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Role of Transcutaneous Perianal Ultrasonography in Evaluation of Perianal Fistulae and Its Correlation with MRI

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Abstract

Background

Perianal fistula is an abnormal epithelial-lined tract connecting the anal canal to the perianal skin. Accurate delineation of the fistulous tract and identification of internal and external openings remain major challenges in management. Transcutaneous perianal ultrasonography (TPUS) is a non-invasive imaging modality, while magnetic resonance imaging (MRI) is considered the gold standard for preoperative assessment. This study evaluated the role of TPUS and correlated its findings with MRI.

Objectives

To evaluate the diagnostic role of TPUS in perianal fistulae and correlate findings with MRI in delineating the fistulous tracts, ramifications and internal openings. Secondary objectives included assessment of secondary tracts, abscesses, sphincter involvement, and determination of TPUS sensitivity and specificity using MR fistulogram as reference.

Methods

This analytical cross-sectional study was conducted from March 2024 to September 2025 in the Department of Radio-Diagnosis, JJM Medical College, Davangere. Forty-five clinically suspected fistula-in-ano patients were included. After ethics approval and informed consent, all patients underwent TPUS followed by MR fistulogram using a 1.5 Tesla MRI scanner. Fistulous tract characteristics, internal openings, course, and ramifications were evaluated.

Results

Mean patient age was 51.29 ± 10.13 years. Perianal discharge was the most common symptom (100%). TPUS demonstrated 100% sensitivity in detecting primary fistulous and sinus tracts, comparable to MRI. Secondary tracts were identified in 42.22% patients, with TPUS detecting 73.68% and MRI detecting 100%. Internal openings were identified in 84.44% cases on TPUS and 100% on MRI.

Conclusion

TPUS is a sensitive, cost-effective, and readily available modality for evaluation of perianal fistulae. However, MRI remains superior for detecting secondary tracts, internal openings, and complex fistulae, making it the gold standard for comprehensive preoperative assessment.

KEYWORDS: USG: Ultrasound; MRI: Magnetic Resonance Imaging; Tpus: Transperianal Ultrasound; Ias: Internal Anal Sphincter, Eas: External Anal Sphincter; Eaus: Endoanal Ultrasound

1. INTRODUCTION

The connection which exists between the anal canal and skin of the perineum is called perianal fistula. In other words, perianal fistula refers to an abnormal tract which is lined by epithelial tissue and connects anal canal to the skin surrounding it.[1]This abnormal opening is located outside the sphincter muscle complex, which results in limited voluntary sphincter muscle action which are adjacent to it. Perianal inflammatory diseases, including anal abscesses, fistulas, and sinuses account for up to 5% of proctology consultations in the health care settings.[2]

Patients present between the age groups of 20to 60 years with a male preponderance, which shows 2–4-fold increase in number of cases in male when compared to female population. Fistulas are uncommon in children.[3,4]

Perianal fistula is a most common anorectal condition, which is more prevalent in men (12.3 cases per 100 000) than in women (5.6 cases per 100 000), which is generally diagnosed at the age of 38years, with its peak occurrence is seen between 20 to 40 years of age.[5,6]

The prevailing cause of fistulas is an anorectal abscess. Around 30- 70% of patients who have an anorectal abscess also have a fistula-in-ano at the same time in combination with anorectal abscess.[7,8] Anal glands provide a free passage through which the infection spreads from lumen of anal canal to deep down in to the sphincters. From Sphincters it spreads secondarily in any direction, resulting in formation of fistulae. Anal glands are definite preformed structures with the function of secretory activity.[9]

Perianal fistulas can be classified into two categories.[10,11]They are categorised as primary, which is caused by the obstruction of anal glands leading to stasis and infection with abscess, and as secondary, which can be attributed to conditions such as inflammatory bowel diseases (IBDs), malignancy, iatrogenic factors, and infection.

The Diagnostic modalities for diagnosing perianal fistula are as follows:[12]

1. Physical examination/Examination under anaesthesia
2. Endoscopy: Evaluation of Intestinal Inflammation, stenosis, internal fistula opening,
3. Imaging studies: EAUS, MRI, TPUS

One of the main challenges which is encountered in the management of fistulas, is mainly to detect the course of the tract between the internal and external openings. This will be utilised for applying appropriate surgical treatment. The modalities which can be utilised for imaging of perianal fistula are ultrasound and magnetic resonance imaging of the pelvis.

