



# Role of Transcutaneous Perianal Ultrasonography in Evaluation of Perianal Fistulae with MRI Correlation

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## Abstract

**Purpose:** The aim of this study was to evaluate the role of transcutaneous perianal ultrasonography (TPUS) in patients with perianal fistula and to correlate the findings with magnetic resonance imaging (MRI) as gold standard.

**Materials and Methods:** This prospective study included patients who presented with suspicion of perianal fistula. After clinical examination, TPUS and MRI of perianal region were performed on each of them. Clockwise position of internal opening of the fistula was described. The entire length of the tract was evaluated up to the external opening. Also, any ramifications along the primary tract were described. Parks et al and St James's University Hospital MR Imaging Classification of Perianal Fistulas were used for classifying the fistulas.

**Results:** Out of total 37 patients, the most common age group of presenting individuals was 45 to 60 years with male to female ratio of 6.4:1. There was excellent agreement between TPUS and MRI for detecting primary fistulous tract with kappa correlation coefficient of 1. The kappa correlation coefficient for detecting secondary fistulous tracts and abscess on TPUS and MRI was 0.839 and 0.937 showing excellent agreement. Moderate agreement was seen with kappa correlation coefficient of 0.839 in the detection of internal opening on TPUS and MRI.

**Conclusion:** TPUS showed promising results in diagnosis and classification of perianal fistulae with MRI as gold standard. A wide availability, cost-effectiveness, and better tolerability of TPUS can make it an imaging modality of first choice for evaluating perianal fistulae.

## Keywords

- ▶ MRI
- ▶ perianal abscess
- ▶ perianal fistula
- ▶ TPUS
- ▶ transcutaneous perianal ultrasonography

## Introduction

Perianal fistula is a connection between the anal canal and the skin of the perineum. It implies a chronic granulating track connecting two surfaces lined by epithelium.<sup>1</sup> Most patients present between the ages of 20 and 60 years with a

twofold to fourfold male preponderance. Fistulae are not so common in children.<sup>2,3</sup>

Anal glands provide a free channel facilitating the spread of infection from the lumen of anal canal deep into the sphincters, from where it may spread secondarily in almost

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any direction, resulting in fistula/e formation.<sup>4,5</sup> There are various causes of perianal fistula. These include tuberculosis, trauma during childbirth, infection, pelvic malignancy and radiation therapy, diverticulitis, Crohn's disease, and idiopathic variety.<sup>6</sup>

The challenge in the management of fistulas is to define the course of the track between the internal and external openings so that the appropriate surgical treatment can be used.<sup>7</sup> Endoanal ultrasound (EAUS) and magnetic resonance imaging (MRI) of the pelvis are commonly employed for imaging of perianal fistulae, sinuses, and abscesses.<sup>8</sup> The use of a rigid EAUS probe can be traumatic or even not possible in patients with inflammatory perianal disease due to anal canal stenosis. Furthermore, EAUS does not allow the evaluation of pathological changes extending to involve the gluteal region.<sup>9</sup> Transcutaneous perianal sonography (TPUS) represents another method to detect perianal inflammatory disease, which can be performed using regular US probes without special patient preparation.<sup>10</sup> It is a quick, noninvasive, and feasible technique for the evaluation of various pathologic conditions of the pelvic floor.<sup>11</sup> Patients are asked to lie down in the dorsal or left lateral decubitus position and the US probe is then placed near the anal opening. US scanning is done in the axial, sagittal, and coronal planes in order to screen the perianal regions.<sup>12,13</sup>

Normal appearance of anal canal and perianal fistula on TPUS is such that the internal sphincter is homogeneous and hypoechoic while external sphincter is heterogeneous and hyperechoic. Ischioanal fat is seen lateral to external sphincter and appears hyperechoic.<sup>14,15</sup>

A fistulous tract appears as an elongated hypoechoic structure with or without internal hyperechogenicity, which extends from the anal canal to the perineal skin.<sup>16</sup> Active fistula shows hyperemia along the fistulous tract on the color Doppler study and/or internal air bubbles on a grayscale.<sup>17</sup>

## Purpose

The main aim of this study was to evaluate the role of TPUS in patients with perianal fistula and to correlate the findings with MRI as gold standard

## Materials and Methods

The 2-year study included 37 patients during May 2017 to June 2019 with suspicion of perianal fistula. Previously operated patients with the recurrent perianal disease were excluded from the study. TPUS and MRI of perianal region were performed on all patients. Two certified radiologists with one having experience of 10 years and the other having experience of 5 years performed the respective perianal US and MRI examination of the perianal region.

### TPUS: Technique and Position

The perianal sonography was performed using high-resolution 3 to 8 MHz linear and 2 to 5 MHz sector probes percutaneously on Voluson E8 (Wipro GE, Bengaluru). The US probe was wrapped with a latex cover after applying contact gel on

the surface of the probe (►Fig. 1). Scanning was performed in lithotomy position or left lateral decubitus position in the sagittal, coronal, and axial planes in order to screen the perianal region. The transducer was put over anal canal and external opening of tract in all patients and images were obtained in different planes as necessary (►Figs. 1 and 2). Clockwise position of internal opening of the fistula was described. The entire length of the tract was evaluated up to the external opening. Also, any ramifications along the primary tract were described. Parks classification was used for classifying the tracts. The patients were asked to strain down to see the movement of the air foci in the fistulous tract indicating active tract. Color flow imaging was done to evaluate the vascularity of the fistulas.

### MRI Protocol

All patients underwent MRI examinations with 1.5 Tesla unit on Philips Gyroscan Achieva using sense body coil. The standard imaging protocol consisted of T2-weighted turbo spin echo fat saturated (T2W TSE FS) in axial plane, T2W TSE FS in coronal plane, T1W TSE in both axial and coronal planes (►Table 1). Gadobenate dimeglumine 0.1 mmol/kg was used as contrast administered intravenously by hand. Post-contrast T1 TSE FS axial and coronal images were taken.

