Section: Radiodiagnosis

Original Research Article

THE EVALUATION OF PERIANAL FISTULAS USING ULTRASONOGRAPHY IN ASSOCIATION WITH MAGNETIC RESONANCE IMAGING FISTULOGRAM

Afshan Ali[1], Bharath Kumar Shetty K[2]

[1]Junior Resident, Final Year Postgraduate, Department of Radiodiagnosis, AJ Institute of Medical Sciences, Kuntikan, Mangaluru, Karnataka, India.
[2]Associate Professor, Department of Radiodiagnosis, AJ Institute of Medical Sciences, Kuntikan, Mangaluru, Karnataka, India.

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Corresponding Author:
Dr. Afshan Ali,
Email: afshanali1997@gmail.com

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ABSTRACT

Background: Perianal fistulas are abnormal tracts causing significant morbidity and require accurate imaging for effective management. Magnetic resonance imaging (MRI) is considered the gold standard, but transcutaneous perianal ultrasonography (TPUS) offers a potentially accessible and cost-effective alternative. **Aim:** To evaluate the diagnostic performance of TPUS compared with MRI in the assessment of perianal fistulas, focusing on primary fistulous tracts, secondary ramifications, abscesses, and fistula classification. **Materials and Methods:** A hospital-based cross-sectional study was conducted on 30 patients with clinically suspected perianal fistula at A.J. Institute of Medical Sciences, Mangalore, from April 2023 to October 2024. All patients underwent both TPUS and pelvic MRI. Fistula characteristics including tract length, course, ramifications, abscesses, internal openings, and St. James's classification were assessed. Agreement between modalities was analyzed using Cohen's Kappa, with a significance threshold of $p<0.05$. **Result:** Both TPUS and MRI detected 100% of primary fistulous tracts, secondary tracts, and abscesses, showing perfect agreement (Kappa=1.0, $p<0.0001$). Internal opening detection showed moderate concordance (Kappa=0.549, $p<0.001$), with MRI identifying all cases versus 28 by TPUS. No significant difference was observed in tract length and distance from the anal verge measurements between modalities ($p>0.05$). Classification of fistulas by St. James's system showed strong overall agreement, with minor variance in detection of complex supralevator fistulas. **Conclusion:** TPUS is a reliable, accurate, and accessible imaging modality for the evaluation of perianal fistulas, with diagnostic performance comparable to MRI in most parameters. Given its cost-effectiveness and availability, TPUS can be effectively used as a first-line tool, reserving MRI for complex or inconclusive cases.

INTRODUCTION

Perianal fistulas, or fistula-in-ano, are aberrant epithelial-lined conduits that link the anal canal to the perianal dermis. They typically manifest as a consequence of anorectal abscesses, which result from the infection of the anal glands. Additional reasons encompass inflammatory bowel illnesses, including Crohn's disease, malignancies, trauma, and iatrogenic factors.[1] These fistulas result in persistent perianal pain, discharge of pus or feces, localized infection, and if neglected or improperly treated, may lead to problems such as fecal incontinence and psychological distress.[2]

The anatomical categorization of perianal fistulas is crucial for diagnosis and treatment, mostly relying on the Parks Classification system. This surgical categorization categorizes fistulas into four kinds based on their association with the anal sphincter complex.[3] Approximately 45–70% of fistulas are Intersphincteric, characterized by a tract that traverses the internal sphincter exclusively and resides between the internal and external sphincters without compromising the external sphincter. Approximately 25–30% are Transphincteric, when the tract penetrates both the internal and external sphincters, extending into the ischiorectal fossa prior to external emergence. Suprasphincteric fistulas, comprising around 5–20%, initiate at the internal sphincter, arch over the external sphincter and puborectalis muscle, and traverse via the levator ani muscle to the perineum. Extrasphincteric fistulas are uncommon (about 1–5%) and consist of a passage extending from the rectum to the perineal skin, circumventing the sphincter complex entirely, typically arising from pelvic pathology rather than cryptoglandular infection. Additionally, superficial fistulas without sphincter involvement and infrequent complex variants may arise, particularly in Crohn's disease or following previous procedures.[3,4]

Pathophysiologically, the majority of perianal fistulas develop due to blockage and infection of the anal glands, resulting in abscess formation that may either rupture or create epithelialized tracts toward the skin. Chronic inflammation preserves fistula patency, occasionally resulting in secondary branching tracts or related abscesses, hence augmenting the complexity of the condition.[5] A clinical examination alone frequently fails to delineate the complete anatomy of a fistula due to the intricate and deep pathways of the tracts and the existence of subsequent expansions. Imaging is essential in preoperative evaluation to define the major fistulous tract, locate internal and external openings, identify secondary branches and abscesses, and evaluate their relationship with the sphincter muscles. Accurate imaging facilitates surgical planning to decrease recurrence and maintain sphincter function, thus reducing morbidity.[2,6]

