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Original Article

Role of Magnetic Resonance Imaging Fistulography in Preoperative Evaluation of Perianal Fistulas

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Abstract

Introduction: As per definition, a perianal fistula is any abnormal passage connecting two epithelial surfaces of anal canal and the skin of the perineum. **Objective:** The objective of this study is to study the various types of perianal fistulas, delineating the primary track and complications of perianal fistula with magnetic resonance imaging (MRI) and evaluate the accuracy of MRI in the pre-operative classification. **Materials and Methods:** A retrospective study included 44 patients referred for MRI by 1.5T Magnetom Avanto MRI unit (Siemens Medical Systems) with clinical suspicion of perianal fistulae between January 2016 and July 2017, for evaluation of the extent of disease. Out of these 26 patients underwent surgery in our hospital and were included in the study. Imaging was performed with multiplanar T1-weighted (T1W), T2-weighted (T2W), and proton density fat saturation (PDFS) sequences. Fistulas were classified according to St. James's University Hospital MRI based classification system (which correlates the Parks surgical classification to anatomic MRI findings) into five grades. Then, the interrelation between surgical and MRI findings was statistically analyzed. **Results:** A total of 26 patients were studied, MRI revealed fistulae in 21 (80.7%) patients while 5 (19.2%) patients had only perianal sinuses. Out of total 21 fistulae seen, 10 (47.6%) were intersphincteric, 9 (42.8%) were transsphincteric, and 2 (9.5%) were suprasphincteric. No extrasphincteric fistula noted. Out of these fistulae, 14 (66.6%) were simple, whereas 7 (33.3%) showed associated abscess formation, inflammation, and branching course. Statistical parameters showed that MRI has a sensitivity of 100% and specificity of 83.3% in determining type and extent of perianal fistula. **Conclusion:** MRI is a reliable noninvasive diagnostic modality for pre-operative assessment of perianal fistulae and guide for surgical planning by giving a correct assessment of the extent of disease, thereby reducing the chances of recurrence.

Key words: Intersphincteric, Magnetic resonance imaging, Perianal fistula, Suprasphincteric, Transsphincteric

INTRODUCTION

As per definition, a perianal fistula is any abnormal passage connecting two epithelial surfaces of anal canal and the skin of the perineum.[1] They are thought to be a result of anal gland obstruction, with secondary abscess formation and external rupture of the abscess.[2]

Anal fistulae have been known ever since the times of Hypocrates and have been described through centuries. In 1835, Frederick Salmon performed a successful operation in London on the writer Charles Dickens. Goodsall describes the fistulous passage in details, and Parks' Classification shows the most practical significance until nowadays.

The incidence of perianal fistula ranges from approximately 1 to 2 per 10,000 individuals with an approximate 2:1 male to female predominance.[1] The most common presenting symptom is discharge, discomfort, and fever but local pain due to inflammation is also common.[3] However, fistulas may be completely asymptomatic.[4]

Treatment of this condition includes surgical exploration and removal of the fistulous track.[5] However, in 25-30% of cases, the condition has a tendency to recur.[5,6] This is most often because surgical exploration can easily miss secondary tracks and abscesses, resulting in recurrent infection requiring re-exploration. Surgeons have traditionally used

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digital rectal examination and examination under anesthesia to detect the fistulous track and their internal opening. However, this method fails to identify complex fistulas and their branches, leading to wrong classification and incomplete treatment.[6,7]

Conventional fistulograms has two main disadvantages: First, the primary track and its extensions do not fill with contrast if they are plugged with pus or debris and, second, the sphincter muscle anatomy is not imaged; hence, the relation between the track, the internal/external sphincter, and the levator ani muscle is not revealed.[6] Transrectal ultrasound better depicts fistulae and their relation to the anal sphincter muscles. The operator dependence, limited field of view and absence of a coronal plane of imaging; however, are its disadvantages.[6] Computed tomography (CT) fistulography is limited by the fact that attenuation values of the fistula track, the areas of fibrosis, and sphincter muscles are similar to each other.[6] Researches have shown that techniques used for imaging perianal fistulas including fistulography, anal endosonography, and CT, have proved no better than clinical examination and are uncomfortable to the patient on one hand and or lack the ability to demonstrate secondary tracks and relationship of the fistulous tracks with the sphincter complex.[6-8]