### Image Analysis

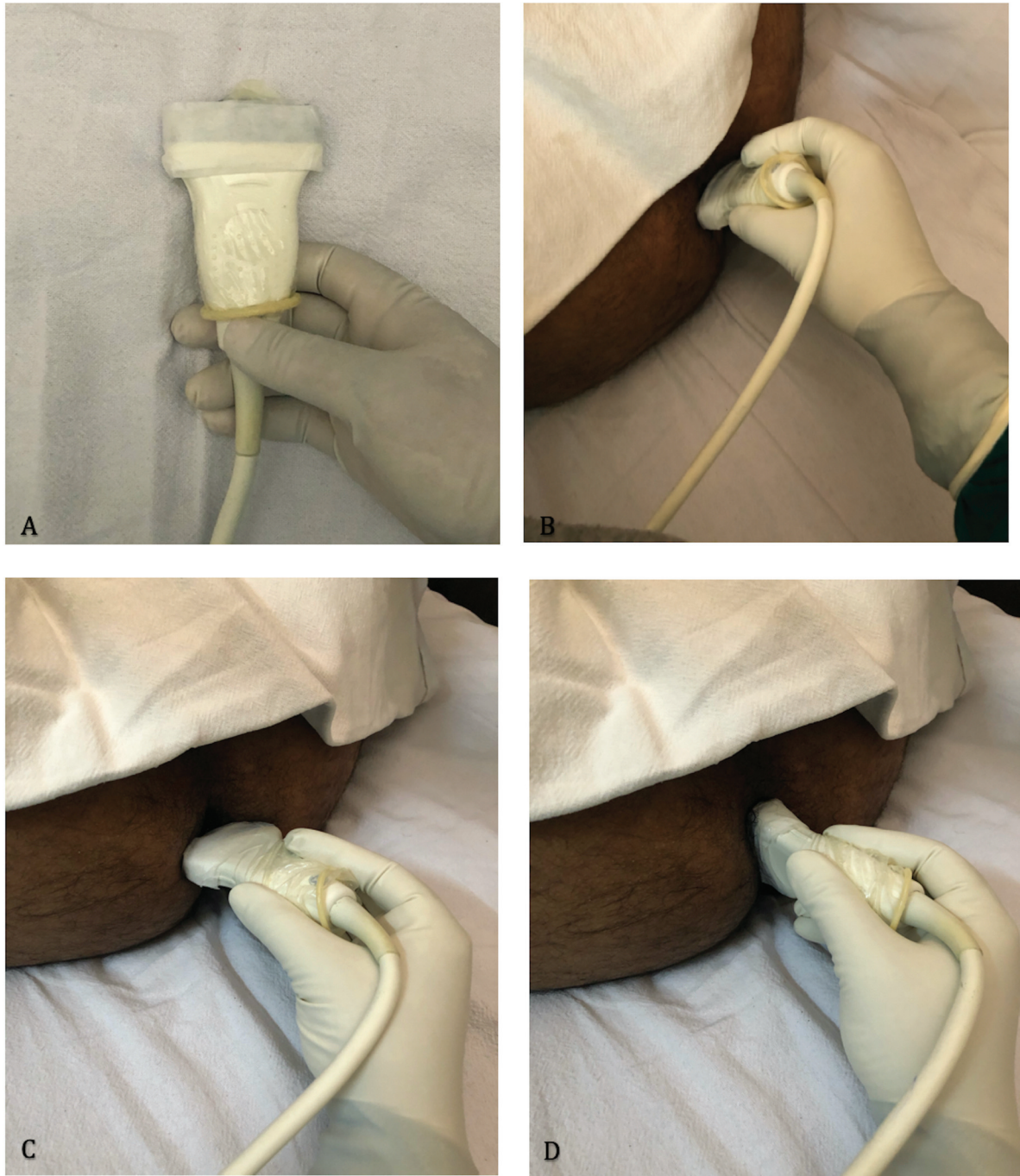
Each MRI was analyzed for specific features that were relevant to the evaluation of perianal fistulae. Both internal and external openings were recorded as their position on anal clock and at their correct level in anal canal/rectum.

Parks classification and St James's University Hospital Classification of perianal fistulas were used for classifying fistulas. According to the Parks et al classification,<sup>17,18</sup> the primary tracts were described as four patterns: intersphincteric, transsphincteric, suprasphincteric, and extrasphincteric.

As per St James's University Hospital MRI Classification,<sup>6,19</sup> fistulas were classified as: 0—normal appearance, I—simple linear intersphincteric fistula, II—intersphincteric fistula with intersphincteric abscess or secondary fistulous track, III—transsphincteric fistula, IV—transsphincteric fistula with abscess or secondary track within the ischioanal or ischioanal fossa, V—suprlevator and translevator disease.

## Results

Out of 37 patients, 35 patients had perianal fistula and sinus tract diagnosed on perianal US that were confirmed on MRI. ►Table 2 shows comparison between findings on TPUS and MRI regarding identification of primary fistulous tract, ramifications, any abscess/s and internal opening. Two patients with clinical suspicion of perianal fistula had no fistulous tract detected on TPUS and were reassessed clinically and diagnosed as cases of perianal fissure. No disagreement was seen between the two imaging modalities for the 35 subjects diagnosed as having perianal fistula. Kappa correlation coefficient between TPUS and MRI findings for detection of primary fistulous tract and sinus tract was 1 with  $p$ -value < 0.001.



