mucosal lining of the anal canal to the perianal skin.[1] This passageway, often linear, originates from an external opening on the skin and extends to an internal opening within the posterior crypt of the anal canal. The fistula wall typically consists of inflamed granulation and fibrous tissue. However, in cases involving previous surgery or Crohn's disease, the fistula tract can become more complex, branching, and deeply penetrating.[2]

Inaccurate classification or evaluation of fistula extent can result in incomplete wound healing, recurrent fistulas and unintended damage to the sphincter. Consequently, precise characterization of fistulous tracts prior to surgical intervention is essential. [3] The primary objective of imaging is to establish the connection between the fistulous tract and the sphincter complex and to identify secondary fistulous tracts and abscesses. Various imaging techniques are available, including X-ray fistulography, endoanal ultrasonography, CT fistulography, and MRI, with MRI being considered the gold standard. Other modalities possess numerous limitations.

Preoperative MRI evaluation of perianal fistulas offers a superior field of view compared to endoanal ultrasonography, allowing for comprehensive assessment of complex fistula anatomy, including branching tracts, lateral extension into perianal spaces, and cranial extension above the levator ani muscles. This overcomes the limitations of previous imaging modalities. MRI accurately characterizes the primary fistula tract, locates the internal

opening, and delineates the extent of tract and abscess formation, which are critical factors for surgical planning. This information provides the surgeon with a roadmap to minimize recurrence and preserve continence by delineating the relationship between the fistula tract and the anal sphincters.[2,4]

The purpose of this study was to evaluate the diagnostic utility of magnetic resonance imaging (MRI) in the preoperative assessment of perianal fistulas. By analyzing various grades and types of fistulas, we sought to compare MRI findings with intraoperative observations. Furthermore, we aimed to investigate the prognostic value of preoperative MRI in predicting postoperative recurrence rates during follow-up.

MATERIAL AND METHODS

A retrospective, hospital-based study was undertaken between January 2023 and June 2024 at the Department of Surgery, Shri Jagannath Medical College and Hospital, Puri. A total of 110 patients presenting with clinical features suggestive of perianal fistula were included in the study based on established inclusion and exclusion criteria.

Clinical data for all included cases were extracted from their medical records. Following a comprehensive history and physical examination, the number and location of cutaneous fistulae were determined. All imaging protocols adhered to the safety and screening guidelines outlined by the American College of Radiology for MRI. Patients were positioned supine on the MRI table, and a perianal MRI was conducted using a GE 1.5 Tesla Sigma HDxt scanner.

MRI sequences included T1-weighted fast spin echo (axial oblique and coronal oblique), T2-weighted fast spin echo (axial oblique, coronal oblique, and sagittal), T2-weighted fat suppression fast spin echo (axial oblique, coronal oblique, and sagittal), and diffusion-weighted imaging. Two senior radiologists independently interpreted the MRI scans, reaching consensus. Patients underwent peritoneal surgery performed by experienced surgeons, with intraoperative findings documented. MRI and intraoperative findings were compared. Data analysis was conducted using SPSS 16.0 software, employing the chi-square test of independence to evaluate associations.

RESULTS

A total of 110 patients (mean age: 40 ± 9.4 years; range: 19-63 years) were enrolled in this study. Male patients (n=90, 85.5%) predominated, primarily within the 45-year age group. The most common presenting symptoms were localized pain, drainage from the external opening, and fever. [Table 1]

Park's classification revealed that the majority of cases (n=64, 58%) were classified as intersphincteric fistulas, followed by transsphincteric, extrasphincteric, and suprasphincteric fistulas. Of the 64 intersphincteric fistulas, 36 were simple, with a single fistulous tract. The remaining 28 cases exhibited complex features including intersphincteric abscesses, secondary branch tracts, and horseshoe formations. Among the 42 transsphincteric fistulas, 24 were simple, with a single primary tract. The remaining 18 cases presented with varying complexities, including ischioanal abscess and secondary branch tracts.

According to the St. James's University Hospital Classification, grade I fistulas were the most prevalent, constituting 36 cases (32.7%), followed by grades II, III, IV, and V. Of the 110 cases, 36 were recurrences after previous surgical intervention. Internal openings were identified in 48 patients, with the most frequent location being at the 6 o'clock position in 50 cases (52%).