MATERIALS AND METHODS

Totally, 44 patients with clinical suspicion of perianal fistulae were referred to the Radiology Department of tertiary care rural hospital from January 2016 and July 2017. Out of these 26 patients underwent surgery in our hospital and were evaluated retrospectively. Magnetic resonance imaging (MRI) imaging was done with a 1.5T Magnetom Avanto MRI unit (Siemens Medical Systems) with parameters and protocol described in Table 1, using a phased array body coil. There was no special patient preparation. MRI fistulogram was performed with instillation of contrast (gadolinium) or saline through the external opening.

The following items were assessed for each of the used MRI sequences: The type of the fistula, location of the internal opening, the presence or absence of sinus tracks, abscesses and a horseshoe component as well as coexisting inflammation. The type of the fistula was evaluated according to the St. James's University Hospital MRI classification system (Table 2)[9] which correlates Parks surgical classification[10] to anatomical MRI findings in the axial and coronal planes (Table 3 and Figure 1). The location of the internal opening was identified on axial images using the "anal clock" with the 12 o'clock position located anterior and the 6 o'clock position located posterior (Figure 2).[11] A fistula with a track medial to the levator plate or puborectalis muscle is supralevator, while a fistula lateral to these muscles is infralevator. Complicated primary tracks with secondary tracks, extensions or abscesses were defined by their anatomical location: Ischio-anal, intersphincteric, or supralevator and they were considered horseshoe if crossing the midline to the contralateral side.[12] Fistulous tracks were differentiated from abscesses using the criteria of Laniado *et al.*[13] in which fistulas were defined as being

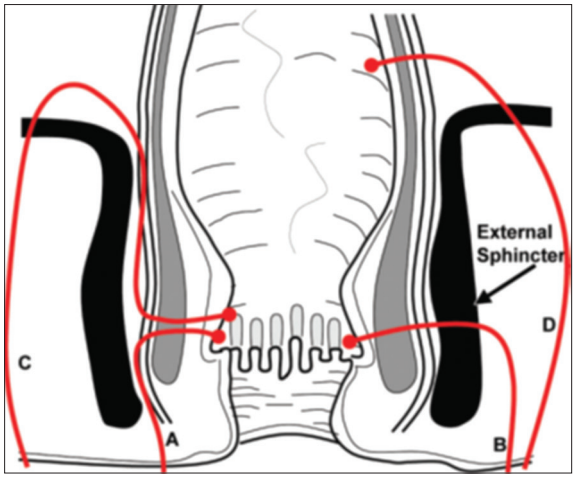


Figure 1: Parks classification. Drawing of the anal canal in the coronal plane shows the Parks classification of perianal fistulas. A = Intersphincteric, B = Transsphincteric, C = Suprasphinc-teric, D = Extrasphincteric. The external sphincter is the keystone of the Parks classification

Table 1: Protocols and parameters used for MRI fistulography

Imaging plane	MRI sequences			
	Non-contrast scan		Non-contrast fat suppressed scan	
	T1W FSE	T2W FSE	FS T1W FSE	FS T2W FSE
	Axial and coronal	Saggital, axial and coronal	Axial and coronal	Saggital, axial and coronal
TR/TE (ms)	450/14	4500/110	560/14	4500/110
FOV (cm)	26 × 26	24 × 24	26 × 26	24 × 24
Section thickness	4.0	4.0	4.0	4.0
Intersection gap (mm)	0.8	0.8	0.8	0.8
Matrix	384 × 224	320 × 256	384 × 224	320 × 256

MRI: Magnetic resonance imaging, T1W: T1-weighted, T2W: T2-weighted, FS: Fat suppression, FOV: Field of view, FSE: Fast spin echo

Table 2: MRI grading of ano-rectal fistula[9]

