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Research Article

A Prospective Study to Determine the Role of MRI in Surgical Decision-Making for Perianal Fistula

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Abstract: ***Introduction:*** Perianal fistula is a common surgical condition with high recurrence rates. Magnetic resonance imaging (MRI) has emerged as the gold-standard modality for preoperative assessment; however, its direct impact on surgical decision-making in the Indian context remains underexplored. This study aimed to evaluate the concordance between preoperative MRI findings and intraoperative observations, and to determine the extent to which MRI influences surgical planning in patients with perianal fistula.**Methods:** This prospective observational study was conducted at Sapthagiri Institute of Medical Sciences & Research Centre, Bengaluru, from January 2024 to December 2025. One hundred consecutive patients diagnosed with perianal fistula who underwent preoperative pelvic MRI followed by definitive surgery were enrolled. MRI findings—including fistula classification (Parks and St. James's University Hospital systems), tract course, internal opening location, secondary extensions, and abscess collections—were compared with intraoperative findings. The impact of MRI on surgical planning was assessed by documenting any modification to the planned surgical approach.**Results:** The mean age was 38.6 ± 10.2 years, with a male predominance (74%). Intersphincteric fistula was the most common type on MRI (42%) followed by transsphincteric (30%). Overall concordance between MRI and surgical findings was 91.0%. MRI demonstrated a sensitivity of 97.9%, specificity of 85.7%, and accuracy of 93.0% for fistula classification. The surgical plan was modified in 34% of patients based on MRI findings, primarily due to the detection of secondary tracts (24%), unsuspected abscesses (14%), and horseshoe extensions (12%). At six-month follow-up, the recurrence rate was 7%.**Conclusion:** Preoperative MRI demonstrates high concordance with surgical findings and significantly influences surgical decision-making in perianal fistula management. MRI-guided surgery reduces missed secondary pathology and may contribute to lower recurrence rates. Routine preoperative MRI is recommended, particularly for recurrent and complex fistulas.

Keywords: Perianal fistula; Magnetic resonance imaging; Parks classification; Surgical decision-making; Fistula-in-ano; Preoperative assessment

INTRODUCTION

Perianal fistula, defined as an abnormal epithelialized tract connecting the anal canal to the perianal skin, is one of the most common and surgically challenging conditions encountered in colorectal practice. The estimated incidence ranges from 1.2 to 2.8 per 10,000 population annually, with a well-documented male predominance. The majority of perianal fistulas arise from cryptoglandular infection, wherein obstruction of the anal glands leads to abscess formation and subsequent fistulization. The condition poses significant morbidity due to recurrent sepsis, pain, discharge, and impaired quality of life.

The primary determinant of successful surgical management of perianal fistula lies in the accurate preoperative delineation of the fistulous anatomy—specifically, the course of the primary tract relative to the sphincter complex, the location of the internal opening, the presence of secondary extensions or ramifications, and any associated abscess collections. Failure to identify these features preoperatively has been identified as the leading cause of surgical failure and recurrence, with reported recurrence rates ranging from 21% to 47% when surgery is performed without imaging guidance.

Magnetic resonance imaging (MRI) has emerged as the gold-standard imaging modality for preoperative assessment of perianal fistulas due to its superior soft-tissue contrast, multiplanar capability, and non-invasive nature. MRI provides high-resolution delineation of fistulous tracts, their relationship to the internal and external anal sphincters, the levator ani muscle, and the ischioanal and ischiorectal fossae. Multiple classification systems have been developed, of which the Parks classification (based on the relationship of the tract to the sphincter complex) and the St. James's University Hospital classification (an MRI-based grading system) are the most widely employed in clinical practice.
Landmark studies have demonstrated that preoperative MRI can reduce recurrence rates by up to 75% by enabling the identification of occult tracts and extensions

not apparent on clinical examination. However, much of the existing literature originates from Western populations, and data from Indian institutions examining the specific influence of MRI on intraoperative surgical decision-making remain sparse. Furthermore, the cost-benefit calculus of routine preoperative MRI in a resource-variable setting like India merits investigation.

This prospective study was designed to evaluate the concordance between preoperative MRI findings and intraoperative surgical observations, to quantify the proportion of cases in which MRI altered the surgical plan, and to assess the short-term recurrence rate following MRI-guided surgery at a tertiary care teaching hospital in Bengaluru.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted in the Department of General Surgery at Sapthagiri Institute of Medical Sciences & Research Centre (SIMSRC), Bengaluru, Karnataka, India, over a period of 24 months from January 2024 to December 2025.