Tract length was determined by measuring the distance between the internal and external openings within the coronal plane, which represents the craniocaudal extent of the tract. The maximum observed tract length was 8.7 cm, while the shortest fistula measured 1.4 cm. The average tract length was 4.8 cm with a standard deviation of 2 cm.

In a cohort of 110 patients with perianal fistula, MRI accurately identified the primary tract in 106 cases (true positives). There were four false positives. MRI demonstrated a sensitivity of 98.14% for detecting the primary tract, with a specificity of 0% due to the exclusive inclusion of perianal fistula cases. The positive predictive value was 96.34%, and the diagnostic accuracy was 94.63%.

Surgical findings revealed secondary tracts in 42 patients. Magnetic resonance imaging (MRI) accurately identified 38 of these tracts, demonstrating a high degree of sensitivity, specificity, and overall diagnostic accuracy. In 98 patients undergoing surgery for internal openings, MRI correctly detected 94 cases. The sensitivity and specificity of MRI for detecting internal openings were 95.9% and 83%, respectively, resulting in a diagnostic accuracy of 94.5%. [Table 2]

A significant association ($p \leq 0.01$) was observed between MRI and surgical diagnoses regarding St. James grading of perianal fistulas. While overall concordance was high (90-94%), certain discrepancies were noted. MRI failed to detect secondary transsphincteric tracts in two cases, leading to underestimation of fistula severity. Additionally, a branched tract was misclassified as grade III instead of IV. However, concordance rates for grades I and II were particularly strong, indicating high accuracy in identifying less complex fistulas. Overall, MRI remains a valuable tool for preoperative assessment of perianal fistulas, but careful interpretation and consideration of potential limitations are essential. [Table 3]

There was a significant correlation ($p=0.002$) between the surgical findings and the MRI-based Park classification. MRI accurately identified the fistula location relative to the sphincter, enabling precise classification according to the surgeon's Park classification. Moreover, MRI had a 100% accuracy rate in detecting abscesses and horseshoe

components. All detected horseshoe components were associated with intersphincteric fistulas, and all ischioanal abscesses were linked to transsphincteric tracts. [Table 3]

Postoperative follow-up data were collected from all 110 patients who underwent surgery within a two-year period. The primary objective of the follow-up was to evaluate the effectiveness of preoperative MRI in predicting fistula recurrence. Among the 110 cases, only two experienced fistula recurrence within one year. The remaining 108 cases demonstrated positive outcomes. Of the four recurrent cases, two were diagnosed with Crohn's disease, and one had a complex fistula with multiple tracts.

Table 1: Clinicoradiological correlation

Clinicoradiological parameters		N=110	%
Age	≤45	82	74.5
	>45	28	25.5
Sex	Male	94	85.5
	Female	16	14.5
Clinical profile	Discharge	76	69.1
	Local pain	110	100.0
	Fever	12	10.9
Park classification	Intersphincteric	64	58.2
	Transphincteric	42	38.2
	Extrasphincteric	2	1.8
	Suprasphincteric	2	1.8
Components of various fistulas	Single fistulous tract	60	54.5
	Branch tracts	38	34.5
	Horseshoe	8	7.3
	Abscess	16	14.5
	Supralevator extension	4	3.6
Complexity of fistula	Simple	60	54.5
	Complex	50	45.5
St James grading	Grade I	36	32.7
	Grade II	28	25.5
	Grade III	24	21.8
	Grade IV	18	16.4
	Grade V	4	3.6
Internal opening detection	Anterior	20	18.2
	Posterior	76	69.1
	Not visible	14	12.7

Table 2: Diagnostic concordance of MRI compared to surgery as the gold standard

Statistics	Detection of primary tract		Detection of secondary tract		Detection of internal opening	
	Value	95% of CI	Value	95% of CI	Value	95% of CI
Sensitivity	98.14%	90.11%-99.95%	90.4%	69.62%-98.83%	95.9%	86.02%-99.5%
Specificity	0.00	0.00	97%	84.67%-99.93%	83%	35.88%-99.58%
PPV	96.36%	96.23% -96.49%	95%	73.27%-99.25%	97.9%	88.7%- 99.65%
NPV	0.00	0.00	94%	81.51%-98.41%	71%	38.05%-91.05%
PLR	-	-	30.3	4.44-213.20	5.6	0.96-34.48
NLR	-	-	0.09	0.03-0.37	0.04	38.05%-91.05%
Diagnostic accuracy	94.63	85.13 – 98.88%	94.5%	84.88%-98.86%	94.5%	84.88%-98.86%

CI-confidence interval, PPV-positive predictive value, NPV-negative predictive value, PLR-positive likelihood ratio, NLR- negative likelihood ratio

Table 3: Correlation between surgical findings and MRI results.