Grade	Description
1	Simple linear inter-sphinctric fistula
2	Inter-sphincteric fistula with inter-sphincteric abscess or secondary fistulous track
3	Trans-sphincteric fistula
4	Trans-sphincteric fistula with abscess or secondary track within the ischioanal or ischiorectal fossa
5	Supralevator and translevator disease

MRI: Magnetic resonance imaging

Table 3: Parks classification of ano-rectal fistula[10]

Fistula type	Description
Inter-sphincteric	Confined to inter-sphincteric plane, does not cross external sphincter or levator muscles
Trans-sphincteric	Track passes radially through external sphincter
Supra-sphincteric	Track passes upward within inter-sphincteric plane over puborectalis muscles and descends through levator muscles to the ischiorectal fossa
Extra-sphincteric	Course is completely outside external sphincter

Quoted from Crido *et al.*[9]

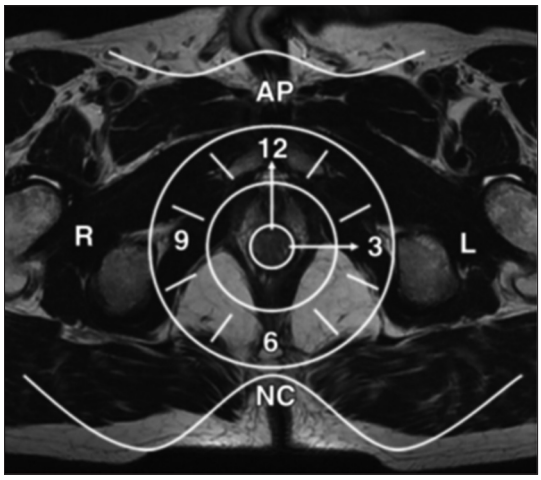


Figure 2: Anal clock. Axial T2-weighted magnetic resonance image of the male perineum shows the anal clock diagram used to correctly locate anal fistulas with respect to the anal canal. AP = Anterior perineum, L = left aspect of the anal canal, NC = Natal cleft, R = Right aspect of the anal canal

fluid–fluid tubular structures with a diameter smaller than 10 mm and abscesses were larger than 10 mm. Air pockets within the fluid collection also suggested the presence of an abscess. MRI findings were then correlated with the operative findings. Surgical findings were accepted as the gold standard and were recorded independently by the surgeon.

RESULTS

Out of the 26 patients included in the study group with age ranging from 20 to 67 years. MRI revealed fistulae

Table 4: MRI findings compared to surgical findings

Abnormality classifications	MRI findings	Surgical findings
Primary track		
Intersphincteric	10	9
Transsphincteric	9	9
Suprasphincteric	2	2
Extrasphincteric	0	0
Fistula detection total	21	20
Sinus track	5	6
Total (fistula+sinus)	26	26
Abscess	6	6
Horseshoe fistula	3	3

MRI: Magnetic resonance imaging

Table 5: Accuracy of MRI for detection of primary track, abscess, horseshoe fistula, and internal opening

MRI finding	Sensitivity	Specificity	PPV	NPV
Primary track	100 (20/20)	83.3 (5/6)	95.2 (20/21)	19.2 (5/26)
Fistula	83.3 (5/6)	100 (20/20)	100 (5/5)	95.2 (20/21)
Abscess	100 (6/6)	100 (6/6)	100 (6/6)	100 (6/6)
Horseshoe fistula	100 (3/3)	100 (3/3)	100 (3/3)	100 (3/3)

MRI: Magnetic resonance imaging, PPV: Positive predictive value, NPV: Negative predictive value

Table 6 : Comparison of sensitivity and specificity of our study with international literature

Study	Sensitivity	Specificity
Beckingham *et al.*[15]	97%	100%
Regina *et al.*[18]	100%	86%
Our study	100%	83.3%

in 21 (80.7%; 17 males and 4 females) patients while 5 (19.2%; 3 males and 2 females) patients had only perianal sinuses. Out of total 21 fistulae seen, 10 (47.6%) were intersphincteric, 9 (42.8%) were transsphincteric, and 2 (9.5%) were suprasphincteric. No extrasphincteric fistula noted (Graph 1). Out of these fistulae, 14 (66.6%) were simple, whereas 7 (33.3%) showed associated abscess formation, inflammation, and branching course. Grade 1 was the most frequent (47.6%) type of anorectal fistula. The most common location of the internal opening of the fistula was at 6 o'clock position.