Ultrasonography and magnetic resonance imaging (MRI) are prevalent imaging modalities. Ultrasonography, encompassing transperineal or endoanal techniques, is efficient, economical, and devoid of ionizing radiation. It offers real-time viewing of fistula tracts and abscesses, which can be augmented with color Doppler or contrast to enhance sensitivity.[7,8] Studies indicate that ultrasound sensitivity for identifying primary fistulas, especially intersphincteric and transsphincteric kinds, ranges from 82% to 98%. Its accessibility facilitates dynamic evaluation and subsequent monitoring for recurrence. Nonetheless, ultrasonography is constrained in its ability to visualize suprasphincteric or extrasphincteric fistulas and intricate branching networks that reach deep into the pelvis.[8,9]

MRI fistulography is considered the gold standard because of its exceptional soft tissue contrast and multiplanar imaging capabilities. MRI can precisely illustrate the complete breadth of the fistulous network, encompassing primary and secondary tracts, abscesses, and their exact spatial relationships to the sphincter muscles and pelvic floor structures. MRI is particularly advantageous for intricate, recurring, or extensive fistulas frequently associated with Crohn's disease or prior surgical interventions. MRI aids in the classification of fistulas based on both Parks and radiological systems, including the St. James's University Hospital grading system, which categorizes fistulas from simple intersphincteric (Grade 1) to supralevator or translevator disease (Grade 5), encompassing abscesses and secondary tracts.[10,11]

Despite the diagnostic advantages of MRI, limitations such as elevated cost, restricted availability, and patient discomfort or contraindications diminish its widespread use, especially in resource-constrained environments. Ultrasonography's benefits such as the absence of radiation, reduced cost, user-friendliness, and repeatability establish it as an essential primary or supplementary imaging modality, particularly for uncomplicated situations. The correlation between ultrasonographic data and MRI enhances doctors' comprehension of diagnostic accuracy and limitations.[8,10]

High-resolution ultrasonography is becoming more available, and advancements in technique call for further evaluation of its role. Comparative studies evaluating ultrasonography versus MRI as a reference standard clarify when ultrasound is sufficient and when MRI is essential. Data can enhance cost-effectiveness, boost patient comfort, and simplify management protocols. This study evaluates ultrasonography's role in diagnosing perianal fistulas, correlating its findings with MRI fistulogram as the gold standard. The present study analyzes ultrasound's performance compared to MRI to clarify its utility, accuracy, and limitations for various fistula types and complexities.

MATERIALS AND METHODS

A hospital-based cross-sectional study was carried out in the Department of Radiodiagnosis at A.J. Institute of Medical Sciences and Research Centre, Mangalore, spanning 18 months from April 2023 to October 2024. The study population comprised patients with a clinical suspicion of perianal fistula, enrolled after initial evaluation in the surgical outpatient department. A total of 30 patients were included based on predefined eligibility criteria after obtaining ethical clearance from the Institutional Human Ethics Committee with reference number AJEC/REV/89/2023.

The inclusion criteria for this study comprised patients of any age and gender with a clinical suspicion of perianal fistula, established through presenting symptoms and preliminary examination. Individuals were eligible if they were being evaluated for either recurrent or primary perianal fistula and provided informed consent to undergo both transcutaneous perianal ultrasonography (TPUS) and MRI for diagnostic purposes. Conversely, patients were excluded if they had contraindications to MRI, such as cardiac pacemakers, cochlear implants, ferromagnetic implants, or severe claustrophobia. Additional exclusion factors included acute proctitis, severe perianal inflammation, or gross perianal edema that precluded adequate imaging, as well as the presence of hemorrhoids, perianal malignancy, or any conditions deemed likely to interfere with clear visualization of the fistulous tracts. Patients who refused to undergo imaging or did not provide written informed consent for participation in the study were also excluded.

Procedure: After recruitment, detailed clinical history and relevant demographic data were collected using a standardized questionnaire. Each participant underwent imaging evaluation, including both TPUS (or endoanal ultrasonography when needed) and pelvic MRI. The ultrasonography was conducted with high-frequency linear probes (L12-4, L12-5) using Philips Affinity 30 and Samsung Hera W9 systems. MRI was performed on a Siemens Avanto 1.5 Tesla unit with a body surface coil, employing standardized imaging protocols. For TPUS, evaluations were conducted in multiple planes—axial, sagittal, and coronal—while patients were positioned in either the dorsal lithotomy or left lateral decubitus position. Anal canal and tract locations were described using the clock-face method (12 o'clock anterior, 6 o'clock posterior). MRI protocols included T2-weighted fast spin echo sequences in sagittal, oblique axial, and coronal planes aligned to the anal canal axis, as well as T1-weighted and contrast-enhanced sequences with fat suppression when indicated.