These two modalities have their pros and cons. The usage of an EAUS probe is challenging as it can result in trauma to the patient or even it cannot be performed in individuals with inflammatory perianal disease because of stenosis of anal canal. Transcutaneous perianal ultrasonography (TPUS) is another diagnostic modality to diagnose perianal inflammatory disease, which can be performed by using Ultrasound probes without patient preparation which serves as one of the advantages of this modality. It is quick, non-invasive, and feasible procedure for the diagnosis of pathologic conditions involving anal canal and pelvic floor.

On transcutaneous perianal ultrasonography of anal canal, internal sphincter appears as hypoechoic structure and external sphincter appears as hyperechoic structure. Fistula appears as elongated hypoechoic structure.

Active fistula shows hyperaemia along the fistulous tract on the color Doppler study and/or internal air bubbles on a grayscale.[13]

In the Recent times, the modality of Magnetic Resonance Imaging emerged as an efficient diagnostic modality for preoperative evaluation of perianal fistula. It helps in the direct visualisation of abscesses and tracts in combination with the benefit of having high soft tissue resolution as well. It can also identify the extension of the disease, which could otherwise be

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missed and which in turn affects the outcomes of the disease in the patients. Hence, MRI is considered as a gold standard in the assessment of anal fistula.[14]

Perianal fistula generally a non-cancerous condition, it can cause considerable discomfort and even psychological problems for the patient. The condition can severely impact a patient's quality of life and can also have a negative effect on their psychological state, leading to symptoms of depression or anxiety in the patient. The overall incidence of anal fistula developing from abscesses was 20%, with predominance in men, and a lower incidence in the lowest income level.[15]

The patients suffering from perianal fistula generally present with severe perineal pain, pus discharge, and discomfort while sitting. They have propensity for chronicity, recurrence and resistance to treatment which needs frequent follow-up imaging and multiple surgeries, thereby, increasing the morbidity and cost of healthcare. Magnetic Resonance Imaging modality with its scarcity and also cost pose a challenge in utilising this modality in diagnosing this condition. Similarly, Computed tomography with its poor capability in soft tissue differentiation of perianal region cannot be reliably used for diagnosis of perianal fistula. Therefore, perianal ultrasound stands out as a simple, low expensive, easily available method that can adequately evaluate perianal fistulae and abscesses.[16] Therefore this study was carried to evaluate the role of transcutaneous perianal ultrasonography in evaluation of perianal fistulae and its correlation with Magnetic Resonance Imaging.

Objectives:

1. To evaluate the role of TPUS in patients with perianal fistula and to correlate the findings with MRI as gold standard.
2. To delineate extent of fistulous tract with ramification and to identify internal opening.
3. To identify secondary tracts, horse-shoe tracts, abscess and their relation with anal sphincter complex on perianal ultrasound.
4. To determine sensitivity and specificity of TPUS on comparison with pre-operative MR Fistulogram.

2. MATERIALS AND METHODS:

***2a. Source of data*:** The main source of data for the study is patients from the following teaching hospitals attached to Bapuji Education Association J.J.M. Medical College, Davangere.

***2b. Study design*:** Analytical cross-sectional study.

***2c. Study period*:** 18 months (March 2024 to September 2025).

2d. Study area: Department of Radio-Diagnosis, JJM Medical College, Davangere (Bapuji hospital), Chigateri District Hospital, Davangere.

***2e. Sample size*:** 45.

***2f. Inclusion criteria*:** Subjects who were willing to participate in study and who gave with consent were included, all clinically suspected cases of fistula-in-ano, patients of all ages and both sex with symptoms of anal fistula.

2g. Exclusion criteria: Contraindication for MRI including incompatible implants (All metal objects, such as hearing aids, dentures, jewellery, watches, and hair pins) and patients with claustrophobia.

Methodology:

The whole procedure was explained to the patient in detail prior to the procedure. Patients suffering from anorectal fistulas who were referred to Department of Radio-Diagnosis and who gave consent were included. After obtaining permission from Institutional ethics committee and informed consent from the patients, they were subjected to TPUS followed by MR Fistulogram.