The MRI findings were in accordance with surgical findings in 25 out of 26 patients regarding type and extent of fistula-in-ano. One intersphincteric fistula misdiagnosed on MRI proved to be a sinus (Table 4).

Statistical parameters showed that MRI has a sensitivity of 100% and specificity of 83.3% in determining type and extent of perianal fistula (Table 5).

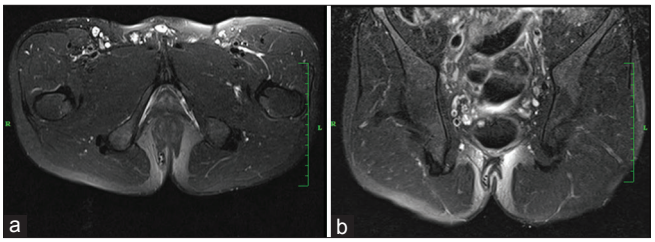


Figure 3: (a and b) T2-weighted FS axial and coronal: Inter-sphincteric fistula in ano with external opening at 7 o' clock position in right buttock and internal opening at 11 o' clock position of anal canal

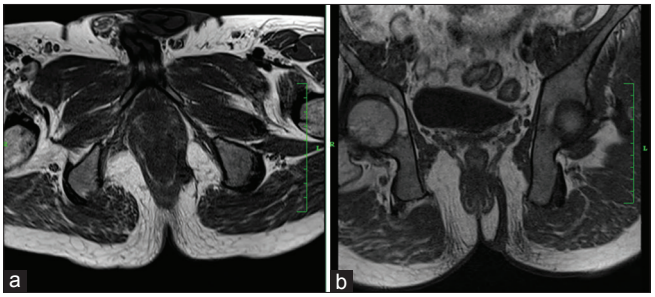


Figure 4: (a and b) T1-weighed axial and coronal: Trans-sphincteric fistula in ano with external opening at 5 o' clock position in left buttock and internal opening at 3 o' clock position of anal canal on the left side

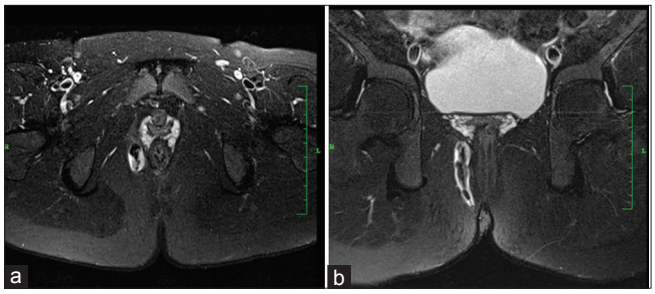


Figure 5: T2-weighted fat suppression axial and coronal: Suprasphinteric fistula in right buttock with external opening at 7 o' clock position and internal opening at 6 o' clock position

DISCUSSION

This is a retrospective comparative study between surgery and preoperative MRI, aiming to precisely evaluate the value of preoperative MRI examination. Until recently, imaging had very little role to play in the preoperative evaluation of perianal fistulas. The advent of MRI with its excellent soft tissue contrast and multiplanar capabilities makes it an ideal choice in the preoperative assessment of perianal fistulas. A detailed assessment of the anatomic relationship between the fistula and the anal sphincter complex allows surgeons to choose the best surgical treatment thus significantly reducing recurrence of the disease or possible secondary effects of surgery, such as fecal incontinence.[9,14,15]