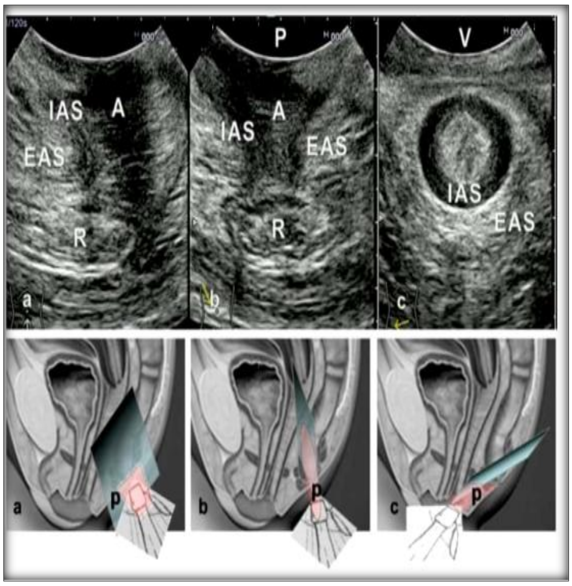

Figure 1: Transperineal ultrasound evaluates the perianal region using three primary imaging planes: (a) sagittal, (b) coronal, and (c) axial or transverse

Key fistula parameters documented during imaging included the number and location of internal and external openings, tract length and direction, distance from anal verge, presence of secondary ramifications, and any associated abscesses. Fistulas were classified according to the St. James's University Hospital classification system based on combined imaging findings.

Statistical Analysis: All data were analyzed using IBM SPSS version 20. Categorical data were reported as frequencies and percentages, while continuous data were summarized as means with standard deviations. Agreement between ultrasonography and MRI results was assessed using Cohen's Kappa statistic. Statistical significance was set at $p<0.05$.

RESULTS

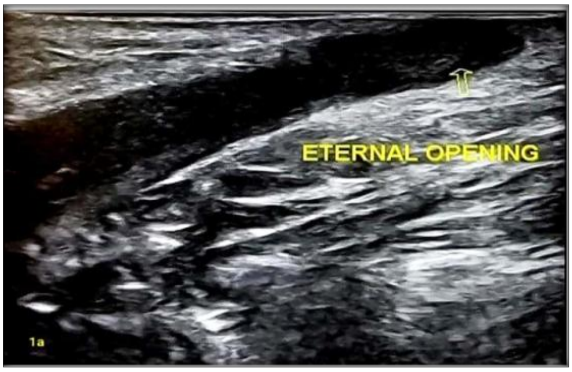

Figure 2: TPUS image demonstrates linear hypoechoic tract with external opening at 12 o clock position

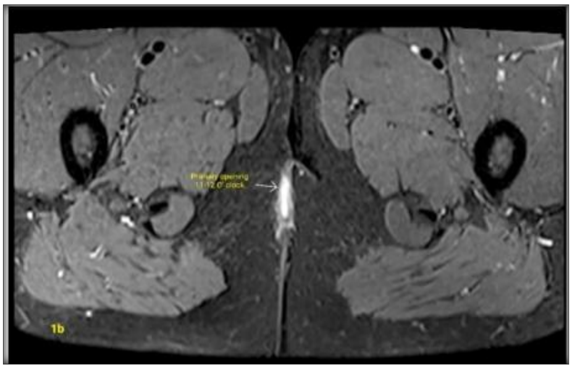

Figure 3: T1 wtd MRI image demonstrates linear IR hyperintense tract with external opening at 11-12 o clock position

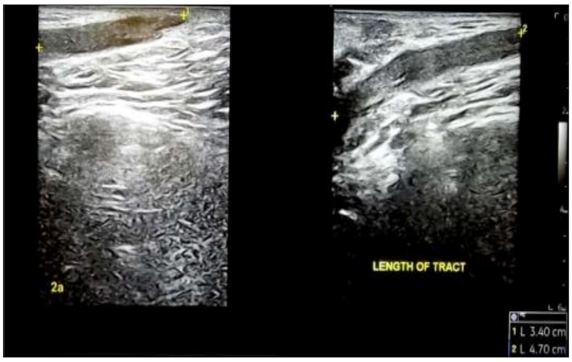

Figure 4: TPUS image demonstrates linear hypoechoic tract measuring 8.1 cms

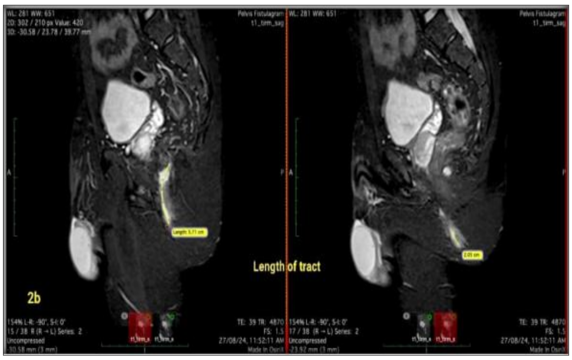

Figure 5: Sagittal T1 wrt IR images demonstrate linear IR hyperintense tract measuring 7.7 cms