Study Population

One hundred consecutive patients aged 18 years or above, diagnosed with perianal fistula on clinical examination and referred for preoperative pelvic MRI followed by definitive surgical management, were enrolled. Patients with inflammatory bowel disease (Crohn's disease or ulcerative colitis), malignancy-associated fistulas, rectovaginal or rectourethral fistulas, those who were medically unfit for surgery, and patients with contraindications to MRI (e.g., ferromagnetic implants, severe claustrophobia) were excluded.

Clinical Assessment

All patients underwent a detailed clinical assessment including history, digital rectal examination, and proctoscopy. Clinical assessment documented the number and position of external openings, induration, the suspected course of the fistulous tract, and any evidence of recurrence. For patients with recurrent fistulas, prior operative records were reviewed when available.

MRI Protocol

Pelvic MRI was performed on a 1.5-Tesla scanner (Siemens Magnetom Aera) using a phased-array body coil. The standardized imaging protocol included the following sequences: (a) axial, coronal, and sagittal T2-weighted turbo spin-echo (TSE) sequences; (b) axial and coronal short-tau inversion recovery (STIR) sequences; (c) axial diffusion-weighted imaging (DWI) with b-values of 0, 400, and 800 s/mm²; and (d) post-contrast fat-suppressed T1-weighted sequences following intravenous administration of gadolinium-based contrast agent (0.1 mmol/kg). The axial plane was aligned perpendicular to the anal canal axis. All MRI studies were interpreted independently by a radiologist with more than five years of experience in pelvic imaging, who was blinded to the clinical findings. The MRI report documented: (i) the number and course of fistulous tracts; (ii) classification according to the Parks and St. James's University Hospital systems; (iii) the location of the internal opening using the clock-face convention; (iv) the presence of secondary tracts, ramifications, or horseshoe extensions; and (v) the presence and location of abscess collections.

Surgical Procedure and Intraoperative Assessment

All surgeries were performed by or under the direct supervision of a consultant surgeon experienced in perianal surgery. The surgeon reviewed the MRI findings preoperatively and formulated an initial surgical plan. Intraoperatively, the surgeon performed a systematic evaluation including probing of all tracts, hydrogen peroxide injection, and methylene blue dye instillation as needed to identify internal openings and secondary extensions. The intraoperative findings were documented independently and subsequently compared with the preoperative MRI findings. Any modification to the initially planned surgical approach that was attributable to MRI findings was recorded. The specific surgical procedure performed—fistulotomy, seton placement, ligation of the intersphincteric fistula tract (LIFT), advancement flap, or fistulectomy—was documented.

Follow-Up

All patients were followed up at 2 weeks, 1 month, 3 months, and 6 months postoperatively. At each visit, clinical examination was performed to assess wound healing, continence status, and any evidence of recurrence. Recurrence was defined as the reappearance of symptoms (discharge, swelling, or pain) with clinical evidence of a new or persistent fistulous tract within the six-month follow-up period.

Statistical Analysis

Data were entered in Microsoft Excel and analysed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as mean ±standard deviation (SD) for continuous variables and frequency (percentage) for categorical variables. Concordance between MRI and surgical findings was assessed using Cohen's kappa (κ) coefficient, with values interpreted as: <0.20 poor, 0.21–0.40 fair, 0.41–0.60 moderate, 0.61–0.80 substantial, and 0.81–1.00 almost perfect agreement. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of MRI were calculated taking intraoperative findings as the reference standard. The chi-square test or Fisher's exact test was used for comparison of categorical variables. A p-value of <0.05 was considered statistically significant.

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RESULTS

Demographic and Clinical Profile

A total of 100 patients with perianal fistula were enrolled during the study period. The mean age of the study population was 38.6 ±10.2 years (range: 21–65 years). Males constituted 74% (n = 74) and females 26% (n = 26), yielding a male-to-female ratio of 2.85:1. The peak incidence was observed in the 31–40-year age group (34%). With respect to presentation, 68 patients (68%) had primary fistulas, whereas 32 (32%) had recurrent fistulas. The mean duration of symptoms prior to presentation was 5.8 ±3.4 months. The demographic and clinical characteristics are summarized in Table 1 and illustrated in Figure 1.

