Journal of Surgical Radiology

Site: https://journalsurgrad.com/

ISSN Print 2156-213X| ISSN Online: 2156-4566 Volume: 05 Issue: 06 Open Access

Research Article

TO COMPARE EFFICACY OF PRE OPERATIVE MRI FISTULOGRAM WITH THE USG PERIANAL REGION IN THE EVALUATION OF FISTULA IN ANO

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Article History
Received: 13.03.2026
Revised: 12.04.2026
Accepted: 12.05.2026
Published: 15.06.2026

Citations:
Pedapudi, K., Dige, S., Patil, M. R., Monika, K. G., & Gandhi, S. (Year). To compare efficacy of pre-operative MRI fistulogram with USG perianal region in the evaluation of fistula in ano. J Surg Radiol, V5(6) 254-259

Abstract: ***Introduction:*** Fistula-in-ano is a common anorectal condition characterized by abnormal communication between the anal canal and perianal skin. Accurate preoperative assessment is essential for identifying fistulous tracts, internal openings, secondary extensions, and associated abscesses to reduce recurrence and optimize surgical outcomes. MRI fistulography and perianal ultrasonography (USG) are commonly used imaging modalities for this purpose. Aim: To compare the efficacy of preoperative MRI fistulogram with perianal USG in the evaluation of fistula-in-ano using intraoperative findings as the reference standard. **Methods**: A prospective observational study was conducted at a tertiary care center from April 2024 and March 2026. 67 patients with clinically suspected fistula-in-ano underwent both MRI fistulography and perianal USG. Imaging findings were compared with operative findings regarding fistula classification, internal opening localization, secondary tracts, abscesses, horseshoe extensions, and overall diagnostic accuracy. Statistical analysis included sensitivity, specificity, predictive values, concordance rates, McNemar test, and paired t-test. **Results:** The mean age of patients was 42.54 ± 12.54 years, with male predominance (76.1%). MRI closely matched operative classification of fistula types, whereas USG tended to overestimate complex fistulas. MRI demonstrated superior detection of secondary tracts (32.8% vs 19.4%), abscesses (26.9% vs 14.9%), internal openings (92.5% vs 77.6%), and horseshoe extensions (11.9% vs 6.0%). MRI showed higher sensitivity (95.2% vs 84.1%), overall accuracy (92.5% vs 79.1%), and concordance with surgery (94.0% vs 77.6%). The difference was statistically significant (McNemar χ^2=5.882, p=0.0153). **Conclusion**: MRI fistulogram is significantly superior to perianal USG for preoperative evaluation of fistula-in-ano and should be considered the preferred imaging modality, particularly in complex or recurrent disease requiring detailed anatomical mapping.

Keywords: Fistulogram, Fistula-in-ano, USG, Fistulography.

INTRODUCTION

Fistula in ano is a common benign anorectal condition characterized by an abnormal communication between the anal canal and the perianal skin, typically resulting from a previous or ongoing cryptoglandular infection. Traditionally, clinical examination and intraoperative exploration have been the primary means of assessment.[1,2]

Among the imaging modalities available, ultrasonography (USG) and magnetic resonance imaging (MRI) are the most commonly used non-invasive diagnostic tools for evaluating perianal fistulae. The need to accurately delineate the primary tract, secondary extensions, internal opening, and any associated abscesses underscores the importance of choosing the most efficacious imaging modality for preoperative evaluation.[2,3]

High-resolution perineal ultrasonography, also referred to as transperineal or endoanal ultrasound depending on the approach, is a cost-effective and widely accessible diagnostic tool. USG of the perianal region provides real-time imaging, enabling dynamic evaluation of the fistulous tract and its relationship with adjacent structures. The use of hydrogen peroxide or saline instillation into the external opening can enhance fistula visualization by creating echogenic contrast within the tract, thereby increasing the sensitivity of USG. However, despite its affordability and utility in superficial or simple fistulae, the diagnostic accuracy of USG tends to decrease in complex, recurrent, or high-

lying fistulas, particularly in cases with multiple branches or deep-seated abscesses.[3,4]

Magnetic resonance imaging has emerged as the gold standard imaging modality in the evaluation of anal fistulas, particularly in complex or recurrent cases. MRI fistulography is a non-invasive, high-resolution imaging technique that provides excellent soft tissue contrast and multiplanar capability, allowing for precise anatomical localization of the fistulous tract, internal opening, and associated complications such as abscesses or secondary tracts. MRI is highly effective in visualizing both active and inactive components of the fistula and can distinguish between fibrosis and active inflammation. Importantly, MRI is less operator-dependent than USG, ensuring more consistent and reproducible results. Furthermore, the classification of fistulae based on MRI findings is closely aligned with the Parks classification and other surgical grading systems, which aids in guiding appropriate surgical management.[4,5]