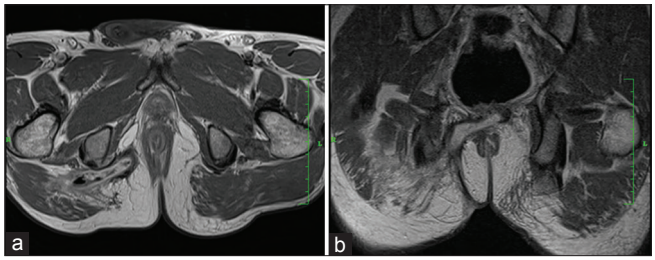


Figure 6: T1-weighted post-contrast axial and coronal: Trans-sphincteric Y shaped recto-cutaneous fistula with external opening at 7 o' clock position with right ischiorectal and gluteal abscess formation as described above

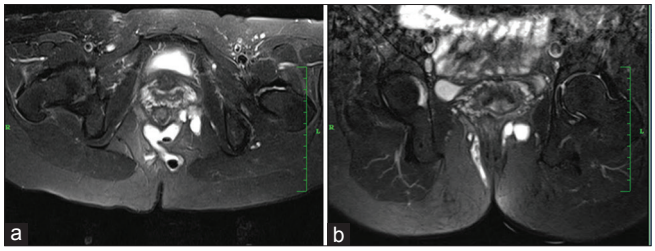
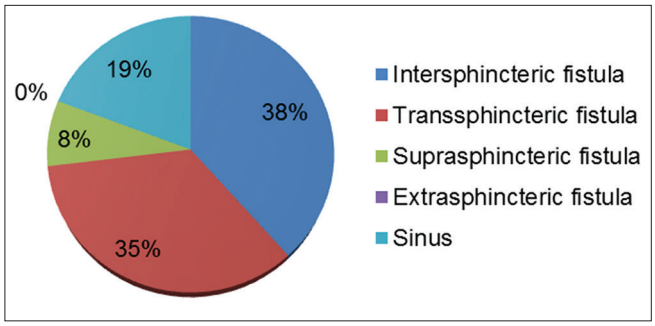


Figure 7: T2-weighted fat suppression axial and coronal: Perianal sinus track with external opening at 7 o' clock position in right buttock with horseshoe shaped abscess involving bilateral ischiorectal fossa



Graph 1: Magnetic resonance imaging findings

The results of our study indicate that MRI is highly accurate for determining the type and extent of perianal fistulae. Sensitivity of 90% and specificity of 100% seen in our study is comparable to international literature Tables 6.

MRI Appearance

T1-weighted (T1W) images give an excellent anatomic overview of the sphincter complex, levator plate, and ischiorectal fossa. Fistulous tracks, inflammation, and abscesses appear as areas of low to intermediate signal intensity on T1W imaging. T2-weighted (T2W) images provide good contrast between the high signal intensity fluid in the track and the low signal fibrous wall of the fistula and allow adequate differentiation of the boundaries of the internal and external anal sphincters. Active fistulous tracks and extensions have high signal intensity on T2W images, while the sphincters have low

signal intensity. Chronic fistulous tracks or scars appear hypointense on both T1W and T2W images. Abscesses appear hyperintense on T2W images due to the presence of pus and fluid in the center. Gadolinium-enhanced T1W images are useful to differentiate a fluid-filled track from an area of inflammation. The track wall enhances, whereas the central portion is hypointense. Abscesses are also very well depicted on post-gadolinium images.[16]

The exact location of the primary track (ischioanal or intersphincteric) is most easily visualized on axial images; the presence of disruption of the external anal sphincter differentiates a transsphincteric fistula from an intersphincteric one. The internal opening of the fistula is also best seen in this plane. As mentioned earlier, coronal images depict the levator plane, thereby allowing differentiation of supralevator from infralevator infection. In our experience, axial T2W fat-suppressed images were the most useful for locating the fistulous track (Figure 3-7).

CONCLUSION

Our study supports that, MR fistulography precisely demonstrate the anatomy of the perianal region, show the anal sphincter complex and clearly identify the relationship of fistulas to the pelvic diaphragm and ischiorectal fossa which has important implications for surgical management and outcome. Pre-operative MRI can help recognize the unidentified infection, accurate in the detection of the secondary extension and abscess formation and markedly decreasing the incidence of recurrence and allowing side effects such as fecal incontinence to be avoided.

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