Table 1: Demographic and clinical characteristics of the study population (N = 100)

Parameter	n / Mean ± SD	Percentage
Age (years), Mean ± SD	38.6 ± 10.2	—
21–30 years	18	18.0
31–40 years	34	34.0
41–50 years	28	28.0
51–60 years	14	14.0
>60 years	6	6.0
Sex		
Male	74	74.0
Female	26	26.0
Presentation		
Primary fistula	68	68.0
Recurrent fistula	32	32.0
Duration of symptoms (months)		
<3	22	22.0
3–6	38	38.0
6–12	28	28.0
>12	12	12.0

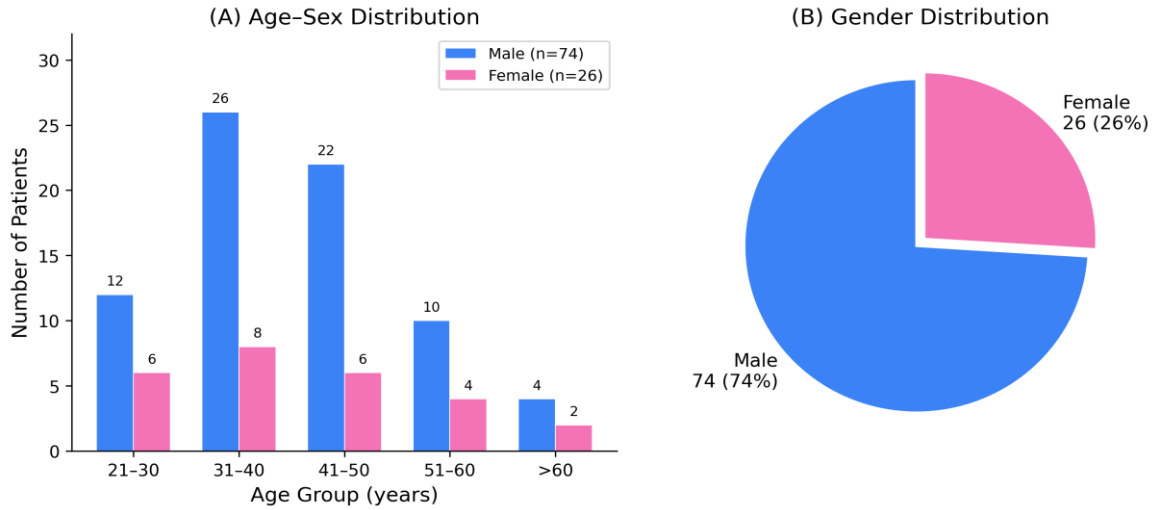

Figure 1: Age and sex distribution of the study population (N = 100).

MRI Findings

On preoperative MRI, the primary fistulous tract was identified in 98 of 100 patients (98%). According to the Parks classification, intersphincteric fistula was the most common type (n = 42, 42%), followed by transsphincteric (n = 30, 30%), superficial (n = 14, 14%), suprasphincteric (n = 8, 8%), and extrasphincteric (n = 6, 6%). The internal opening was

identified on MRI in 94 patients (94%). Secondary tracts or extensions were detected in 28 patients (28%), horseshoe extensions in 12 (12%), and abscess collections in 22 (22%). Active inflammation, evidenced by high signal intensity on T2-weighted and STIR sequences with restricted diffusion, was present in 76 patients (76%). The distribution of fistulas according to the St. James's University Hospital classification is presented in Table 2 and Figure 5.

Table 2: Distribution of perianal fistulas on MRI by Parks and St. James's University Hospital classifications (N = 100)

Classification	**MRI (n)**	**Surgery (n)**	**%**
Parks Classification			
Intersphincteric	42	40	42.0
Transsphincteric	30	31	30.0
Suprasphincteric	8	7	8.0
Extrasphincteric	6	5	6.0
Superficial	14	14	14.0
St. James's Classification			
Grade I (Simple intersphincteric)	36	—	36.0
Grade II (Intersphincteric + abscess)	12	—	12.0
Grade III (Transsphincteric)	22	—	22.0
Grade IV (Transsphincteric + abscess)	14	—	14.0
Grade V (Supralevator/translevator)	16	—	16.0