The comparison between MRI and USG for the evaluation of fistula in ano has been the subject of several clinical investigations, with most studies favoring MRI in terms of overall sensitivity, specificity, and concordance with intraoperative findings. However, some studies have demonstrated comparable diagnostic efficacy of USG in simple fistulas or when performed by experienced radiologists. These findings suggest that the selection between MRI and USG should be individualized based on clinical context, resource availability, and the suspected complexity of the disease.[6,7]

The aim of this study was to compare efficacy of pre-operative MRI fistulogram with the USG perianal region in the evaluation of fistula in ANO.

MATERIALS AND METHODS

The prospective observational study was conducted at the Department of Surgery, Dr. D.Y. Patil Medical College Hospital and Research Institute, Kolhapur, over a period of 24 months, from April 2024 to March 2026. A purposive sampling technique was employed to select participants and total of 67 participants were selected for the study. The study was started after receiving ethical clearance from the Institutional Ethics Committee.

Inclusion Criteria

Patients aged 18 years or older with clinical suspicion of fistula-in-ano, willing to provide written informed consent and available for follow-up and surgical intervention if required.

Exclusion Criteria

Contraindications to MRI (e.g., claustrophobia, metallic implants, or pacemakers), Known allergies to contrast agents used in MRI, Pregnant women, patients with active perianal infections requiring immediate surgical drainage.

Eligible patients were identified during clinical consultations and provided informed consent. MRI Fistulogram was conducted using a 3T MRI machine with high-resolution T2-weighted and contrast-enhanced sequences. Patients were positioned supine, and images were acquired in axial, coronal, and sagittal planes.

USG Perianal Region performed with a high-frequency transducer (7–12 MHz) using a standardized protocol to visualize fistula tracts and abscesses in real time. Findings were documented in a proforma, including tract location, relation to sphincter complex, and presence of abscesses.

Data was collected using a structured proforma that included Demographic details, Clinical history Imaging findings from MRI and USG, Surgical findings, Adverse events related to imaging procedures. Statistical analysis was performed using SPSS software (version 26). Descriptive statistics (mean, standard deviation) summarized continuous variables, while categorical data was presented as frequencies. The McNemar test compared paired proportions (MRI vs. USG), and p-values <0.05 were considered significant. Subgroup analyses explored differences in efficacy based on fistula complexity.

RESULTS

Table 1: Demographic Profile of Study Participants (n = 67)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	Mean ± SD	42.54 ± 12.54	—
	Range	22 – 64	—
	Median	41.0	—
Age Group	20-30	14	20.90
	31-40	18	26.87
	41-50	15	22.39
	51-60	13	19.40
	61-70	7	10.45
Gender	Male	51	76.1
	Female	16	23.9
Total	—	**67**	**100.0**

Mean age was 42.54 ± 12.54 years (range 22–64). The study population was predominantly male (76.1%), consistent with the known epidemiological predominance of fistula in ano in males.

Table 2: Symptom Distribution Among Study Participants (n = 67)

Symptom	Yes – n (%)	No – n (%)
Discharge	47 (70.1%)	20 (29.9%)
Pain	39 (58.2%)	28 (41.8%)
Swelling	21 (31.3%)	46 (68.7%)
Constipation	9 (13.4%)	58 (86.6%)
Fever	8 (11.9%)	59 (88.1%)

Discharge was the most common symptom (70.1%), followed by pain (58.2%) and swelling (31.3%). Fever was the least frequent symptom (11.9%), suggesting the majority of patients presented with chronic rather than acute disease.

Table 3: Duration of Symptoms and Location of External Opening (n = 67)

Variable	Category	n	%
Duration of Symptoms	< 3 months	17	25.4
	3–6 months	19	28.4
	7–12 months	18	26.9
	> 12 months	13	19.4
Location of External Opening	Posterior	40	59.7
	Anterior	19	28.4
	Lateral	8	11.9

The majority of patients (54.5%) presented within 6 months of symptom onset. The posterior location of the external opening was most frequent (59.7%), in keeping with the known anatomical prevalence due to the longer posterior anal crypts.

