ORIGINAL ARTICLE

MRI in the Diagnosis and Pre-operative Classification of Perianal and Anal Fistulas

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ABSTRACT

BACKGROUND: This study was conducted to assess the value of MRI in diagnosis and pre-operative staging of perianal and anal fistulas. **MATERIALS AND METHODS:** Patients with perianal local pain and discharge were evaluated by pelvic MRI without any bowel preparation. Type of the fistula, location of the internal opening, presence or absence of secondary tracts, abscesses and a horseshoe component and supralevator extension were assessed. Cohen's Kappa coefficient is used to analyze the agreement between MRI and surgical findings. Diagnostic standard of reference in all cases was the surgical findings. **RESULT:** Type of fistula was identified by using the St James's University Hospital classification in 44 subjects with a mean of 38.9 years. The commonest type of ano-rectal fistula encountered in the study was Grade 1 seen in 37.5%. MRI showed sensitivity and specificity of 100% and 50% respectively in detecting internal opening, 100% and 93.33% respectively in detecting abscesses, 100% and 89.47% respectively in depicting secondary tracks, 85.71% and 100% respectively in detection of simple non branching tracks. MRI was 100% sensitive and specific in detecting horseshoe abscess and supralevator extensions. The concordance with surgery was 89.1%. Our results show that MRI findings were in substantial agreement (Cohen's Kappa coefficient of 0.67) with surgical findings. **CONCLUSION:** MRI is a valuable tool in pre-operative evaluation of the perianal and anal fistulas. It provides high resolution images of the anatomy of the anorectal region with delicate depiction of the fistulous tracts with their associated secondary ramifications and abscesses.

Key words: Perianal and anal fistulas, Magnetic Resonance Imaging, St.James University Hospital Classification.

INTRODUCTION

A fistula is defined as an abnormal communication between two epithelium lined surfaces. Perianal and anal fistulas are abnormal connections between the epithelialised surface of the skin and anal canal and usually in continuity with one or more external openings in the perianal skin. The incidence of perianal fistula ranges from approximately 1–2 per 10,000 individuals with an approximate 2:1 male to female predominance. The maximum incidence is between the third and fifth decades of life.[1-3] Although many fistulas are easily recognized and treated, others can be complex and difficult to treat.

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Surgery is the definite treatment and is successful in most cases. For successful surgical management of anal fistulas accurate preoperative assessment is required.[4] Though imaging played a limited role in evaluation of these fistulas in the past, it is now recognized that imaging modalities, especially magnetic resonance (MR) imaging, play a crucial role. MR imaging allows identification of infected tracks and abscesses that would otherwise remain undetected. Furthermore, radiologists can provide detailed anatomic descriptions of the relationship between the fistula and the anal sphincter complex, thereby allowing surgeons to choose the best surgical treatment, significantly reducing recurrence of the disease or possible secondary effects of surgery, such as fecal incontinence.[5,6] The main objective in performing and interpreting any imaging study for p erianal fistulas are:

- To know the relationship of fistula to the sphincter muscles. Whether the sphincter

complex is involved, does the track traverse both layers of the sphincter (trans-sphincteric) or only the internal sphincter (intersphincteric).

- To identify any secondary tracks and abscess cavities. To identify "Horseshoe" tracks which pass circumferentially and may cross the midline.[7]

Role of Magnetic resonance imaging: MR imaging has emerged as the leading contender for preoperative classification of fistula in ano. It help to accurately classify tracts and also identify disease that otherwise would have been missed and had a palpable effect on surgical treatment and patient outcome.[8]

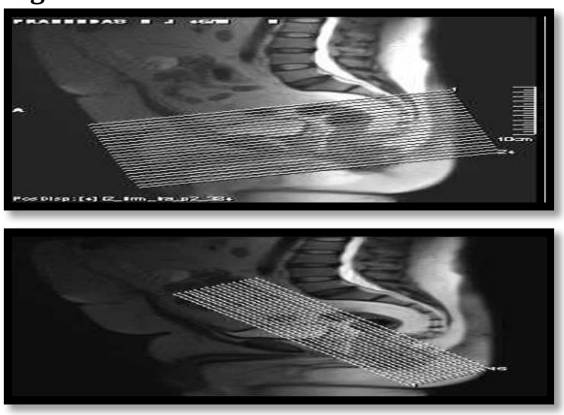
St. James University Hospital Classification: The St James's University Hospital classification was proposed by radiologists on the basis of imaging findings.[3] The classification grades fistulas into five groups: grade 1, simple linear intersphincteric fistula; grade 2, intersphincteric fistula with abscess or secondary track; grade 3, transsphincteric fistula; grade 4, transsphincteric fistula with abscess or secondary track in ischiorectal or ischioanal fossa; grade 5, supralevator and translevator fistula.