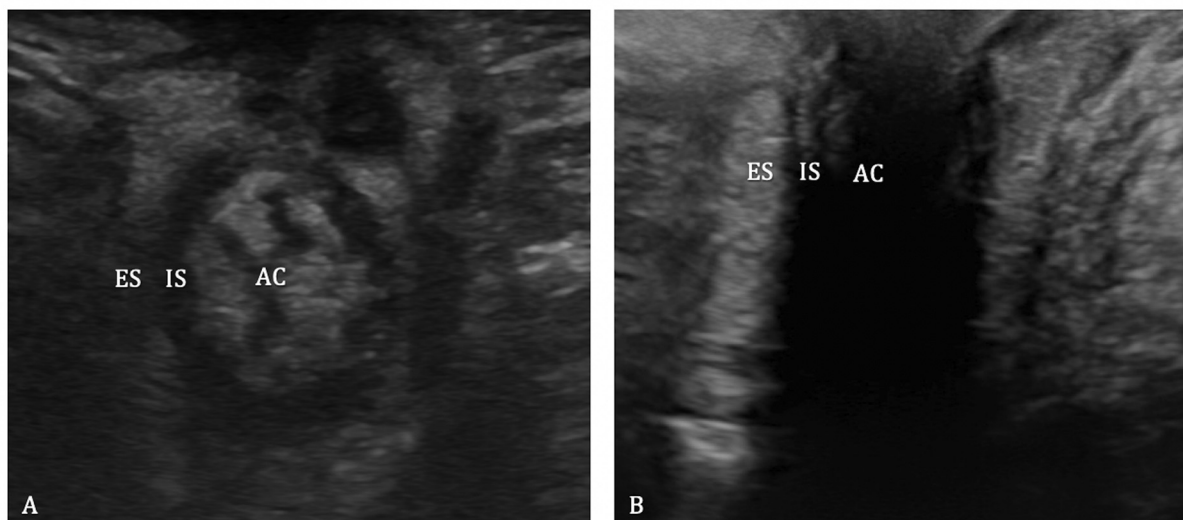
**Fig. 1** Preparation of the probe (A) and its placement above the anus in axial (B), coronal (C), and sagittal (D) scans in a patient in dorsal lithotomy position.

There were seven patients with secondary tract/ramifications diagnosed on TPUS and were confirmed on MRI. No disagreement was seen between the two modalities for these seven cases. However, MRI diagnosed two additional cases with secondary tract/ramifications, which were not observed on TPUS. Kappa correlation coefficient between TPUS and MRI findings for detection of secondary tract/ramifications was 0.839 with  $p$ -value  $< 0.001$ .

Abscess was seen in 12 of the subjects on TPUS. However, MRI could confirm abscess in 11 subjects. In one of these

subjects, abscess could not be demonstrated on MRI. Kappa correlation coefficient between TPUS and MRI findings for abscess was 0.937 with  $p$ -value  $< 0.001$ .

Internal opening could be seen on TPUS in 32 patients, which was concordant with MRI. No disagreement was seen between the two modalities for these 32 cases. However, MRI was able to diagnose internal opening in two additional cases of perianal fistula that could not be seen on TPUS. Kappa correlation coefficient between USG and MRI findings for internal opening was 0.536 with  $p$ -value  $< 0.001$ .



**Fig. 2** Axial (A) and coronal (B) transcutaneous perianal sonographic images of the anal canal showing the anal canal (AC), internal sphincter (IS), and the external sphincter (ES).

**Table 1** MRI sequences

	TR	TE	FOV	Thickness (MM)	GAP (MM)	NSA	MATRIX
T2W TSE COR FS	3500-4000	90-100	300-400	4	0.5	3	206/336
T2W TSE TRA FS	3500-4000	90-100	300-400	4	0.5	3	206/336
T1W TSE COR	475-650	14-20	300-400	4	0.5	3	167/336
T1W TSE COR FS	475-650	14-20	300-400	4	0.5	3	167/336
T1W TSE TRA FS (post-contrast)	475-650	14-20	300-400	4	0.5	3	167/336
T1W TSE COR FS (post-contrast)	475-650	14-20	300-400	4	0.5	3	167/336

Abbreviations: COR, coronal; FOV, field of view; FS, fat saturation; MRI, magnetic resonance imaging; NSA, number of signal averages; TE, time to echo; TR, time to repeat; TRA, transverse; TSE, turbo spin echo.

**Table 2** Comparison of TPUS and MRI

	Positive on TPUS	Positive on MRI
Detection of primary fistulous and sinus tract	35	35
Detection of secondary tracts/ramifications	7	9
Detection of abscess	12	11
Detection of internal opening	32	34

Abbreviations: MRI, magnetic resonance imaging; TPUS, transcutaneous perianal ultrasonography.

► **Tables 3 and 4** show the classification of fistulous tracts in the study as per Parks Classification and St James's University Hospital MR Imaging Classification of Perianal Fistulas.

### Discussion

Among the 37 patients included in the study, 32 were males (86.5%) and five were females (13.5%), with the most common age group of 45 to 60 years. In study conducted by

**Table 3** Parks classification on TPUS

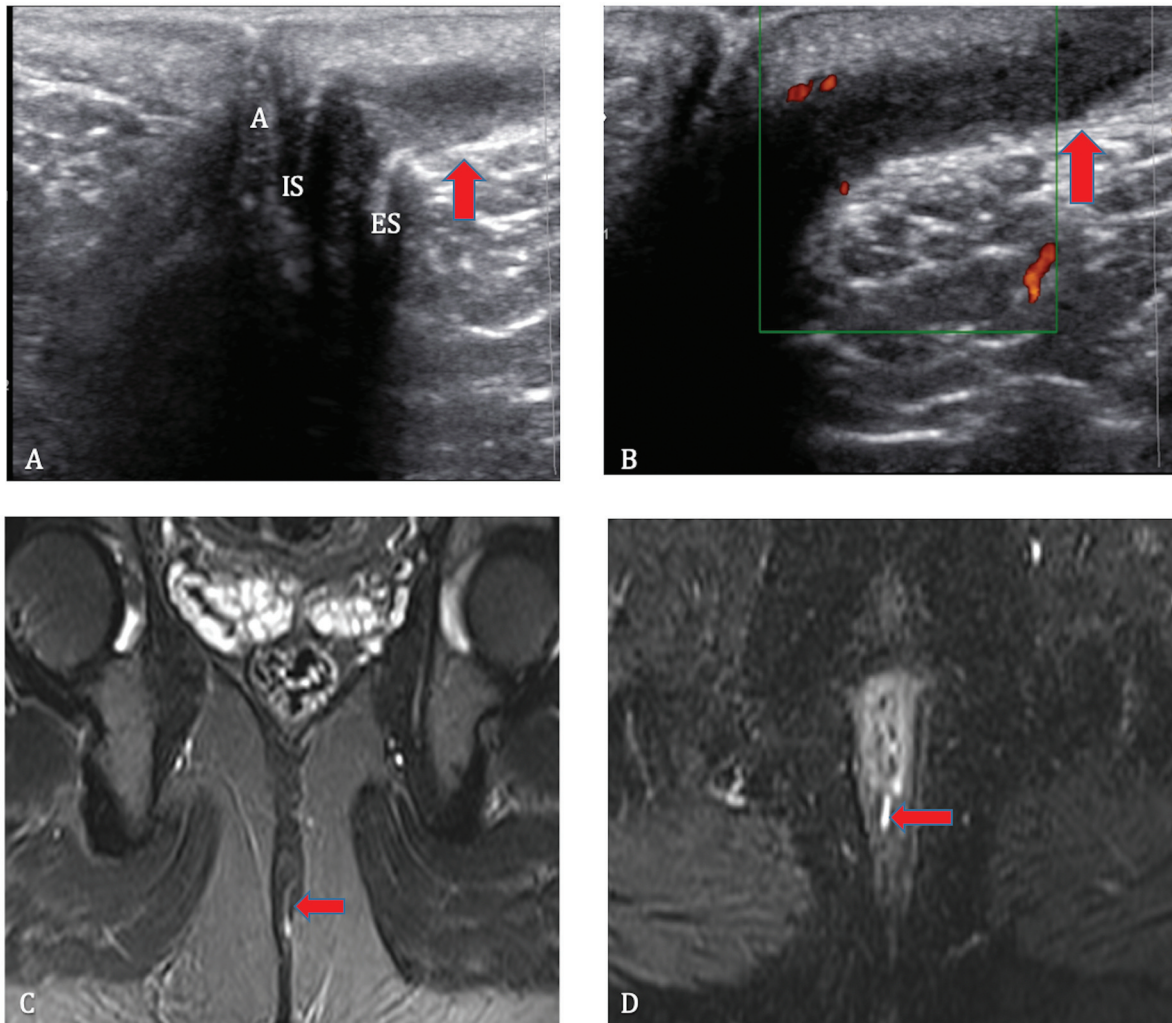
Type	No of subjects	Percentage (%)
Intersphincteric	19	54.28
Transsphincteric	15	42.85
Suprasphincteric	1	2.85
Extrasphincteric	0	0
Total fistulas	35	—