Table 4: Fistula Type Classification – Comparison of Modalities (n = 67)

Fistula Type	Surgery (Gold Standard)	MRI n (%)	USG n (%)
Intersphincteric	32 (47.8%)	31 (46.3%)	29 (43.3%)
Transsphincteric	23 (34.3%)	24 (35.8%)	18 (26.9%)
Suprasphincteric	7 (10.4%)	7 (10.4%)	13 (19.4%)
Extrasphincteric	5 (7.5%)	5 (7.5%)	7 (10.4%)

MRI showed near-identical classification to surgical findings (Intersphincteric: 31 vs 32; Transsphincteric: 24 vs 23; Suprasphincteric: 7 vs 7; Extrasphincteric: 5 vs 5). USG overestimated suprasphincteric fistulas (13 vs 7 surgically confirmed), suggesting a tendency for over classification of fistula complexity by USG.

Table 5: Anatomical Feature Detection – MRI vs USG vs Surgery (n = 67)

Parameter	Surgery n (%)	MRI n (%)	USG n (%)
Secondary Tract	21 (31.3%)	22 (32.8%)	13 (19.4%)
Abscess	17 (25.4%)	18 (26.9%)	10 (14.9%)
Internal Opening	63 (94.0%)	62 (92.5%)	52 (77.6%)
Horseshoe Extension	8 (11.9%)	8 (11.9%)	4 (6.0%)

MRI demonstrated superior detection of secondary tracts (32.8% vs 19.4%), abscesses (26.9% vs 14.9%), internal opening (92.5% vs 77.6%), and horseshoe extension (11.9% vs 6.0%) compared to USG, with MRI values closely matching surgical findings. USG under detected most anatomical features, potentially leading to inadequate surgical planning.

Table 6: MRI Fistulogram: MRI vs Surgery

MRI	Positive (Surgery)	Negative (Surgery)
Positive (MRI)	TP = 60	FP = 2
Negative (MRI)	FN = 3	TN = 2

MRI showed 60 true positives and 2 false positives among those who were surgery-positive, while there were 3 false negatives and 2 true negatives among those who were surgery-negative.

Table 7: USG Perianal Region: USG vs Surgery

USG	Positive (Surgery)	Negative (Surgery)
Positive (USG)	TP = 53	FP = 4
Negative (USG)	FN = 10	TN = 0

USG showed 53 true positives and 4 false positives, with 10 false negatives and no true negatives.

Table 8: Diagnostic Accuracy Metrics – MRI vs USG (n = 67)

Parameter	MRI	USG
Sensitivity	95.2%	84.1%
Specificity	50.0%	0.0%
PPV (Positive Predictive Value)	96.8%	93.0%
NPV (Negative Predictive Value)	40.0%	0.0%
Overall Accuracy	92.5%	79.1%
Concordance with Surgery	**94.0% (63/67)**	**77.6% (52/67)**

MRI demonstrated significantly higher sensitivity (95.2% vs 84.1%), specificity (50.0% vs 0.0%), PPV (96.8% vs 93.0%), NPV (40.0% vs 0.0%), and overall accuracy (92.5% vs 79.1%) compared to USG.

The McNemar test comparing paired concordance rates yielded $\chi^2 = 5.882$, $p = 0.0153$, confirming a statistically significant difference in the diagnostic performance of the two modalities ($p < 0.05$).

Overall concordance between each imaging modality and intra-operative findings was calculated as the proportion of patients where the pre-operative imaging correctly identified the fistula type and course.

MRI showed concordance with surgical findings in 63 of 67 patients (94.0%), while USG demonstrated concordance in 52 of 67 patients (77.6%). The McNemar test for paired proportions yielded $\chi^2 = 5.882$ (df = 1), $p = 0.0153$ (statistically significant at $\alpha = 0.05$), confirming that MRI has significantly better agreement with surgical findings than USG.

Table 9: Reporting Time – MRI vs USG (n = 67)

Modality	Mean (min)	SD	Min	Max
MRI Fistulogram	20.81	3.94	12.0	29.6
USG Perianal	9.36	2.28	5.0	14.7
Statistical test	**Paired t-test: t = 20.29, p < 0.0001 (Highly Significant)**			

MRI required significantly more reporting time (mean 20.81 ± 3.94 min) compared to USG (mean 9.36 ± 2.28 min). Paired t-test: $t(66) = 20.29$, $p < 0.0001$ (highly significant). Despite being faster, USG showed inferior diagnostic accuracy, indicating that the additional time required for MRI is clinically justified.

Table 10: Complex Fistula and Recurrence Data (n = 67)

Variable		n	%
Type of fistula	Complex Fistula	25	37.3
	Simple Fistula	42	62.7
Reccurence	Recurrence within 3 months	4	6.0
	No Recurrence	63	94.0

25 patients (37.3%) had complex fistulas. Recurrence at 3 months was observed in only 4 patients (6.0%), reflecting the quality of pre-operative planning aided by imaging.