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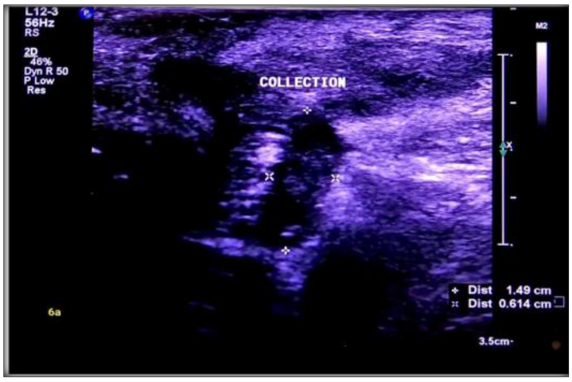

Figure 6: TPUS image demonstrates heterogenous hypoechoic collection

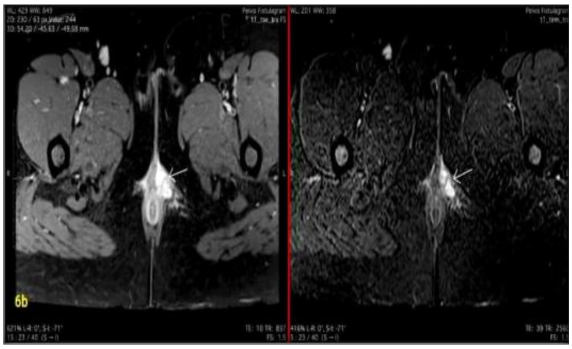

Figure 7: Axial T2 wtd [Left and IR wtd [Right] images demonstrate hypertense collection/ abscess

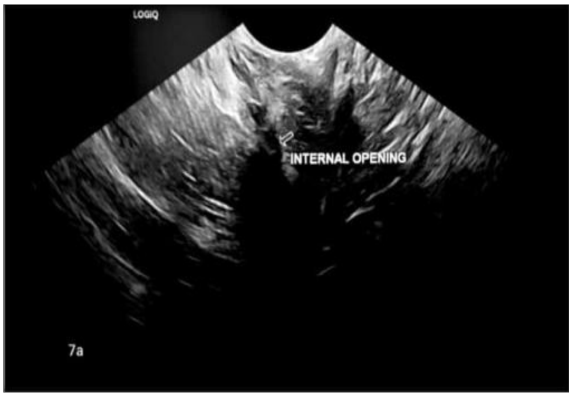

Figure 8: TPUS image demonstrates hypoechoic tract with internal opening at 11 o clock position

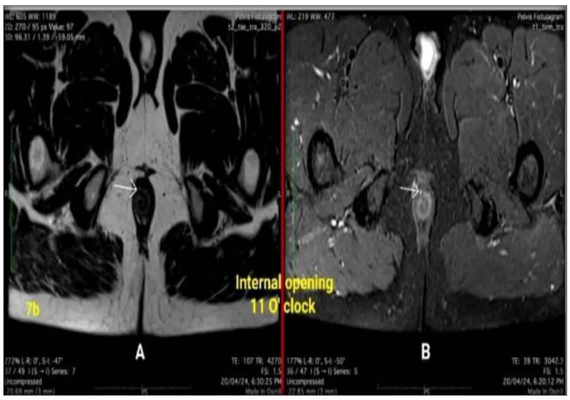

Figure 9: Axial T2 [Left] and IR [Right] wtd images demonstrate internal opening at 11 o'clock position

Figure 10: TPUS image demonstrates linear hypoechoic tract measuring 8.1 cms

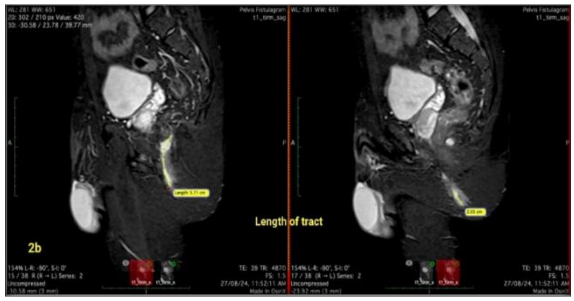

Figure 11: Sagittal T1 wtd IR images demonstrate linear IR hyperintense tract measuring 7.7 cms

Figure 12: TPUS image demonstrates hypoechoic fistulous tract opening internally at a distance of 2.1 cms from the anal verge

Figure 13: Sagittal IR image shows IR hyperintense tract opening internally at a distance of 2.5 cms from the anal verge

Table 1: Participant Demographics and Clinical Features

Characteristic	Category	n	%
Age (years)	< 30	11	36.7
	31-40	7	23.3
	41-50	7	23.3
	51-60	4	13.3
	> 61	1	3.4
Sex	Male	27	90
	Female	3	10
Number of primary openings	Single	27	90
	Multiple	3	10