Abbreviation: TPUS, transcutaneous perianal ultrasonography.

**Table 4** St. James's classification of perianal fistula on MRI

Grade	No of subjects	Percentage (%)
I	12	33.33
II	8	22.22
III	7	19.44
IV	8	22.22
V	1	2.77

Abbreviation: MRI, magnetic resonance imaging.



**Fig. 3** (A and B) Transperineal sonography coronal images showing hypoechoic intersphincteric fistulous tract (marked by red arrows). Increased vascularity is noted on color flow imaging (B). (C and D) T2-weighted coronal and axial images showing hyperintense primary tract (marked by red arrows) seen in intersphincteric plane. No secondary tract and abscess are seen. A, anal canal; ES, external sphincter; IS, internal sphincter.

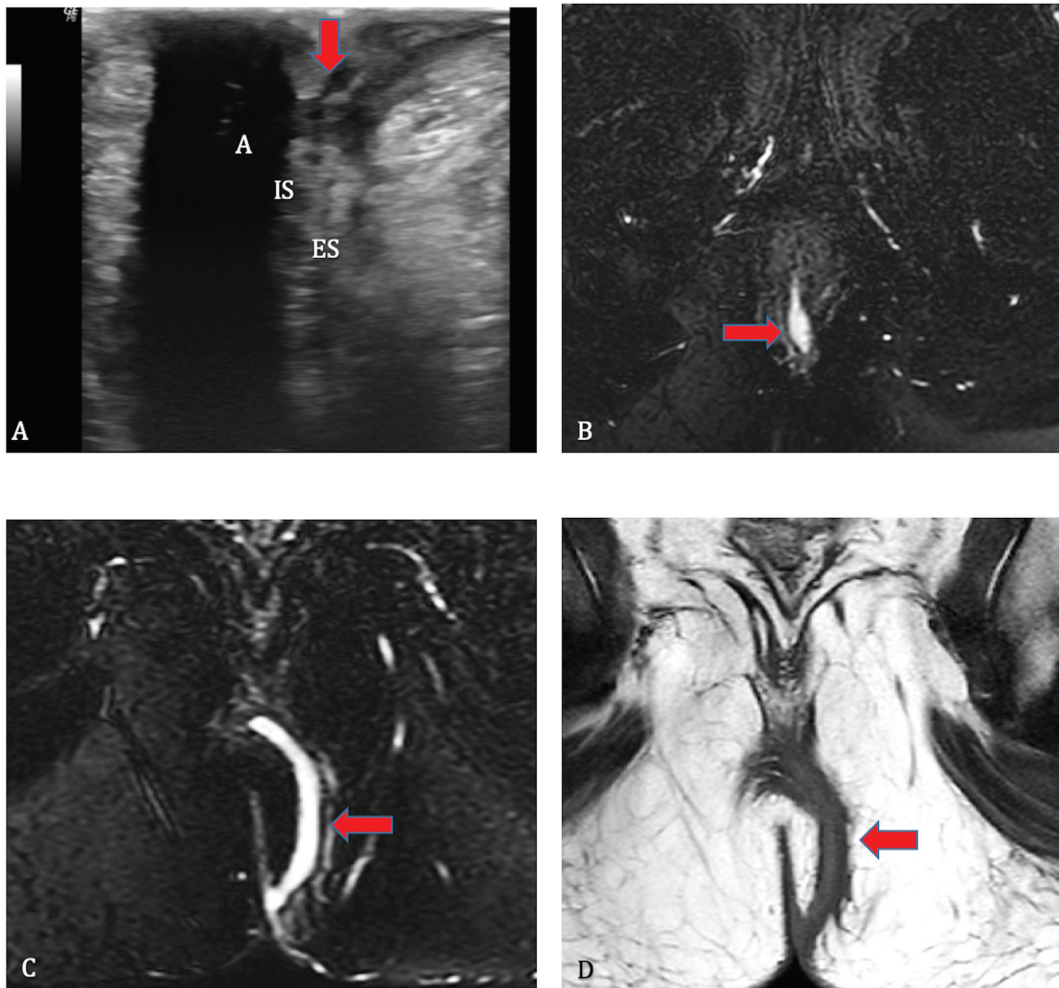
Puranik et al<sup>20</sup> and Jhobta et al,<sup>21</sup> there were 88% males and 12% females with the most common age group of 20 to 59 years.