DISCUSSION

The aim of the present study was to compare the efficacy of preoperative MRI fistulogram with ultrasonography of the perianal region in the evaluation of fistula-in-ano, using intra-operative surgical findings as the gold standard. The study specifically sought to assess and compare the ability of both imaging modalities to accurately classify fistula type according to Parks' classification, identify the internal opening, detect secondary tracts, abscesses, and horseshoe extensions, determine their overall diagnostic accuracy through sensitivity, specificity, predictive values, and concordance with surgery, and evaluate the reporting time required for each modality.

The present study demonstrated that fistula-in-ano predominantly affected middle-aged adults, with a mean age of 42.54±12.54 years, and showed a marked male predominance (76.1%). These findings are consistent with the demographic profile reported in previous studies by Buchanan GN et al. [8], West RL et al. [9], Sudoł-Szopińska I et al. [10], which largely included adult patients undergoing preoperative fistula evaluation. Discharge (70.1%) and pain (58.2%) were the most common presenting symptoms, reflecting the chronic

inflammatory nature of fistulous disease and the need for accurate anatomical delineation before surgery.

Posterior external openings were the most frequent (59.7%), consistent with the cryptoglandular origin of anal fistulas. Intersphincteric fistulas constituted the commonest subtype (47.8%), followed by transsphincteric fistulas (34.3%). MRI closely reproduced the operative classification, whereas USG demonstrated greater variation, particularly in complex fistulas. Similar observations have been reported by West RL et al. [9], Rasul S et al. [11], Roig JV et al. [12], and Liu Z et al. [13], who documented superior accuracy of MRI for fistula classification and assessment of deep extensions.

A major finding of the present study was the superior performance of MRI in detecting secondary tracts, abscesses, internal openings, and horseshoe extensions. MRI findings showed near-complete agreement with surgical observations, while USG missed a considerable proportion of these clinically important features. These results are comparable to those reported by Buchanan GN et al. [8], Sudoł-Szopińska I et al. [10], Garg P et al. [14], Vogel JD et al. [15], all of whom highlighted the ability of MRI to provide comprehensive visualization of complex fistulous anatomy.

MRI achieved a sensitivity of 95.2%, overall accuracy of 92.5%, and concordance with surgical findings of 94.0%, significantly outperforming USG, which showed corresponding values of 84.1%, 79.1%, and 77.6%. These findings are in agreement with previous studies by Buchanan GN et al. [8], Sudoł-Szopińska I et al. [10], Sahni VA et al. [16], Siddiqui MR et al. [17], and Sozutek A et al. [18], all of which reported superior diagnostic performance of MRI over ultrasound-based techniques. Although MRI required significantly longer reporting time than USG, the additional time was justified by its substantially greater diagnostic accuracy and superior anatomical mapping.

Furthermore, more than one-third of patients (37.3%) had complex fistulas, underscoring the importance of advanced imaging in preoperative planning. The low recurrence rate observed during follow-up (6.0%) may be attributable to accurate identification of internal openings, secondary extensions, and associated sepsis, facilitating appropriate surgical management. Overall, the present study confirms that MRI provides the most reliable preoperative assessment of fistula-in-ano and should be considered the imaging modality of choice, particularly in patients with complex or recurrent disease.

The major strengths of this study include its prospective design, direct head-to-head comparison of MRI and perianal ultrasonography in the same patient cohort, and the use of intraoperative findings as the gold standard. Comprehensive evaluation of fistula classification, internal openings, secondary tracts, abscesses, horseshoe extensions, diagnostic accuracy, and surgical concordance enhances the clinical relevance of the findings. Statistical validation further strengthens the reliability of the results. However, the study was limited by its relatively small sample size, single-center setting, and a low number of surgery-negative cases, which may affect the precision of specificity estimates. The operator-dependent nature of ultrasonography, short follow-up period for recurrence assessment, and lack of evaluation of cost-effectiveness, patient comfort, and advanced ultrasound techniques also represent important limitations. Despite these constraints, the study provides valuable evidence supporting the superiority of MRI in preoperative assessment of fistula-in-ano.

CONCLUSION

Taken together, the findings of the study establish that MRI fistulogram is more effective than USG of the perianal region for preoperative assessment of fistula-in-ano and should be considered the preferred modality whenever detailed anatomical delineation is required. Ultrasonography may still have a role as a rapid, accessible, and less time-consuming initial investigation, particularly in resource-limited settings or in simpler cases, but it does not provide the same degree of diagnostic confidence as MRI. Therefore, for patients with suspected complex, recurrent, branching, or deeply extending fistulous disease, MRI should be strongly favored as the principal imaging investigation to optimize surgical planning, improve operative accuracy, and reduce the likelihood of missed disease and early recurrence.

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