Table 1 showed that the study included a total of 30 participants. Regarding age distribution, 36.7% were under 30 years old, 23.3% were between 31 and 40 years, another 23.3% were between 41 and 50 years, 13.3% were between 51 and 60 years, and 3.4% were over 61 years. In terms of sex, 90% of the participants were male, and 10% were female. Regarding the number of primary fistula openings, 90% of patients had a single primary opening, while 10% had multiple openings. [Table 1]

Table 2: Primary Opening Location and Distance

Location Group	Clock Position	n	%	Distance from Anal Verge (cm)
Anterior (n=9; 30%)	1 o'clock	4	13.3	1.5-2.3
	2 o'clock	2	6.7	
	12 o'clock	1	3.3	
	12-1 o'clock	2	6.7	
	3 o'clock	1	3.3	
Posterior (n=21; 70%)	6 o'clock	5	16.7	1.2-5.0
	9 o'clock	4	13.3	
	5-6 o'clock	3	10	
	11 o'clock	3	10	
	4 o'clock	2	6.7	
	5 o'clock	2	6.7	
	6-7 o'clock	1	3.3	

Among the 30 participants, 9 (30%) had anterior primary openings and 21 (70%) had posterior primary openings. For anterior openings, 4 cases (13.3%) were at the 1 o'clock position, 2 cases (6.7%) at 2 o'clock, 1 case (3.3%) at 12 o'clock, 2 cases (6.7%) at 12–1 o'clock, and 1 case (3.3%) at 3 o'clock. These anterior openings were located 1.5 to 2.3 cm from the anal verge. For posterior openings, 5 cases (16.7%) were at 6 o'clock, 4 cases (13.3%) at 9 o'clock, 3 cases (10%) at 5–6 o'clock, 3 cases (10%) at 11 o'clock, 2 cases (6.7%) at 4 o'clock, 2 cases (6.7%) at 5 o'clock, and 1 case (3.3%) at 6–7 o'clock. The distance from the anal verge for posterior openings ranged from 1.2 to 5.0 cm (Table 2). [Table 1]

Table 3: Morphological and Anatomical Characteristics of Perianal Fistulas on USG and MRI Following Embolization and Sclerotherapy

Characteristic	Modality	Sub category	n (%)
Course	USG	Transphincteric	16 (53.3)
		Intersphincteric	14 (46.7)
	MRI	Transphincteric	16 (53.3)
		Intersphincteric	14 (46.7)
Ramifications (secondary tracts)	USG	Absent	22 (73.3)
		1	4 (13.3)
		2	2 (6.7)
		3-4	1 (3.3)
		Multiple	1 (3.3)
	MRI	Absent	22 (73.3)
		1	3 (10)
		2	2 (6.7)
		3-4	2 (6.7)
		Multiple	1 (3.3)
Abscesses	USG	Absent	21 (70)
		1	7 (23.3)
		2	1 (3.3)
		Multiple	1 (3.3)
	MRI	Absent	21 (70)
		1	7 (23.3)
		2	1 (3.3)
		Multiple	1 (3.3)

USG: Ultrasonography; MRI: Magnetic Resonance Imaging

The course of fistulous tracts identified by both ultrasonography (USG) and MRI showed 16 cases (53.3%) as transphincteric and 14 cases (46.7%) as intersphincteric. Regarding ramifications or secondary tracts, USG detected no secondary tracts in 22 cases (73.3%), one ramification in 4 cases (13.3%), two in 2 cases (6.7%), 3–4 ramifications in 1 case (3.3%), and multiple ramifications in 1 case (3.3%). MRI findings were similar, with 22 cases (73.3%) showing no ramifications, 3 cases (10%) with one ramification, 2 cases (6.7%) with two, 2 cases (6.7%) with 3–4, and 1 case (3.3%) with multiple ramifications. In terms of abscesses, USG found 21 cases (70%) without abscesses, 7 cases (23.3%) with a single abscess, 1 case (3.3%) with two abscesses, and 1 case (3.3%) with multiple abscesses. MRI detected the same distribution of abscesses: 21 cases (70%) absent, 7 cases (23.3%) with one, 1 case (3.3%) with two, and 1 case (3.3%) with multiple abscesses (Table 3). [Table 3]

Table 4: Modality Comparison (Cohen's Kappa)

Feature	TPUS Positives	MRI Positives	Kappa	p-value
Primary tract detection	30	30	1	**<0.0001***
Secondary tracts/ramifications	8	8	1	**<0.0001***
Abscess detection	9	9	1	**<0.0001***
Internal opening detection	28	30	0.549	**<0.001***

: statistically significant difference

The comparison between TPUS and MRI revealed perfect agreement in detecting primary fistulous tracts, with both modalities identifying all 30 cases, resulting in a Kappa value of 1.0 and a statistically significant p-value of less than 0.0001. Similarly, detection of secondary tracts or ramifications showed perfect concordance, with both TPUS and MRI identifying 8 positive cases (Kappa = 1.0, $p < 0.0001$). Abscess detection also demonstrated complete agreement, as both modalities detected abscesses in 9 cases, again with a Kappa of 1.0 and a highly significant p-value. However, for internal opening detection, there was moderate agreement between the two imaging techniques; TPUS detected 28 cases while MRI detected all 30 cases, yielding a Kappa value of 0.549. This difference was statistically significant with a p-value less than 0.001. Overall, TPUS and MRI showed excellent and significant agreement in detecting primary and secondary fistula tracts and abscesses, while internal opening detection had a statistically significant but moderate level of concordance (Table 4).