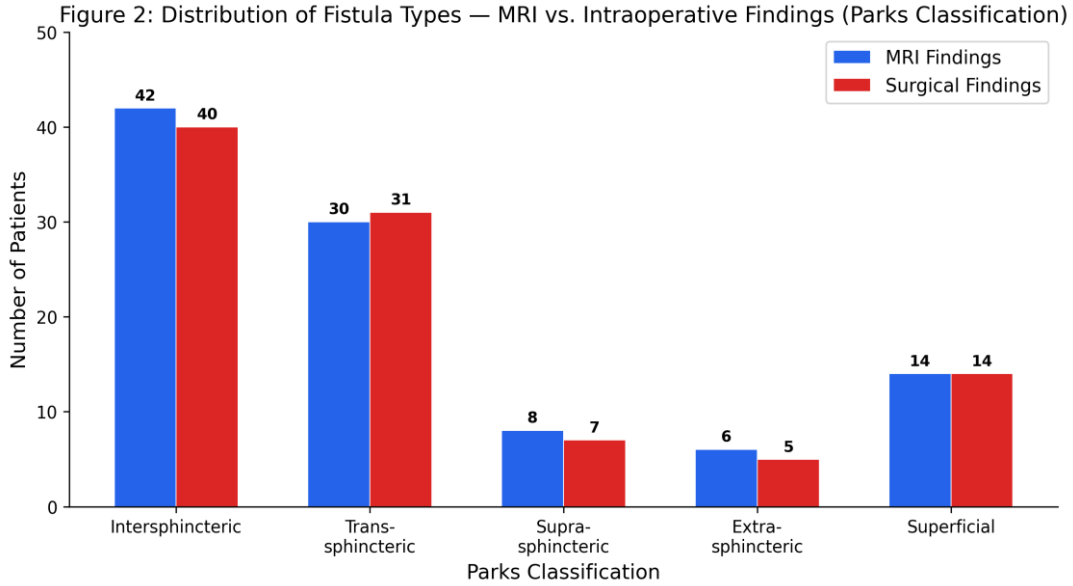

Figure 2: Distribution of fistula types — MRI versus intraoperative findings (Parks classification).

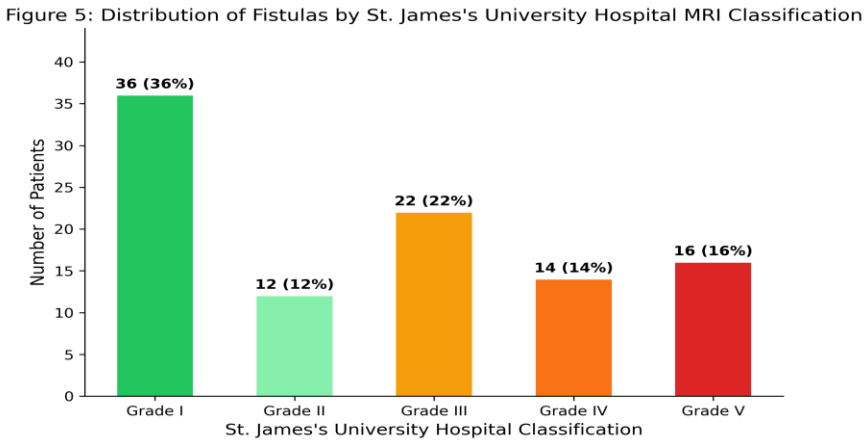

Figure 5: Distribution of fistulas by St. James's University Hospital MRI classification.

Concordance Between MRI and Surgical Findings

The overall concordance between preoperative MRI and intraoperative findings was 91.0%. When analysed by specific parameters, the concordance was highest for primary tract classification (93.0%), followed by secondary extension detection (92.9%), abscess detection (90.9%), and internal opening localization (88.0%). Cohen's kappa coefficient for fistula classification was 0.89 (95% CI: 0.83–0.95), indicating almost perfect agreement. The detailed concordance data, sensitivity, specificity, and diagnostic accuracy of MRI are presented in Tables 3 and 4, and illustrated in Figure 3.