In the present study, all fistulae detected by MRI were also diagnosed by TPUS. The kappa coefficient for the primary fistulous tract and sinus tract was calculated as 1, resembling an excellent agreement. A study involving 25 patients by Wedemeyer et al confirmed high sensitivity and specificity of TPUS when compared with pelvic MRI for diagnoses and characterization perianal fistulae with excellent agreement between the two imaging methods (kappa > 0.83).<sup>22</sup>

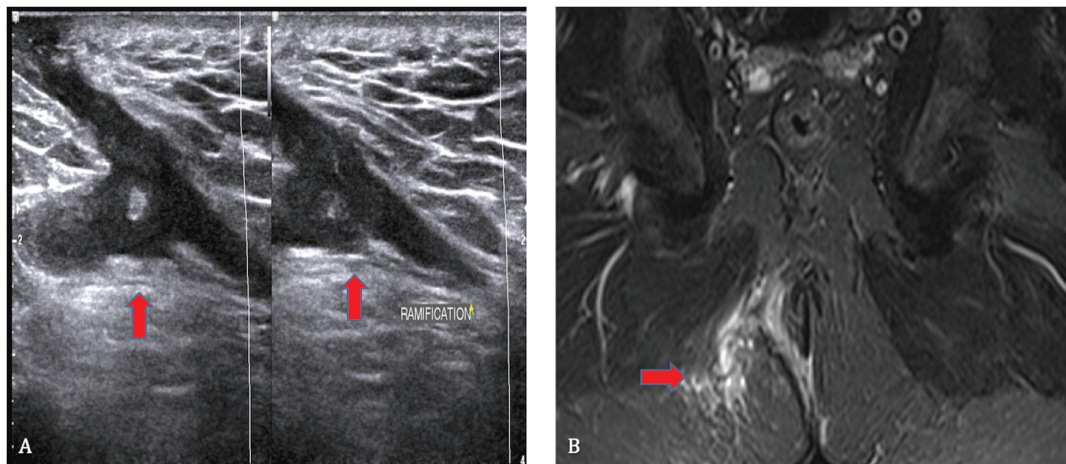
The most common fistula seen was active intersphincteric fistula (►Fig. 3) followed by transsphincteric fistula (►Fig. 4), which was concordant with Parks classification. On sonography, active perianal fistula appears as hypoechoic to anechoic track with multiple internal echoes and air foci within it. Increased echogenicity was demonstrated in the surrounding soft tissue due to inflammation. On color flow imaging, increased vascularity was demonstrated in the walls of active fistulous tracks.

Kappa correlation coefficient between US and MRI findings for detection of secondary tract/ramification was 0.839 with  $p$ -value < 0.001, which was highly significant. Similar findings have been seen in the study conducted by Fulvia et al which confirmed excellent agreement between the TPUS and MRI (kappa > 0.83).<sup>23</sup> Ramifications that run in intersphincteric plane were difficult to see on TPUS and needed confirmation of MRI. Extrasphincteric ramifications were well visualized on MRI as well as on TPUS (►Fig. 5). A few extrasphincteric superficial ramifications were difficult to appreciate on MRI, because they were seen near the skin surface and one of patients showed partially fibrosed tract, so it appeared less hyperintense on MRI.

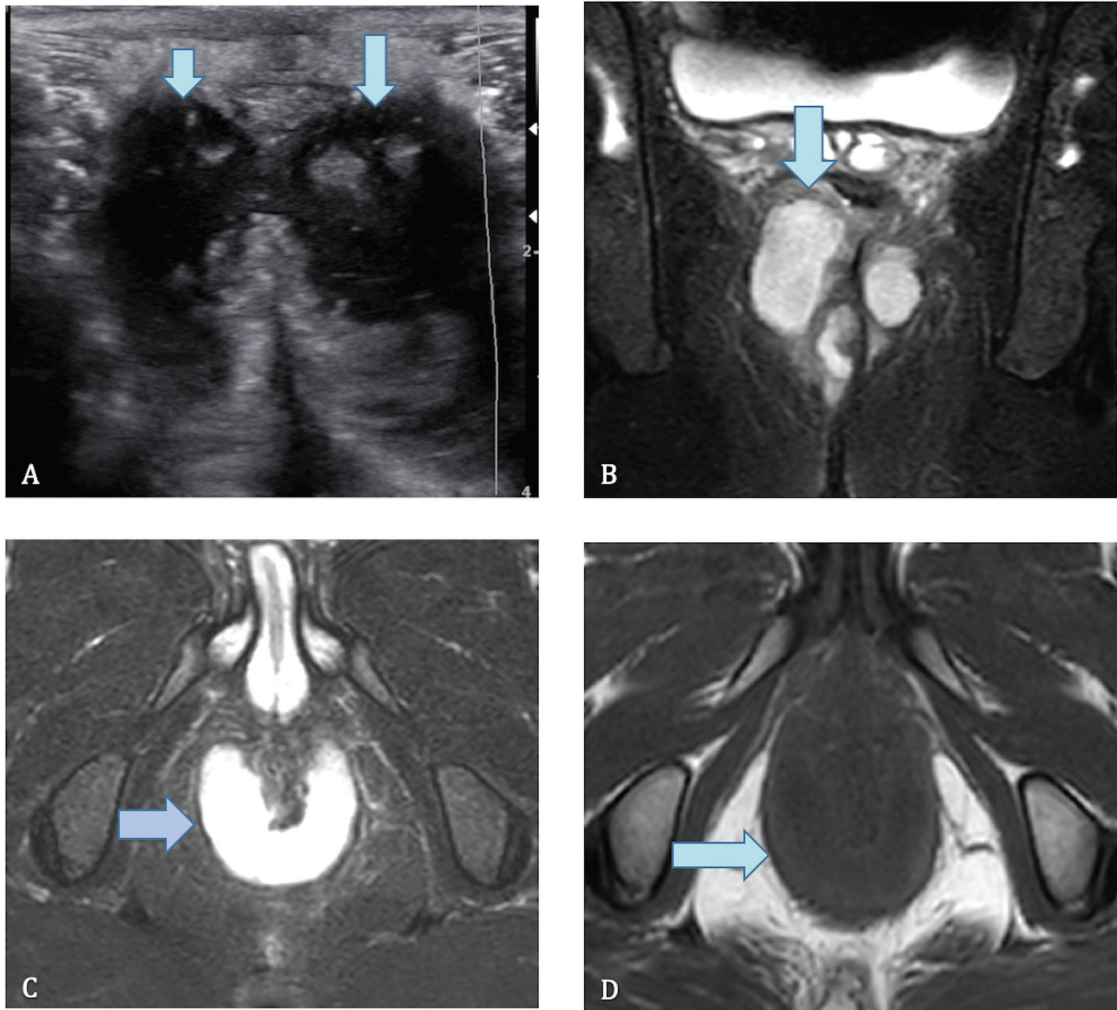
A study conducted by Wedemeyer et al confirmed high sensitivity and specificity of TPUS when compared with pelvic MRI for diagnoses and characterization abscess (►Fig. 6) with excellent agreement between the two imaging methods (kappa > 0.83).<sup>22</sup> In the present study, it was found that in terms of detection of abscess, kappa correlation coefficient between US and MRI findings was 0.937