Table 5: Quantitative Fistula Tract Measurements Comparing USG and MRI in Post-Embolization and Sclerotherapy Cases

Characteristic	Modality	Mean ± SD	p-value
Tract length (cm)	**USG**	4.09 ± 1.93	0.40
	MRI	4.52 ± 2.01	
Distance from anal verge (cm)	**USG**	13.39 ± 7.56	0.982
	MRI	12.81 ± 7.26	

The interim outcomes comparing USG and MRI for tract length and distance from the anal verge showed no statistically significant differences. The mean tract length measured by USG was 4.09 ± 1.93 cm, while MRI measured 4.52 ± 2.01 cm, with a p-value of 0.40 indicating no significant difference. Similarly, the mean distance from the anal verge was 13.39 ± 7.56 cm on USG and 12.81 ± 7.26 cm on MRI, with a p-value of 0.982, also not statistically significant. These findings suggest comparable measurements between the two imaging modalities for these parameters (Table 5).

Table 6: St. James's MRI-Based Classification

Grade	Description	USG n (%)	MRI n (%)
I	**Simple Intersphincteric**	11 (36.7)	11 (36.7)
II	**Intersphincteric with abscess/secondary track**	2 (6.7)	2 (6.7)
III	**Uncomplicated Transphincteric**	7 (23.3)	7 (23.3)
IV	**Transphincteric with abscess/secondary track**	10 (33.3)	9 (30.0)
V	**Supralevator / Translevator**	0 (0.0)	1 (3.3)

The St. James's MRI-Based Classification of perianal fistulas in the study showed that Grade I (simple intersphincteric) fistulas were present in 11 cases (36.7%) on both USG and MRI. Grade II (intersphincteric with abscess or secondary track) was identified in 2 cases (6.7%) by both modalities. Grade III (uncomplicated transsphincteric) fistulas were noted in 7 cases (23.3%) on USG and MRI alike. For Grade IV (transsphincteric with abscess or secondary track), USG detected 10 cases (33.3%) while MRI identified 9 cases (30.0%). Grade V (supralevator or translevator) fistulas were seen in 1 case (3.3%) on MRI but were not detected by USG. Overall, both imaging techniques demonstrated similar distributions across classifications, with minor discrepancy observed only in the highest grade category (Table 6).

DISCUSSION

Perianal fistulas are pathological conduits connecting the anal canal to the perianal skin, frequently resulting in considerable morbidity characterized by discomfort, discharge, and recurring infections. Precise identification of the fistula tract, main and secondary orifices, and related abscesses is crucial for efficient treatment and to reduce recurrence. Historically, MRI has been considered the gold standard for preoperative evaluation due to its superior resolution and capacity to delineate intricate anatomy; however, TPUS is gaining recognition as a noninvasive, accessible, and economical alternative, especially beneficial in resource-constrained environments.[7,11] This study was undertaken to compare the diagnostic performance of TPUS and MRI in the evaluation of perianal fistulas, aiming to provide comprehensive insight into their relative utility and to inform optimal diagnostic strategies for clinical practice.

The demographic profile of the study participants revealed a predominance of men (90%) in their thirties and forties, with a significant majority exhibiting a single primary tract (90%), reflecting trends observed in current imaging cohorts. Singh et al.'s prospective MRI study indicated a 24:1 male-to-female ratio, with the majority of cases concentrated in early to mid-adulthood, ascribing the gender gap to hormonal and structural influences.12 A large retrospective TCUS study with 549 patients revealed an 84% male predominance and indicated that 94% of subjects possessed a single fistula tract, underscoring the prevalence of solitary presentations.[13] The TPUS study by Altam et al. revealed comparable distributions in age (mean ≈ 32 years) and sex (81% male), highlighting the uniformity of these demographic patterns across various geographic and resource contexts.[14] Smaller Indian TPUS cohorts, including those of Bharath Reddy et al., have corroborated this trend, indicating a male predominance above 80% and a peak incidence in the third decade of life.[15] The results obtained in the present study were similar to other previously published evidence as well.[16,17,18] However, a study conducted by Mocanu et al reported a majority of female patients with perianal fistula with a mean age of 30 years which is in contrast with the results obtained in this study.[19] The data indicate that the current cohort aligns with recognized epidemiological standards, implying that the findings are generalizable and underscore the necessity for increased clinical attention in young males exhibiting perianal sepsis.