Table 3: Concordance between MRI and intraoperative findings

Parameter	MRI (n)	Surgery (n)	Concordant (n)	κ (95% CI)
Primary tract type	100	97	93	0.89 (0.83–0.95)
Internal opening	94	96	88	0.82 (0.74–0.90)
Secondary extensions	28	26	26	0.87 (0.76–0.98)
Horseshoe extension	12	11	11	0.91 (0.80–1.00)
Abscess collection	22	21	20	0.90 (0.79–1.00)

Table 4: Diagnostic accuracy of MRI in perianal fistula assessment (surgical findings as reference)

Parameter	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Tract classification	97.9	85.7	93.0	95.2	93.0
Internal opening	91.7	75.0	93.6	69.2	88.0
Secondary extensions	96.2	95.9	89.3	98.6	96.0
Horseshoe extension	100.0	98.9	91.7	100.0	99.0
Abscess detection	95.2	98.7	90.9	98.7	98.0

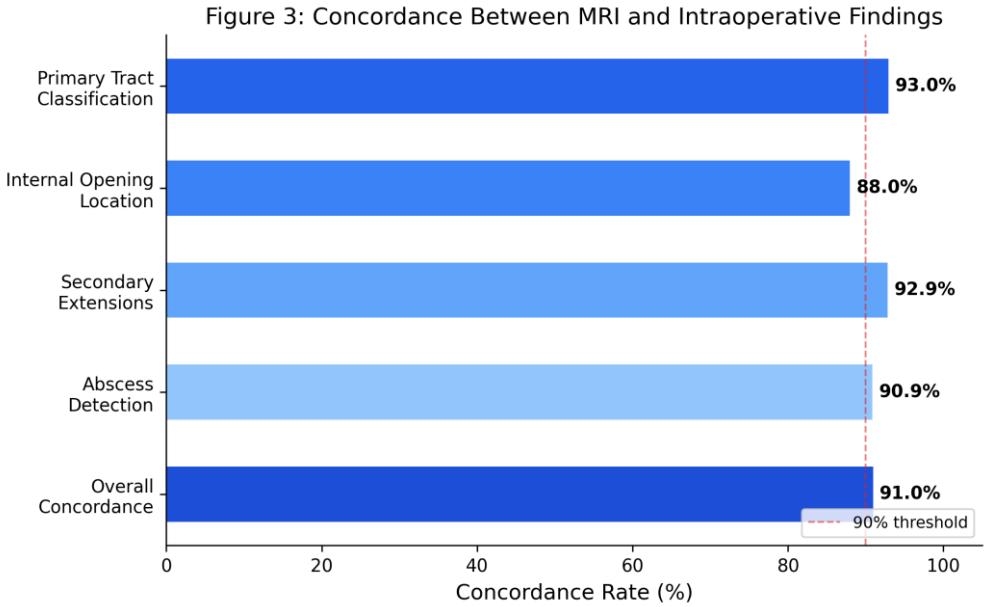

Figure 3: Concordance rates between preoperative MRI and intraoperative findings for key parameters.

Impact of MRI on Surgical Decision-Making

MRI findings led to a modification of the planned surgical approach in 34 patients (34%). The most common reason for modification was the identification of additional fistulous tracts not detected on clinical examination (n = 24, 24%), followed by the identification of a change in the planned surgical technique (n = 28, 28%), detection of clinically

unsuspected abscess collections requiring drainage (n = 14, 14%), and identification of horseshoe extensions (n = 12, 12%). The specific modifications included conversion from a planned fistulotomy to seton placement in 10 patients, addition of concurrent abscess drainage in 14 patients, and reclassification of the fistula complexity necessitating a change from fistulotomy to LIFT or advancement flap in 10 patients. These findings are summarized in Table 5 and depicted in Figure 4.

Table 5: Impact of MRI on surgical decision-making (N = 100)

MRI-Induced Modification	**n**	**%**
Surgical plan modified (overall)	34	34.0
Additional tract(s) detected on MRI	24	24.0
Clinically unsuspected abscess identified	14	14.0
Horseshoe extension detected	12	12.0
Surgical approach changed	28	28.0
Fistulotomy → Seton placement	10	10.0
Concurrent abscess drainage added	14	14.0
Fistulotomy → LIFT / Advancement flap	10	10.0
No change in surgical plan	66	66.0