MATERIALS AND METHODS

This is a prospective study conducted in our institution. Study population was 44 patients and the study period was one year. All patients included in the study presented with pain and discharge in perianal region. They were evaluated by pelvic Magnetic Resonance imaging (1.5T) with a phase array coil without any bowel preparation. Evaluation of the individual risk is performed before the MRI examination by eliciting the history for various contraindications for MRI. Patients were placed in the supine position during image acquisition. The imaging volume was planned to incorporate the distal rectum and subcutaneous tissue with inclusion of the anal canal, the sphincter muscles, the ischio-rectal fossa, the levator muscle and the supralevator space.

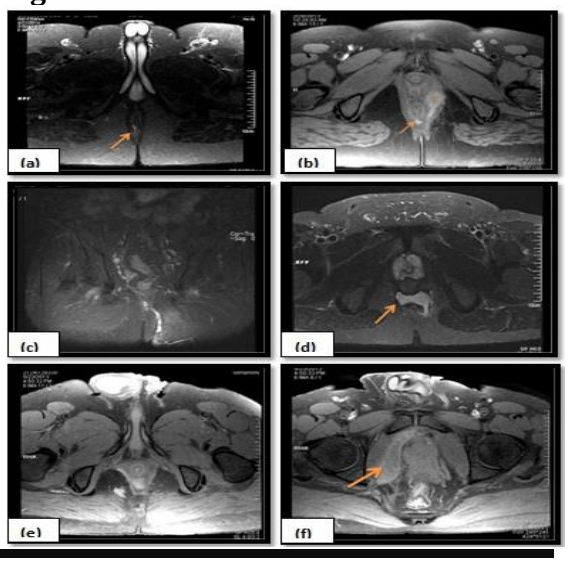
MRI protocol: The following MRI protocol was done for all patients - oblique coronal T1-weighted STIR (TE/TR 3600/54, FOV 28 cm, matrix 256 x 256), sagittal T1-weighted STIR (TE/TR 3600/54, FOV 28 cm, matrix 256 x 256), oblique axial T2-weighted FSE (TE/TR 5770/99, FOV 35 cm, matrix 256 x256), sagittal T2-weighted TSE (TE/TR 5770/99, FOV 35 cm, matrix 256 x256), oblique coronal T2-weighted FSE (TE/TR 5770/99, FOV 35 cm, matrix 256 x256), oblique axial T1-weighted FS (TE/TR 612/19, FOV 22cm, matrix 256 x 256), sagittal T1-weighted FS (TE/TR 612/19, FOV 22cm , matrix 256 x 256). The coronal plane runs parallel to the length of the anal canal and axial plane runs perpendicular to the length of anal canal which is visualized in the sagittal survey images [Fig.1].

Figure 1



Planning for axial and coronal MR imaging of the anal canal. Sagittal T2-weighted image through the midline is used to obtain images that are truly axial relative to the anal canal. Coronal MR imaging is performed at 90° relative to the axial plane to obtain images parallel to the long axis of the anal canal.

Figure 2



(a) STIR oblique axial MR image showing Grade 1 Intersphincteric fistula(arrow). (b) Oblique axial T1-weighted MR images with fat saturation showing Grade 2 Intersphincteric fistula with internal opening at 6 'o'clock location (arrow) and intersphincteric abscess(*). (c) STIR coronal MR images showing Grade 3 Trans-sphincteric fistula with internal opening at 6'o'clock location (arrow). (d) STIR oblique axial MR images showing Grade 4 Trans-sphincteric fistula with horseshoe abscess. (e,f) STIR oblique axial T1-weighted MR images with fat saturation showing Grade 5 supralevator fistula with abscess (arrow).

The target of MRI was to answer the decisive surgical questions prior to the surgical interference. Type of the fistula according to St. James University Hospital Classification, location of the internal opening, the presence or absence of secondary tracts, abscesses and horseshoe component were assessed.

Table 1: MRI Grades and Associated MRI Findings in Study Population

Ano-rectal fistula grading on MRI			Associated MRI findings				
			Fistulous tract		Horseshoe extension	Abscess	Supra-levator extension
Grade	No	%	Simple non branching	Branching fistulas			
Grade 1	12	29.3	12	0	0	0	0
Grade 2	6	14.6	4	2	1	5	0
Grade 3	8	19.5	8	0	0	0	0
Grade 4	10	24.4	2	8	2	6	0
Grade 5	5	12.2	1	4	1	4	5
Total	**41**	**100**	**27 (65.85%)**	**14 (34.15%)**	**4 (9.76%)**	**15 (36.59%)**	**5 (12.2%)**