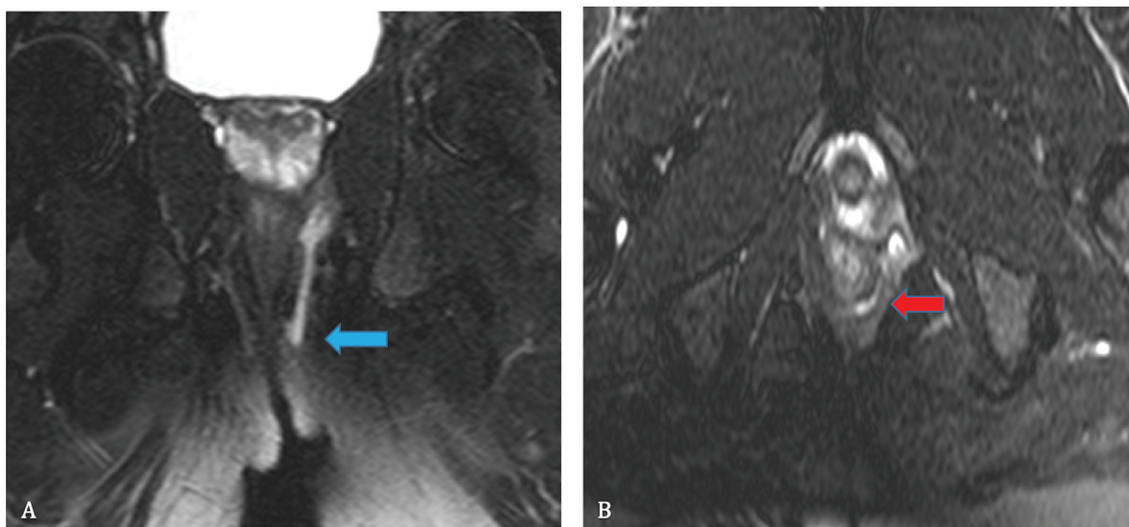
**Fig. 4** (A) Transperineal sonography coronal image showing hypoechoic transsphincteric fistula (marked by red arrows). (B, C, and D) Magnetic resonance imaging T2-weighted fast spin (MRI T2W FS) axial, coronal, and T1W coronal images showing hyperintense transsphincteric fistula (marked by red arrows) on T2W and which appears hypointense on T1W image. No secondary tract and abscess are seen. A, anal canal; ES, external sphincter; IS, internal sphincter.



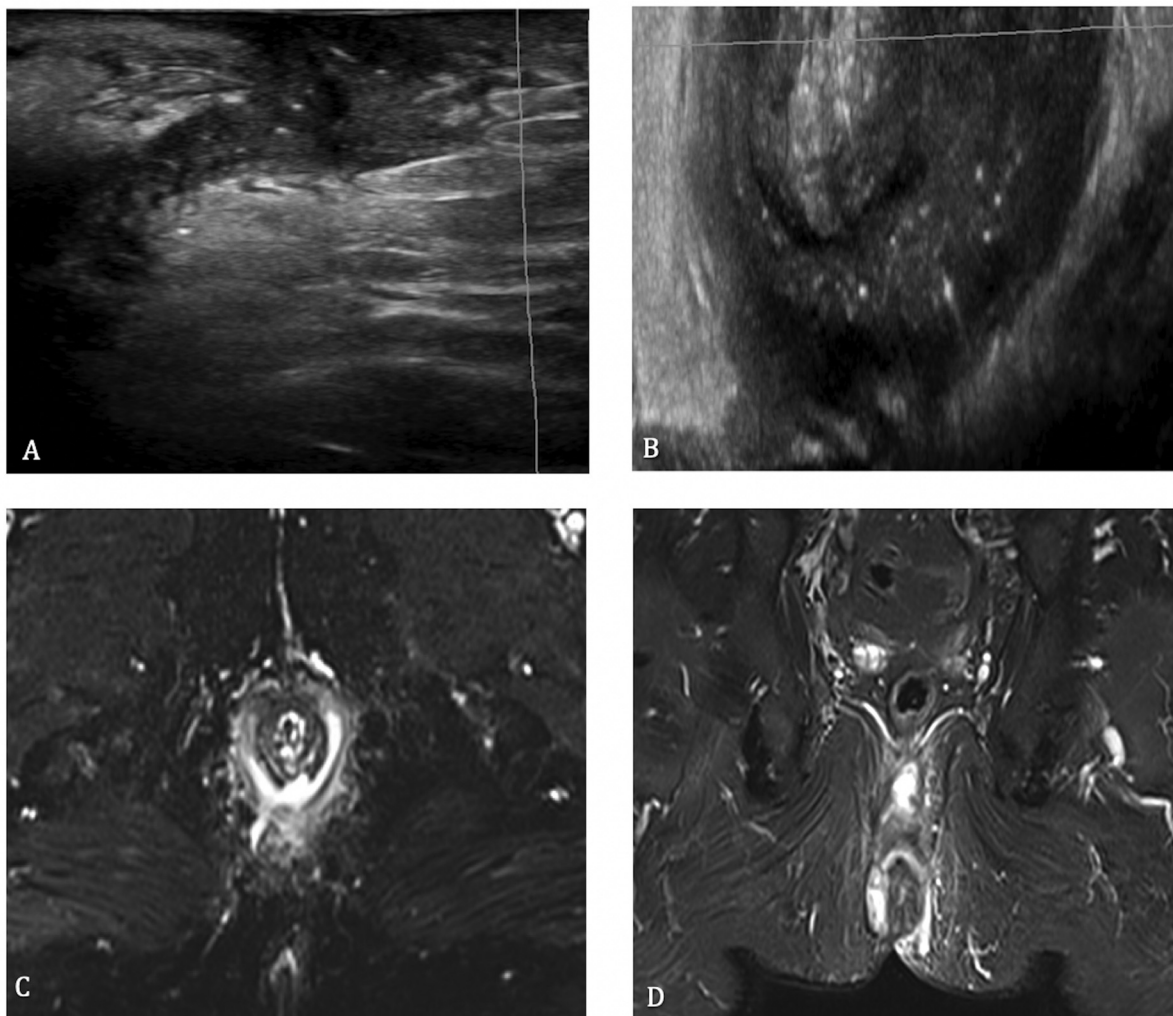
**Fig. 5** (A) Transperineal ultrasound coronal image showing hypoechoic primary fistulous tract along with bind ended secondary tract/ramification (marked by red arrows). (B) Magnetic resonance imaging T2-weighted fast spin coronal image showing hyperintense primary and secondary tract, along with intersphincteric abscess (marked by red arrow).