3a. Positioning and preparation: Initially, clinical examination of the perineal region of patients for perianal external opening of tracts, swelling and tenderness was done. The perianal USG was performed using ultrasound machine. Internal opening of any fistulous tract was described with clockwise position and tracts are traced upto their external opening and perifocal area was screened for any ramifications.[17]TPUS does not need prior preparations. Patients were asked to lie in left lateral decubitus with semi-flexed knees and some patients were asked to change into the lithotomy position when needed. Ultrasound gel was applied to the transducer, and a latex cover wrapped on it for hygienic causes. The probe was placed near the anal verge and anterior to it.[18]After examination by TPUS; all patients underwent MRI examination using a 1.5 T MRI

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scanner using a phased-array body coil. Patients were asked to lie in supine position. Standard MRI protocol of anal canal in our institution was applied, planned in perpendicular and parallel direction to the anal canal.[9]No special bowel preparation was required. Maintaining a partially full bladder at the time of examination to allow for better pelvis anatomy delineation was ensured. Instillation of aqueous jelly into the sinus tract to help improve the diagnostic accuracy was done if required.

3b. Equipments used: MRI machine: Philips 1.5 Tesla. MRI Protocol: T1-AXIAL, T2 SAGITTAL, T2 AXIAL, T2 FS AXIAL, T2 CORONAL and T2 FS CORONAL.USG Machine: Mindray Resona i9.

4. RESULTS: The study involved 45 patients with perianal fistula and the diagnostic performance of transcutaneous perianal ultrasonography (TPUS) in comparison to magnetic resonance imaging was evaluated. Study population predominantly consisted of middle-aged individuals, with mean age and standard deviation of 51.29 ± 10.13 years, and the majority belonged to the 40–60-year age group. There was a significant male predominance 34 (75.56%), consistent with the known epidemiology of perianal fistula. Discharge from the perianal region was the common presenting complaint 45(100%), followed by pain in the anal region 8 (17.78%) and difficulty in passing stools 5 (11.11%). One-third of patients 15(33.33%) had a history of previous fistula surgery, indicating a significant number of recurrent or persistent disease. Diabetes mellitus was the common comorbidity 9 (20%) which was observed. Most patients had a single primary opening 35 (77.78%), and the most frequent site of external opening was at the 6 o'clock position 9 (20%). Chronic constipation emerged as the most common etiological factor 32 (71.11%). TPUS demonstrated 100% sensitivity in detecting primary fistulous and sinus tracts, comparable to MRI. Secondary tracts were present in 19 (42.22%) of patients; TPUS detected 73.68% of these, while MRI detected all secondary tracts (100%). Abscesses were identified in 9(20%) of patients, and both TPUS and MRI detected all abscesses accurately. Detection of the internal opening showed a difference between modalities. TPUS identified internal openings in 38(84.44%) of patients, whereas MRI detected internal openings in 100% of cases. This highlights the superior capability of MRI in identifying internal openings. According to the St James' University Hospital classification, TPUS most commonly identified Grade 1 fistulas 15 (33.33%), whereas MRI demonstrated a more even distribution with Grade 2 fistulas being the most common 14 (31.11%) and additionally identified Grade 5 fistulas 3 (6.67%), which were not detected by TPUS. Overall, TPUS showed excellent diagnostic accuracy in detection of primary tracts and abscesses but comparatively lower sensitivity in detection of secondary tracts and internal openings when compared with MRI.

5. DISCUSSION: The Current study evaluated the diagnostic performance of Transcutaneous perianal ultrasonography (TPUS) and its correlation with magnetic resonance imaging (MRI) in patients with perianal fistula, with focus on detection of primary tracts, secondary tracts, abscesses, internal openings, and St James' classification.

5a. Demographic profile: In the current study, the mean age was 51.29 ± 10.13 years, with majority of patients belonging to the 40–60-year age group and with male predominance (75.56%). All patients in the index study presented with discharge from the perianal region, which was the common presenting symptom.

5b. Clinical Presentation and Etiology: Pain and difficulty in passing stools were the most common associated complaints. Chronic constipation was detected as the common etiological factor (71.11%), supporting the cryptoglandular theory of fistula formation.

5c. Detection of primary fistulous tracts: Both TPUS and MRI demonstrated 100% sensitivity in detecting primary fistulous and sinus tracts in the present study. This excellent concordance supports the findings of Borra et al., which also reported highest diagnostic accuracy of TPUS in identifying primary sphincter abnormalities, although MRI showed a marginal overall advantage over the TPUS. These results reinforce that TPUS is a reliable modality for identifying the main fistulous tract, especially in uncomplicated cases.