The anatomical distribution of primary fistula openings in this cohort revealed that 70% were posterior and 30% anterior, supporting established clinical paradigms like Goodsall's Rule, which predicts a predominance of posterior routes and more intricate pathways in these instances. The aggregation of anterior openings at 1 o'clock (13.3%), 2 o'clock (6.7%), 12–1 o'clock (6.7%), 12 o'clock (3.3%), and 3 o'clock (3.3%), all situated 1.5–2.3 cm from the anal verge, corresponds with the observations of Altam et al., who similarly noted that anterior tracts are typically shorter and more direct, frequently confined to the lower anterior quadrants of the perianal skin. Conversely, posterior apertures exhibited increased positional diversity, predominantly at 6 o'clock (16.7%) and 9 o'clock (13.3%), as well as at 5–6 (10%), 11 (10%), 4 (6.7%), 5 (6.7%), and 6–7 o'clock (3.3%), with lengths extending up to 5.0 cm.[14] The wider distribution and greater tract length align with the MRI findings by Singh A et al., who showed that posterior fistulas typically had more convoluted pathways and longer lengths than anterior ones.[12] Bharath Reddy H et al. similarly noted a predominance of posterior openings in their TPUS dataset, hence validating the consistency of these anatomical patterns across both ultrasound and MRI modalities.[15] Collectively, our data underscore the necessity of thorough imaging of both TPUS and MRI to precisely delineate fistula architecture, inform surgical planning, and foresee technical difficulties, especially for elongated, more convoluted posterior connections.

The distribution of fistulous tract courses in this cohort indicated that 53.3% were Transphincteric and 46.7% were Intersphincteric, as shown in both ultrasound and MRI, corroborating data from larger studies that reflect a nearly equal division between these two prevalent fistula types. A prospective study involving 126 patients revealed that endoanal ultrasound exhibited superior accuracy compared to MRI for both Transphincteric and Intersphincteric fistulas, highlighting the dependability of high-resolution sonography in delineating tracts.[20] Ultrasound and MRI concordantly detected secondary tracts in the majority of cases (no ramifications in 73.3%), with ultrasound indicating one, two, and numerous ramifications in 13.3%, 6.7%, and 3.3% of patients, respectively, figures closely aligning with MRI results. This commendable agreement (κ≈0.84 for secondary tracts) aligns with the kappa values documented for TPUS against MRI (0.839), signifying that USG consistently detects the majority of secondary branches.8 Abscess detection demonstrated complete concordance, with 70% absence, 23.3% single, 3.3% double, and 3.3% multiple abscesses, reflecting the substantial agreement (κ≈0.94) noted in recent TPUS trials.8 Collectively, the findings confirm that TPUS and MRI demonstrate comparable efficacy in delineating both primary tract pathways and related secondary characteristics, including ramifications and abscesses, hence endorsing the utilization of ultrasound as a key, cost-efficient modality in the assessment of perianal fistulas.

Numerous recent studies have examined the comparison between TPUS and MRI in assessing perianal fistulae, continuously revealing that TPUS

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has a good level of concordance with MRI in identifying the primary fistulous tract, secondary branches, and abscesses. Numerous investigations indicate near-perfect concordance in the diagnosis of main tracts and abscesses, with Kappa values for TPUS and MRI frequently above 0.8 and occasionally attaining 1.0, denoting nearly total agreement on essential diagnostic characteristics.[8,21,22] A prospective analysis revealed a Kappa correlation coefficient of 1.0 between TPUS and MRI for primary tract detection, with equally elevated correlations for secondary tracts and abscesses (Kappa = 0.839 and 0.937, respectively).[8] The findings are corroborated by data indicating that both modalities attained sensitivity and specificity rates for abscess diagnosis surpassing 90%.[21]

Nonetheless, the detection of interior openings is generally less reliable with TPUS than with MRI. Published studies demonstrate that TPUS sensitivity for identifying the internal opening varies between 44% and 82%, however it frequently does not match the consistently superior sensitivity and specificity of MRI. Some investigations have demonstrated that MRI can achieve a sensitivity of up to 100% for the localization of internal openings.[23,24,25] A new meta-analysis indicates considerable concordance for internal opening identification (Kappa=0.61) between TPUS and MRI, with MRI significantly surpassing TPUS in complicated or deeply situated pathways.[24,26]

Recent systematic reviews and prospective trials substantiate that TPUS is exceptionally effective in delineating the primary anatomy of perianal fistulas, achieving accuracy rates of 82%–90% relative to intraoperative findings, thereby affirming its utility as a primary, non-invasive imaging modality, particularly in circumstances where MRI is inaccessible or impractical.[14,27,28] Although MRI is the gold standard for thorough examination, especially in instances with intricate branching or multiple tracts, TPUS is acknowledged as a dependable, economical, and accessible method that significantly supports initial assessment and preoperative planning.