**Fig. 6** (A) Transperineal sonography coronal image showing horse shoe-shaped intersphincteric abscess (marked by blue arrows). (B-D) Magnetic resonance imaging T2-weighted fast spin coronal, axial and T1-weighted axial images showing horse shoe-shaped abscess in intersphincteric plane with intersphincteric fistula (marked by blue arrows).



**Fig. 7** (A and B) Magnetic resonance imaging T2-weighted fast spin coronal and axial image showing hyperintense fistulous tract (marked by blue arrow) going above the level of levator ani sling and further extending into intersphincteric plane (marked by red arrow).



**Fig. 8** (A and B) Transperineal ultrasound coronal and axial images showing hypoechoic transsphincteric fistula with horse shoe-shaped intersphincteric abscess. (C and D) Magnetic resonance imaging T2-weighted fast spin axial and coronal images showing horse shoe-shaped hyperintense intersphincteric abscess. Two hyperintense tracts with separate external openings on both sides uniting in the midline leading to formation of horse shoe fistula.

(excellent correlation) with  $p$ -value  $< 0.001$  that was highly significant. Color Doppler imaging gave additional information of surrounding vascularity along the fistulous tract due to hyperemic changes. Air foci and echogenic contents were again better seen on TPUS. Small deeper abscesses in intersphincteric planes and that were near to levator ani sling were better visualized on MRI (►Figs. 7 and 8).

Internal opening diagnosed on TPUS was concordant with MRI in 32 patients (►Figs. 9 and 10). For detecting internal opening, MRI had better sensitivity and specificity than TPUS. Agreement between TPUS and MRI was moderate.

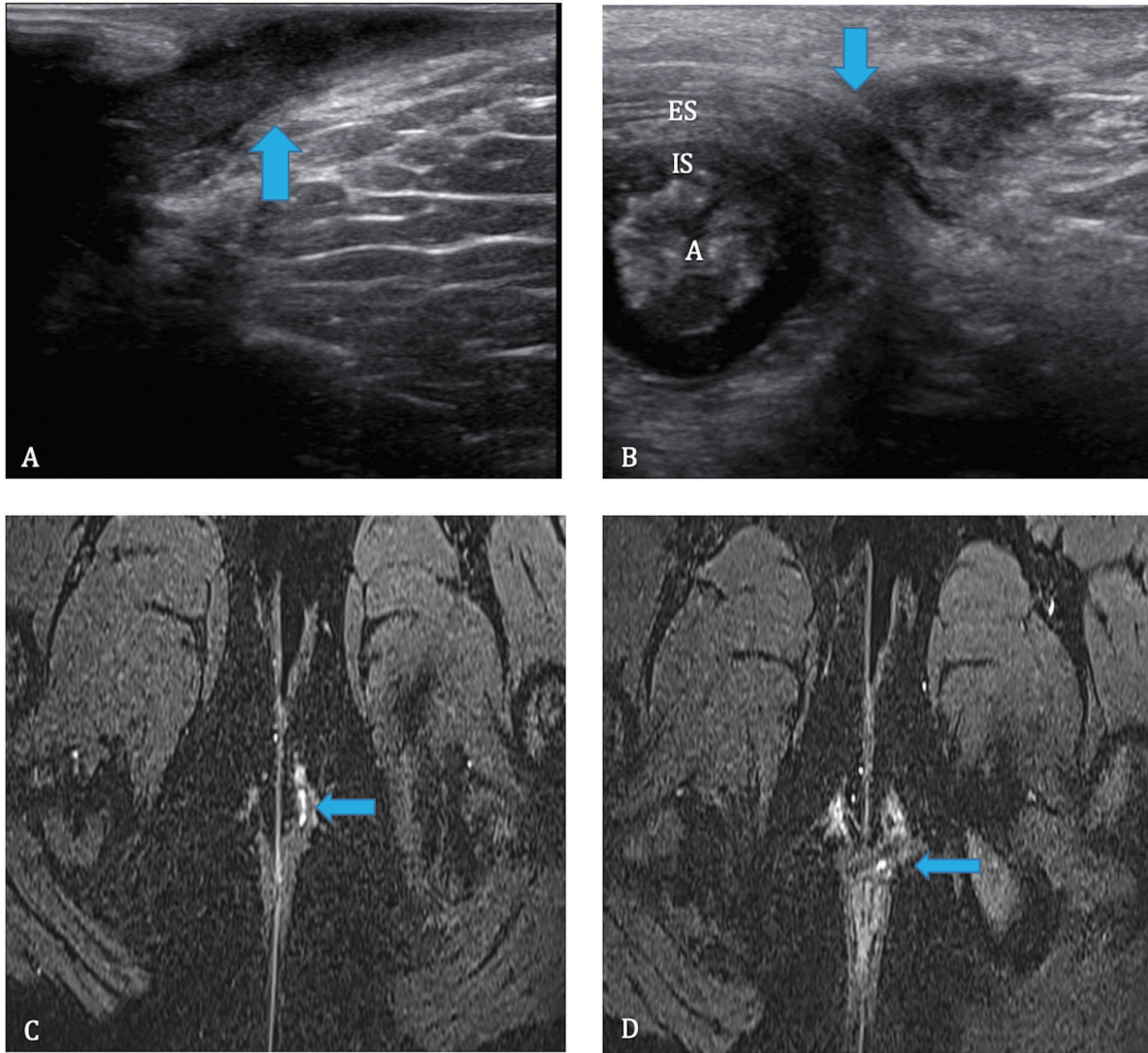
There are few limitations of TPUS. It was operator dependent and required technical expertise in evaluating associated ramifications and the internal opening. Besides