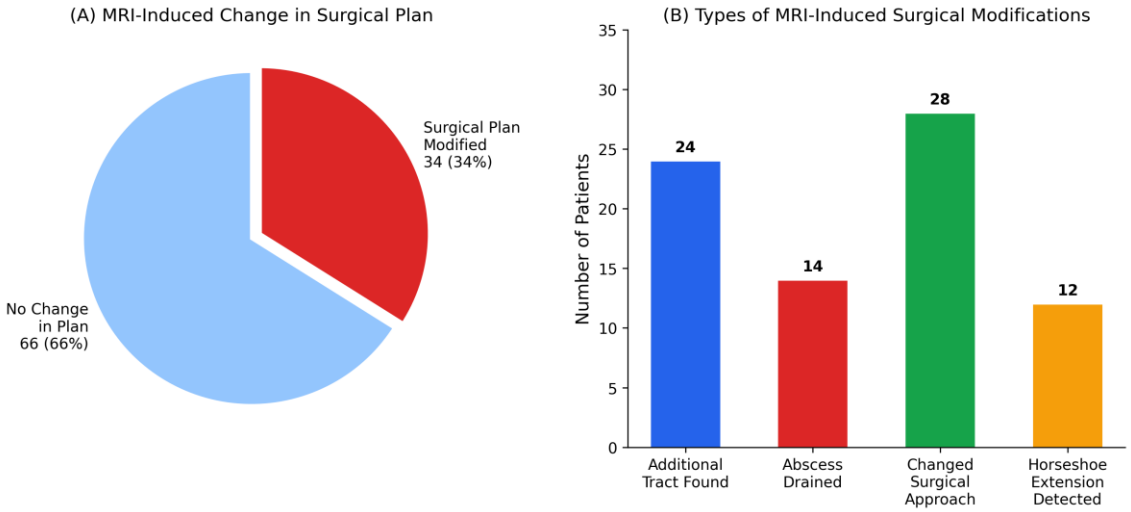

Figure 4: Impact of MRI on surgical decision-making — proportion of cases with modified surgical plans and the types of modifications.

Surgical Procedures and Outcomes

The most commonly performed surgical procedure was fistulotomy (n = 38, 38%), followed by seton placement (n = 26, 26%), LIFT (n = 14, 14%), fistulectomy (n = 12, 12%), and advancement flap (n = 10, 10%). During the six-month follow-up, recurrence was observed in 7 patients (7%). Among patients with recurrent disease at presentation (n = 32), the recurrence rate following MRI-guided surgery was 12.5% (4/32), compared to 4.4% (3/68) among patients with primary fistulas (p = 0.21). No patient developed significant faecal incontinence postoperatively, though mild soiling was reported in 3 patients (3%), all of whom had complex transsphincteric or suprasphincteric fistulas. These outcomes are presented in Table 6.

Table 6: Surgical procedures performed and outcomes at six-month follow-up (N = 100)

Parameter	**n**	**%**	**p-value**
Surgical Procedure			
Fistulotomy	38	38.0	—
Seton placement	26	26.0	—
LIFT	14	14.0	—
Fistulectomy	12	12.0	—
Advancement flap	10	10.0	—
Recurrence at 6 months	7	7.0	—
Primary fistula (n = 68)	3	4.4	0.21
Recurrent fistula (n = 32)	4	12.5	

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DISCUSSION

The present study provides prospective evidence from a tertiary care centre in South India demonstrating that preoperative MRI has a substantial and measurable impact on surgical decision-making for perianal fistulas. The overall concordance rate of 91.0% between MRI and intraoperative findings, with a kappa coefficient of 0.89 for fistula classification, corroborates the established position of MRI as the gold-standard imaging modality for this condition. These findings are consistent with those of Madany et al. (2023), who reported an overall MRI accuracy exceeding 90% in their prospective study of 50 patients, and with Anwar et al. (2023), who demonstrated high diagnostic efficacy of diffusion-weighted MRI for fistula detection.

The demographic profile of our cohort—a male predominance of 74% with a peak incidence in the fourth decade—is in concordance with the global epidemiological pattern of perianal fistulas. The male-to-female ratio of 2.85:1 in our study is comparable to the 5.4:1 ratio reported by Issa et al. (2024) in their Ethiopian cohort of 276 patients, though lower, likely reflecting regional differences in health-seeking behaviour.
The predominance of intersphincteric fistulas (42%) in our study aligns with the classical distribution described by Parks and is consistent with the cryptoglandular theory of pathogenesis. The 30% prevalence of transsphincteric fistulas is also in agreement with the broader literature. The St. James's University Hospital classification, which integrates MRI morphology with the Parks anatomical framework, provided a practical grading system for surgical planning; Grade I fistulas (simple intersphincteric) were the most common (36%), while the combined proportion of Grades IV and V (complex fistulas with abscesses or supralevator extensions) was 30%, underscoring the significant burden of complex disease in our patient population.