Table 2: Comparision of Diagnostic Value of MRI Findings

	Sensitivity	Specificity	PPV	NPV	Kappa coefficient
Location of internal opening	100%	50%	86.96%	100%	0.59
Abscess	100%	93.33%	91.67%	100%	0.92
Horseshoe abscess	100%	100%	100%	100%	1
Secondary tracks	100%	89.47%	77.78%	100%	0.83
Simple non branching tracks	85.71%	100%	100%	85.71%	0.85
Supralevator extension	100%	100%	100%	100%	1

Table 3: Comparision of Perianal Fistula Grades at MRI with Those at Surgery

	At Surgery	At MRI
Grade 1	7 (27%)	6 (23%)
Grade 2	4 (15%)	5 (19%)
Grade 3	6 (23%)	5 (19%)
Grade 4	6 (23%)	7 (267%)
Grade 5	2 (8%)	2 (8%)
Perianal abscess	1 (4%)	1 (4%)
Total	26	26

Primary tract: High signal track on T2W and fat saturated images related to the sphincter complex in anal and perianal region was considered as primary tract and hyperintensity extending beyond the tract as adjacent inflammation. A fistula which remained contained by the external sphincter throughout its course was taken as intersphincteric, tract penetrating the external sphincter as transsphincteric, the one which extends upwards through the intersphincteric plane over the top of levator ani muscle as suprasphincteric and the track extending directly from its origin in the pelvis to the perineal skin through the ischiorectal and ischioanal fossae, with no involvement of the anal canal as Translevator.[8]

Internal opening: 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. Either the continuation of the primary tract itself into the anal mucosa or the radial site closest to the maximal inflammation found in the intersphincteric space was taken as the internal opening.[8]

Extensions: Complicated primary tracts with secondary tracts, 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 contra-lateral side. Fistulous tracts were differentiated from abscesses by using the criteria of Laniado et al.[9] in which fistulas were defined as being 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 abscess. Possible supralevator extension was documented.

External opening: location of external opening of the fistula if present on the skin is noted in all the cases using anal clock[8]

Grade of fistula: The type of the fistula was evaluated according to the St. James's University Hospital MRI classification system. MRI findings were then correlated with the surgical results in patients who underwent surgery in our institute.

Statistical methods: MRI findings and surgical findings were recorded on a predesigned proforma and managed using Microsoft Excel 2007 (Microsoft Corp, Redmond, WA). Free online software packages like Openepi and Medcalc were used for statistical analysis. Sensitivity, specificity, positive predictive value and negative predictive value of MRI in detecting internal opening, abscess, secondary tracks, supralevator extension are assessed. Cohen's Kappa coefficient is used to analyze the agreement between MRI and surgical findings. The diagnostic standard of reference in all cases was the surgical findings.

RESULTS

This work included 44 patients. Four (9.1%) patients had history of recurrent fistulas and 8 (18.2%) had undergone previous fistula surgery. Negative study for perianal fistula was seen in 3 patients, in whom MRI diagnosis was perianal abscess, perianal sinus and no perianal fistula respectively. Seventeen patients were absent on call, hence excluded from surgical correlation. Remaining 26 patients with surgically proven perianal fistulas were included for surgical correlation.

Out of 44 patients, thirty five were males, 9 were females with male to female ratio 4:1. The age ranged from 10 to 73 years with a mean age of 38.9 years. Most common age groups affected were 31 to 40 years comprising 31.8%. The commonest type of ano-rectal fistula encountered in our study was Grade 1 seen in 37.5%. Grade 2 fistulas are seen in 13.6%, Grade 3 in 18.2%, Grade 4 in 22.7% and Grade 5 in 11.4% of study population. No translevator fistula was encountered in our study. MRI showed sensitivity and specificity of 100% and 50% respectively in detecting internal opening, 100% and 93.33% respectively in detecting abscesses, 100% and 89.47% respectively in depicting secondary tracks, 85.71% and 100% respectively in detection of simple non branching tracks. MRI was 100% sensitive and specific in detecting horseshoe abscess and supralevator extensions. St. James's University hospital classification of perianal and anal fistulas correctly assessed fistulas in 23 (88.5%) patients. The concordance with surgery was 89.1%. Our results show that MRI findings were in substantial agreement (Cohen's Kappa coefficient of 0.67) with the surgical findings.

DISCUSSION

Preoperative imaging of perianal and anal fistulas with Magnetic Resonance Imaging is increasingly gaining popularity as it combines diagnostic capabilities of X- ray fistulography, endoanal sonography and computed tomography in a single examination.