5d. Detection of secondary tracts and ramifications: In the present study, secondary tracts were present in 42.22% of patients. TPUS detected secondary tracts in 73.68% of these cases, whereas MRI detected all secondary tracts (100%). This superiority of MRI is consistent with the observations of Borra et al. which

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emphasized that MRI's higher sensitivity in delineating complex anatomy, secondary extensions, and ramifications due to its soft-tissue contrast and its multiplanar capability modalities. Thus, while TPUS is useful as an initial screening tool, MRI remains the gold standard in complex fistulae.

5e. Abscess detection: TPUS detected all abscesses in the current study (20%), showing 100% sensitivity, comparable to MRI. Borra et al. similarly reported that MRI had excellent accuracy in identifying perineal collections, but TPUS was also effective for superficial and clinically significant abscesses. These findings suggest that TPUS can reliably detect abscesses, particularly when they are superficial or when the abscesses are in moderate size range.

5f. Detection of internal opening: Notable difference was observed in detection of internal openings. TPUS identified internal opening in 84.44% of patients, whereas MRI detected internal opening in 100% of patients. Borra et al. also reported superior performance of MRI in visualizing sphincter anatomy and subtle defects. The limitation of TPUS was in identifying all internal openings and it can be due to operator dependence, patient discomfort, and obscuration by fibrosis or deep-seated tracts.

5g. St James' classification: Discrepancies were observed between TPUS and MRI in St James' classification. TPUS predominantly classified fistulas as Grade 1, while MRI demonstrated a higher proportion of Grade 2 and detected Grade 5 fistulas, which were completely missed on TPUS. This aligns with Borra et al.'s conclusion that MRI provides a more comprehensive anatomical assessment and better grading accuracy, particularly for complex and high-grade fistulas. In the present study, TPUS showed 100% sensitivity in detecting primary fistulous tracts 84.4% sensitivity in detecting internal openings. In comparison, Minhas et al. reported: 95.5% sensitivity, 81.8% specificity and 94% diagnostic accuracy of MRI in detecting perianal fistulas. This indicates that while TPUS is highly sensitive for identifying primary tracts and superficial disease, MRI remains superior for comprehensive evaluation, particularly for internal openings, secondary tracts, and complex fistulas.[19]

Table 1: Distribution of study participants based on co-morbidities

Co-morbidities	N	%
Diabetes	9	20
Radiotherapy for Carcinoma cervix	1	2.22
Radiotherapy for Carcinoma rectum	1	2.22
Operated for rectourethral fistula	1	2.22
Alcoholism	5	11.11
Smoking	4	8.89

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Table 2: Comparison between TPUS and MRI

Variables	TPUS	MRI
Primary fistulous and sinus tract detected • Yes • No	45 (100) 0 (0)	45 (100) 0 (0)
Secondary tracts/ramifications detected if present Present • Detected • Not detected Not present	19 (42.22) 14 (73.68) 5 (26.32) 26 (57.78)	19 (42.22) 19 (100) 0 (0) 26 (57.78)
Abscess Present • Detected • Not detected Not present	9 (20) 9 (100) 0 (0) 36 (80)	9 (20) 9 (100) 0 (0) 36 (80)
Internal opening • Yes • No	38 (84.44) 7 (15.56)	45 (100) 0 (0)

Both TPUS and MRI demonstrated 100% sensitivity in detecting primary fistulous tracts. MRI showed superior performance in detecting secondary tracts and internal openings compared to TPUS.

Table 3: Comparison of St Jame's classification between TPUS and MRI

St Jame's classification	TPUS	MRI
Grade 1	15(33.33)	12(26.67)
Grade 2	11(24.44)	14(31.11)
Grade 3	11(24.44)	10(22.22)
Grade 4	8(17.78)	6(13.33)
Grade 5	0(0)	3(6.67)

In TPUS, Grade 1 fistulas were the most common (33.33%), followed by Grades 2 and 3 (24.44% each) while Grade 5 fistula was not found in any of the patient. In contrast, MRI showed a more even distribution with Grade