A key finding of this study was that MRI led to a modification of the surgical plan in 34% of patients. This figure is clinically significant and is consistent with the results of Sardinha et al. (2023), who emphasized that structured MRI reporting directly shapes surgical strategy selection. In our study, the most common reason for surgical modification was the detection of secondary tracts not apparent on clinical examination (24%), followed by identification of clinically unsuspected abscesses (14%). Horseshoe extensions, notoriously difficult to detect clinically, were identified by MRI in 12% of patients. These occult findings, if missed at surgery, are well-recognized causes of postoperative recurrence.

The high sensitivity of MRI for primary tract classification (97.9%) and secondary extension detection (96.2%) in our study reflects the diagnostic strength of the multisequence protocol employed, which included T2-weighted, STIR, DWI, and post-contrast sequences. The addition of DWI, in particular, enhanced the identification of active inflammation and early abscess formation, consistent with the findings of Anwar et al. (2023), who reported improved diagnostic efficacy with diffusion-weighted sequences in a 2023 study. The specificity for abscess detection was 98.7%, and the corresponding PPV of 90.9% confirms the reliability of MRI in identifying abscesses that warrant surgical drainage.

The comparatively lower concordance for internal opening localization (88.0%) is noteworthy and is consistent with the existing literature, which recognizes this as the most challenging aspect of MRI interpretation for perianal fistulas. The internal opening is often small, may be obscured by adjacent inflammation, and its identification is influenced by the experience of the reporting radiologist. Nonetheless, an 88% concordance rate represents a clinically useful level of accuracy, and the combination of MRI with intraoperative probing and dye injection provides a complementary diagnostic strategy.

The six-month recurrence rate of 7% in our study compares favourably with the reported rates of 21–47% in series where surgery was performed without preoperative MRI. Although our study did not include a non-MRI control group, the low recurrence rate is consistent with the hypothesis that MRI-guided surgical planning reduces missed pathology and, consequently, recurrence. The higher recurrence rate in patients with previously recurrent fistulas (12.5% vs. 4.4%) reflects the inherently more complex anatomy and scarring in this subgroup. Cheng et al. (2023), in their meta-analysis of advanced therapeutic strategies including mesenchymal stem cell therapy, similarly noted the prognostic significance of disease complexity and recurrence.

The clinical implication of these findings is that preoperative MRI should be considered standard of care in the evaluation of perianal fistulas, particularly for recurrent or clinically complex fistulas. While the cost of MRI may be a consideration in resource-limited settings, the reduction in missed secondary pathology and the potential to decrease reoperation rates likely offsets this cost. The development of standardized MRI reporting

templates, as advocated by Sardinha et al. (2023), and the potential application of artificial intelligence in automated fistula detection and classification, represent promising avenues for future research.

Limitations

This study has several limitations. First, it was a single-centre study, which may limit generalizability. Second, the absence of a non-MRI control group precludes a direct comparison of recurrence rates. Third, the six-month follow-up period may be insufficient to capture late recurrences, as some fistulas may recur beyond one year. Fourth, interobserver variability in MRI interpretation was not assessed, as all scans were read by a single radiologist. Fifth, the sample size of 100, though adequate for a prospective observational study, limits the power to detect differences in recurrence rates between subgroups. Finally, the cost-effectiveness of routine preoperative MRI was not formally evaluated.

CONCLUSION

Preoperative MRI demonstrates high concordance with intraoperative findings and significantly influences surgical decision-making in the management of perianal fistula. MRI altered the planned surgical approach in one-third of patients in this cohort, primarily by identifying occult secondary tracts, unsuspected abscesses, and horseshoe extensions not detected on clinical examination. The diagnostic accuracy of MRI was consistently high across all assessed parameters, with almost perfect agreement for fistula classification. The low recurrence rate of 7% at six-month follow-up supports the contention that MRI-guided surgery reduces missed pathology and improves outcomes. Routine preoperative MRI is recommended as an integral component of the surgical workup for perianal fistulas, particularly in cases of recurrent or clinically complex disease.

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