some limitations, TPUS had great advantage of real-time imaging besides better tolerability and lower cost that makes it a choice for first line of investigation for evaluating perianal fistulae.

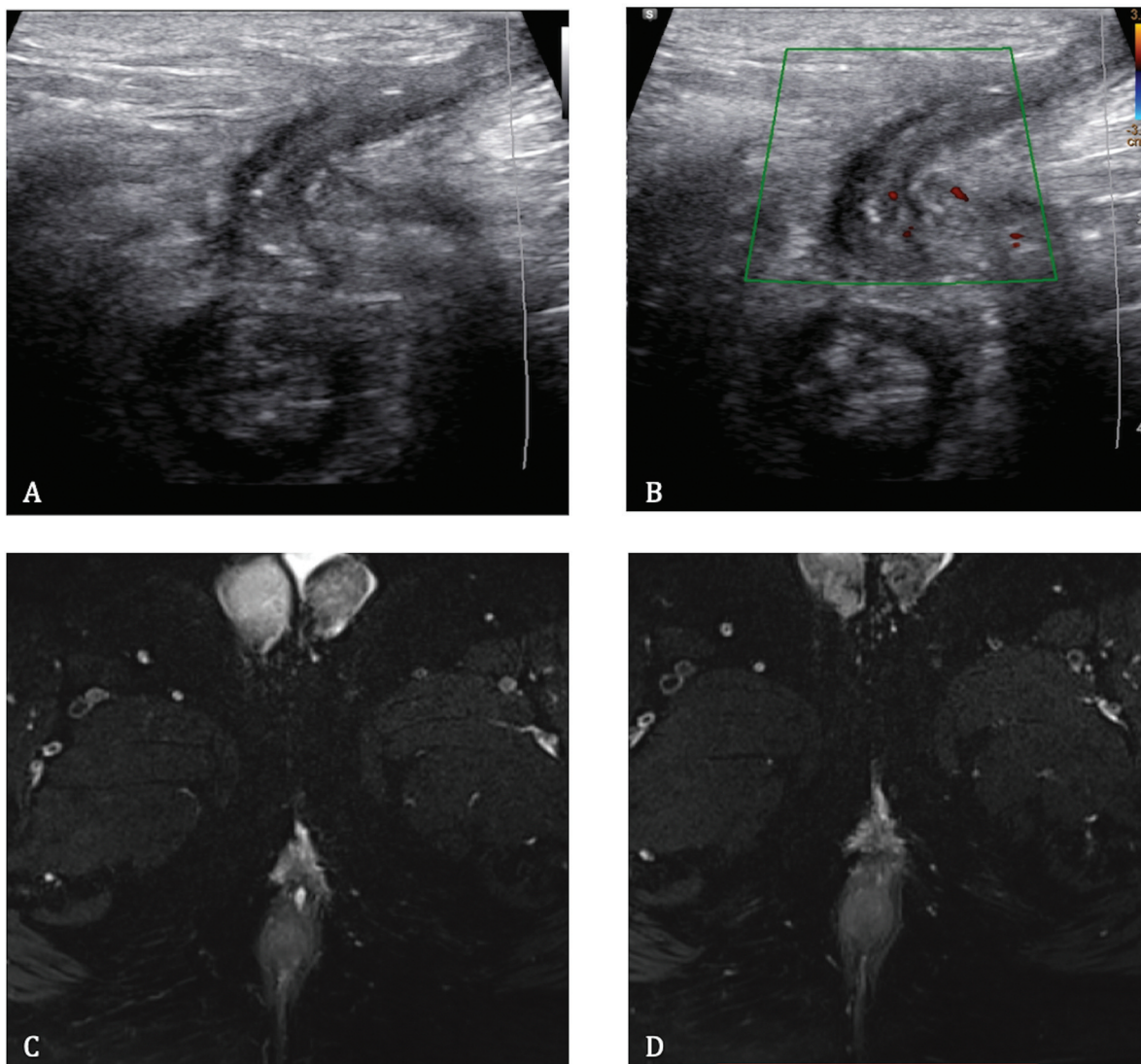
## Conclusion

TPUS is an effective imaging modality in the evaluation of perianal fistulae. It has high sensitivity and specificity in diagnosing and classifying perianal fistulae and abscess comparable with MRI. TPUS can especially be recommended as a first-line radiological imaging investigation in acute perianal disorders such as perianal abscess and for follow-up studies of perianal inflammatory disease.





**Fig. 9** (A and B) Transperineal sonography sagittal and axial images showing hypoechoic primary fistulous tract (marked by blue arrow). External sphincter is seen as hyperechoic striated structure. Internal sphincter is seen as hypoechoic ring on axial images. (C and D) Magnetic resonance imaging T2-weighted fast spin axial images showing hyperintense transsphincteric fistula (marked by blue arrow) with internal opening at 1-2 O'clock position. A, anal canal; ES, external sphincter; IS internal sphincter.



**Fig. 10** (A and B) Axial image of anal hypoechoic tract is seen ending blindly within the external sphincter. It is not reaching up to intersphincteric plane. On color flow imaging, increased vascularity is noted indicating active fistula. (C and D) Magnetic resonance imaging T2-weighted fast spin axial image showing hyperintense tract ending abruptly in external sphincter.

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Nil.

#### Conflicts of Interest

There are no conflicts of interest.

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