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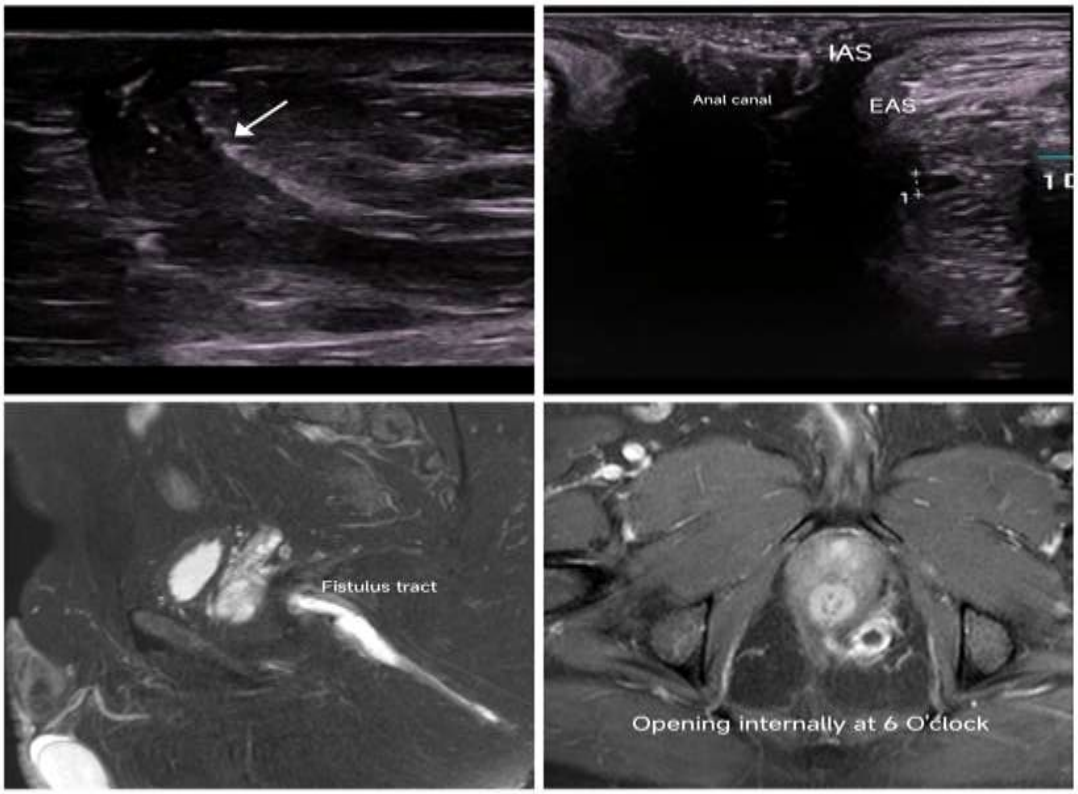
2 being the most frequent (31.11%), followed by Grade 1 (26.67%) and a small proportion of patients classified as Grade 5 (6.67%).

Figure 1: 60 years old male with discharge from perianal region on and off;



In above figure 1; on TPUS- a curvilinear hypoechoic fistulous tract seen with collection in left ischioanal region, piercing both IAS and EAS, opening internally at 6 O'clock position into anal canal.

On MRI: T2/SPAIR hyperintense curvilinear fistulous tract noted in the left gluteal region with external opening at 5- 6 O' position, traversing supero-medially in the left ischioanal fossa and forming a peripherally enhancing collection and traversing medially piercing internal anal and external anal sphincter opening at 6 0' clock position into the anal canal; Grade IV Trans-sphincteric fistula with left ischioanal abscess (St Jame's hospital university classification).

6. CONCLUSION:

Transcutaneous perianal ultrasonography (TPUS) is a highly sensitive, non-invasive, cost-effective, and readily available modality for diagnosing perianal fistulas, demonstrating 100% sensitivity in detecting primary fistulous tracts and excellent accuracy for abscess detection. However, MRI fistulography remains superior for identifying secondary tracts, internal openings, complex/high-grade fistulas, and accurate St. James' classification, making it the gold standard for comprehensive preoperative assessment, particularly in recurrent and complex cases. TPUS can serve as an effective initial imaging modality, especially in low-resource settings and for screening or follow-up, while MRI should be reserved for suspected complex or inconclusive cases. The complementary use of both modalities may optimize surgical planning and reduce postoperative recurrence.

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