The most widespread theory about the cause of perianal fistula is the cryptoglandular hypothesis[10], which states that perianal fistulas arise from anal canal glands. If these glands become blocked, stasis occurs and infection develops. The infection can pass the internal anal sphincter and progress into a fistula or abscess. It may pass through the external sphincter, forming a transsphincteric fistula, and enter the ischiorectal fossa, causing inflammatory changes and abscesses.[11] Most common location of external opening in our study population was 5 & 6 'o' clock location seen in 50% of the patients. External opening was not visualized in 2 of our patients. This may be due to early stage of fistula formation, thus supporting cryptoglandular hypothesis.[11]

In our study internal opening was demonstrated in MRI in 39 patients (88.7%) the common location being 6 'o'clock, seen in 18 (40.9%) patients. The next common location was 7 'o' clock seen in 8 (18.2%) patients. Out of 26 patients who underwent surgery, MRI showed agreement with surgical findings with respect to internal opening in 23 patients (88.5%). In the remaining 3 patients, internal opening was not found at

surgery. The accurate location of the internal opening can be sometimes difficult to recognize at surgery due to local anatomical conditions as it is usually narrow, small or intermittently closed. Demonstration of level of the internal opening at MRI is important since this will determine the extent of sphincter division during fistulotomy. Stoker et al.[12] stated that the internal opening was successfully depicted by T2WI and STIR images and were in agreement with the surgical findings.

All the 12 out of 26 patients who had simple tracks at MRI showed the same at surgery.

Two patients who showed branching tracks at MRI were actually simple track at surgery. Retrospective review of MRI showed that the adjacent inflammation was misinterpreted as secondary track. Two out of 9 patients in whom MRI showed secondary tracks did not agree with surgical findings. This false positive was due to confusion between neural and vascular elements within the ischio-anal fossa. False positive for secondary tracks may be due to following reasons. Fatty tissue may sometimes mimic a fistula track, though can be excluded with confidence on the fat saturated images.[13] Vascular structures, hemorrhoids, old nonactive fibrotic tissue in the perianal region may also stimulate a recurrent fistula at MRI. Imaging during symptomatic period helps to distinguish fibrous tissue from a recurrent or a longstanding active fistula. The greatest difficulty encountered in our study was identification of internal opening and active side tracks.

The agreement of internal opening and abscess extension between MRI findings and surgical findings were 88.5% (23/26) and 96.1% (25/26) respectively. 11 out of 12 patients in whom MRI showed abscess correlated with surgical findings. One patient in whom MRI showed abscess did not have abscess at surgery. This may be due to spontaneous discharge of abscess contents before surgery. Our study showed MRI has 100% sensitivity and specificity with respect to horseshoe abscesses and supralevator extension. Beets-Tan RG et al[14] also found similar result in their study in detecting horseshoe abscess and supralevator extension. They also stated that the largest additional value of MRI is its ability to detect horseshoe abscesses and supralevator disease.

In our study fourteen out of 26 patients had complex fistulas (Grade 3 ,4 and 5) in whom preoperative MRI was helpful in surgical planning. Also, MRI results were in substantial agreement (Cohen's Kappa coefficient - 0.67) with the surgical findings. Maccioni F et al[15] observed a high diagnostic accuracy of preoperative MRI in the evaluation of perianal fistulas with 90% concordance with surgery. Our study was in agreement with this, as there is 89.1% concordance with surgical findings.

The findings of our study seem to be in contrast with the findings of Stoker et al.[12] who found that preoperative MR imaging was of little use in the surgical treatment of peri-anal fistulas. This may be due to that study consisted more of Grade 1 and 2 fistulas. Most of the comparative studies between MRI and other imaging studies like endoanal sonography agreed that MRI is significantly superior.[13] A recently published paper[14] has demonstrated that the accuracy of endosonography, MRI and surgical exploration under anaesthesia was 91%, 87% and 91% respectively, and reached 100% if two of these methods were combined. A prospective study by Gordon N et al[15] summarized that MR imaging is the most accurate preoperative technique for classification of fistula in ano and performs best in the evaluation of the primary track and any extensions. Anal endosonography, although inferior to MR imaging, was always superior to clinical examination. Anal endosonography may be used when MR imaging is unavailable or expertise in its interpretation is lacking.

One of the limitations of our study was non use of contrast material which would have better differentiated secondary tracts from inflammation. Also usage of three dimensional MRI sequences and maximum intensity projection (MIP) would have given more accurate results.

Another limitation of the study was relatively small sample size. We recommend usage of contrast and three dimensional sequences on a larger study population in future work.

Hence, accurate preoperative classification and assessment of the perianal fistulous tract is the main target of the preoperative investigations aiming to eliminate the infection while preserving anal continence as well as reduction of the incidence of recurrence with determination of the surgery efficiency.

CONCLUSION

In summary, our results revealed that MRI is an essential useful tool in pre-operative evaluation of the perianal and anal fistulas. It provides high resolution images of the anatomy of the anorectal region with delicate depiction of the fistulous tracts with their associated secondary ramifications and abscesses.

Conflicts of interest: None.

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