Variables		MRI findings (No of cases)	Surgical findings (No of cases)	Concordance rate (%)	P value
St. James grade	Grade I	36	34	94.4	0.01
	Grade II	28	28	100	
	Grade III	24	22	91.6	
	Grade IV	18	20	90.0	
	Grade V	4	4	100	
Types of fistula	Intersphincteric	32	62	96	0.0002
	Transsphincteric	21	42	100	
	Extrasphincteric	2	2	100	
	Suprasphincteric	2	2	100	
Other components	Intersphincteric abscess	2	2	100	0.00
	Ischioanal abscess	6	6	100	
	Horseshoe	4	4	100	
	Supralevator	2	2	100	

DISCUSSION

Perianal fistulas are complex anorectal conditions characterized by abnormal passages connecting the perianal region to the distal gastrointestinal tract. Radiological imaging modalities are indispensable for evaluating the anatomical extent of fistulous tracts, localizing their external openings, delineating the primary tract and its branches, and identifying associated tissue involvement and inflammatory foci..[2]

This retrospective study included 110 consecutive patients with suspected perianal fistulas who underwent preoperative magnetic resonance imaging (MRI). The sample size was comparable to previous studies by Singh et al. [5] (n=50) and Beets Tan et al.[6] (n=56). All patients were under the age of 45, with a mean age of 49.4 years, consistent with prior reports (mean ages: 45 ± 15 years, 39 years, and 42 years).[5,7,8] The study demonstrated a higher prevalence of male patients (86%) compared to female patients (14%), aligning with findings from Singh et al.[5] (male: female ratio 9:1) and other studies.[9] The most common presenting symptoms were pain (100%), discharge from external openings (70%), and fever (11%), which were in line with the findings of Chauhan et al. [10]

Perianal fistulas were classified based on their anatomical course relative to the external anal sphincter into four primary types: intersphincteric, transsphincteric, suprasphincteric, and extrasphincteric.[11]Additionally, fistulas were categorized as superficial or subcutaneous. In our study, intersphincteric fistulas were the most prevalent, constituting 64 cases (58%), followed by transsphincteric with 42 cases (38%). Suprasphincteric and extrasphincteric fistulas were uncommon, comprising approximately 2% of cases each. These findings are consistent with those reported by Darwish et al. [12] who observed 63% intersphincteric, 29% transsphincteric, 5% suprasphincteric, and 3% extrasphincteric fistula cases. Our results further corroborate the findings of other studies. [13,14]

Cases at St. James University Hospital were classified according to Park's surgical classification system, based on MRI imaging findings in the axial and coronal planes. Fistulas were categorized as grade I (simple linear intersphincteric fistula), grade II (intersphincteric fistula with abscess or secondary tracts), grade III (transsphincteric fistula), grade IV (transsphincteric fistula with abscess or secondary tracts), and grade V (suprasphincteric and translevator disease). [15]

In our study, the most prevalent fistula grade was I (32.7%), followed by II (25.4%), III (21.8%), IV (16.33%), and V (3.6%). These findings align with a prior study, which also identified grade I fistulas as the most common.[16] However, our results diverge from those of de Miguel et al.[17] and Dabbis et al.[18] who reported higher frequencies of grade IV fistulas, with a distribution order of IV > I > II > III > V and IV = III > I > II > V, respectively.

The distribution of fistula components was analyzed, including secondary tracts, abscesses, and horseshoe formations. Secondary branch tracts were identified in 19 cases (34.5%), consistent with Singh et al.'s finding of 32% in their study.[5] Abscesses were defined as fluid collections exceeding 10 mm in diameter, while fistula tracts were characterized as fluid-filled tubular structures less than 10 mm, aligning with previous research criteria.[5,19] Ischioanal and intersphincteric abscesses were present in 14.5% of our cases, closely resembling the 16% abscess rate reported by Singh et al.[5] Furthermore, a horseshoe-shaped extension was observed in 7% of cases, similar to the 9% prevalence documented in a previous study.[8]