The absence of statistically significant differences in tract length and distance from the anal verge between USG and MRI, as demonstrated in this study (mean tract length: 4.09±1.93 cm for USG vs 4.52±2.01 cm for MRI, p=0.40; mean distance from anal verge: 13.39±7.56 cm for USG vs 12.81±7.26 cm for MRI, p=0.982), highlights the equivalent accuracy of both modalities in assessing these critical parameters in perianal fistula evaluation. This finding aligns with recent published research and the examined papers from the content. Singh A et al. shown that estimations of fistula tract length and alignment obtained from MRI and USG generally vary by less than 0.5 cm, a discrepancy deemed clinically insignificant and within the bounds of inter-observer and inter-modality variability.[8] Similarly, Altam et al. and Bharath Reddy H et al. both indicated no significant disparities between ultrasound and MRI (or their respective versions) for fistula tract length, seeing overall measurement concordance and comparable categorization rates when compared to surgical results.[14,15]

Numerous recent investigations validate the equivalent efficacy of ultrasonography and magnetic resonance imaging in the anatomical delineation and structural evaluation of perianal fistulas. Siddiqui MRS et al. conducted a systematic review and diagnostic meta-analysis, revealing that MRI and endoanal ultrasound exhibit comparable sensitivities (87% each) for fistula detection; however, MRI demonstrates superior specificity (69% versus 43%), with both modalities providing diagnostic value for assessing primary tracts and secondary extensions.[29] Varsamis N et al. concluded in their extensive review that ultrasonography and MRI yield comparable diagnostic information for most clinically significant parameters in perianal fistula evaluation, especially concerning tract anatomy and localization, thereby affirming USG as a feasible alternative when MRI is inaccessible or impractical.[30] These findings are corroborated by several prospective cohort studies that highlight the precision and concordance between ultrasound-based methods and MRI, substantiating the routine application of ultrasound for the structural evaluation of perianal fistulas in various clinical contexts.[20,31]

The study revealed a high degree of concordance between USG and MRI in the distribution of perianal fistulas according to this classification. Eleven instances (36.7%) were classified as Grade I, two cases (6.7%) as Grade II, and seven cases (23.3%) as Grade III across both imaging modalities. In Grade IV, ultrasound discovered 10 cases (33.3%), whereas MRI recognized 9 cases (30.0%). One case (3.3%) of Grade V fistulas was detected by MRI but not by ultrasound. The variation in the highest grade aligns with MRI's enhanced sensitivity for complex fistulas with supralevator or translevator extensions, which are difficult to identify with ultrasonography due to anatomical depth and resolution constraints. Both USG and MRI had comparable distributions across classes, affirming the dependability of ultrasonography for the majority of fistula types, while underscoring MRI's superiority in detecting the most intricate lesions.[32,33]

This investigation on the assessment of perianal fistulas via TPUS and MRI offers significant diagnostic insights, while certain limits should be recognized. The primary drawback is the limited sample size and the single-center, hospital-based design, which may impact the generalizability of the results to wider or more diverse populations. The exclusion of patients with MRI contraindications or severe perianal illness may further diminish the sample's representativeness, introducing a risk of selection bias. The absence of direct surgical or pathological linkage for all imaging-detected features is a limitation, as not all individuals had operative confirmation of tract anatomy and internal apertures. Operator dependency in ultrasonography may lead to interobserver variability, which was not explicitly evaluated in this sample. Notwithstanding these constraints, the study possesses significant merits. It offers a thorough, direct comparison of TPUS and MRI in clinically suspected perianal fistula, employing standardized imaging protocols and rigorous statistical techniques. The optimal concordance reported for primary tract, secondary tract, and abscess identification substantiates the diagnostic dependability of TPUS for most clinically pertinent attributes, with MRI acting as the reference standard. The implementation of comprehensive lesion categorization methods and quantitative mapping improves the relevance of these findings in clinical decision-making.

The findings support the utilization of TPUS as a primary, accessible, and economical imaging modality for assessing perianal fistulas, especially in resource-constrained or high-demand environments where MRI availability is limited. The comparable accuracy of most fistula characteristics indicates that TPUS can effectively inform preoperative planning and minimize unnecessary MRI use, reserving MRI for difficult, recurring, or confusing situations. This method may enhance service efficiency, diminish wait times, and decrease diagnostic expenses, hence improving patient outcomes and the allocation of healthcare resources.

CONCLUSION

The findings of this study indicate that TPUS is a dependable and precise imaging technique for assessing perianal fistulas, exhibiting strong concordance with MRI in identifying primary and secondary fistulous tracts and abscesses. Although MRI excels in identifying interior openings and classifying complex fistulas, TPUS provides a cost-effective and accessible initial alternative. These findings endorse TPUS as a proficient diagnostic instrument, particularly in resource-constrained environments, while conserving MRI for intricate or ambiguous instances to enhance patient care.

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