The present study found that 55% of cases were classified as simple fistulas and 45% as complex, characterized by abscesses, branch tracts, or a horseshoe configuration. These findings are in concordance with Khera et al.'s [20] report of 61% simple and 39% complex fistulas. Additionally, our analysis revealed a distribution of 67.2% primary and 32.8% recurrent fistulas, aligning with the 71% primary and 29% recurrent cases reported by previous study. [8]

The internal opening was predominantly located posteriorly (80%) in the present study, with the 6 o'clock position being the most frequent site (49%) among posterior cases. This finding is consistent with previous literature reporting posterior-located openings in 78% of cases. [9, 16, 21] The tract length in the current study exhibited a mean of 4.72 cm (range: 1.4-8.7 cm), aligning with Gurung et al.'s reported mean of 3.92 cm. [22]

Among the cases evaluated for the identification of primary fistulous tracts, only one was not accurately detected by MRI (a false negative). In this instance, the primary tract was initially misclassified as a pilonidal sinus due to the absence of a visible connection to the intersphincteric region. However, subsequent surgical exploration revealed a slender, linear extension of the tract into the intersphincteric space, thereby confirming its classification as a complete fistulous tract.

Among the false positive cases, one involved a tract mistakenly identified as active but filled with granulation tissue and devoid of pus. The other false positive was a large blood vessel that was mistakenly identified as a tract. MRI scans were very accurate in identifying surgical findings, correctly detecting 98% of cases and overall being correct 94% of the time. These results are similar to those found by Manar and his colleagues,[8] who reported a 96% accuracy in detecting primary tracts. Villa and his team also compared MRI findings to surgical outcomes and found MRI to be 100% accurate in detecting primary tracts but only 86% accurate in correctly identifying cases without primary tracts.[23]

MRI scans accurately identified secondary tracts in most cases where surgery confirmed their presence. However, MRI missed two tracts. Overall, MRI was highly accurate in detecting these tracts, with a sensitivity of 90%, specificity of 97%, and a positive predictive value of 95%. The two missed cases were later found during surgery. In one case, a subtle tract was missed on the MRI, and in the other, a branching tract was hidden by swelling and infection. There was also one false positive case where an apparent tract turned out to be a normal extension of the main tract.

Our findings are consistent with previous studies that have demonstrated MRI's high accuracy in detecting secondary tracts, horseshoe components, and abscesses associated with pilonidal disease. [5, 6, 24, 25] Singh et al. [5] reported MRI sensitivity and specificity of 93.5% and 94.5%, respectively, in detecting secondary tracts in surgical cases. Mahjoubi et al. [24] observed similar sensitivity (80%) and perfect specificity (100%) for MRI in identifying these abnormalities.

Our study accurately identified 47 of 49 patients with surgically confirmed internal openings. Magnetic resonance imaging (MRI) missed only two cases, both of which had blind-ended, fibrotic tracts that obscured the openings. A single false-positive MRI result was likely attributed to incomplete healing or a partial response to medical therapy. The sensitivity and specificity of our study were 95.9% and 83%, respectively, consistent with the findings reported by Singh et al. [5], Beets-Tan et al. [6], and Barker et al. [25]

MRI exhibited a high diagnostic accuracy, correctly identifying 104 of 110 patients (94.55%), aligning with Mullen et al.'s[26] findings of an 85% diagnostic yield. Moreover, preoperative MRI evaluation was associated with improved postoperative outcomes, as evidenced by a significantly lower fistula recurrence rate of 3.6% (4/110) compared to the 16% rate reported by Buchannan et al.[27] These results collectively suggest that preoperative MRI surpasses traditional methods such as X-ray fistulography and clinical examination in reducing fistula recurrence.

Study limitations

The study protocol did not include the administration of contrast agents. In one instance, an MRI scan characterized a tract as an active fistulous tract, whereas surgical exploration revealed it to be granulation tissue. The use of contrast enhancement could have been advantageous in such cases, as granulation tissue typically demonstrates increased signal intensity on contrast-enhanced imaging. Moreover, the visibility of internal openings might be improved with a contrast study.

CONCLUSION

Magnetic resonance imaging (MRI) is an invaluable modality for preoperative assessment of perianal fistulas. It provides precise visualization of perianal anatomy, including the fistula tract's course relative to the sphincter complex, its intricate morphology, and the location of the internal opening. This allows for accurate classification and facilitates optimal surgical planning. Our findings suggest that preoperative MRI evaluation is indispensable for the successful management of perianal fistulas, leading to a significant reduction in postoperative morbidity and recurrence rates.

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