Role of MRI in the Diagnosis and Pre-Operative Classification of Perianal and Anal Fistulas - A Cross-Sectional Study, Southern Rajasthan

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ABSTRACT

BACKGROUND

Perianal fistulas account for a substantial discomfort and morbidity to the patient thus affecting productive man hours and quality of life. Accurate pre-operative assessment of course of the primary fistulous track and secondary extension or abscesses is required for successful surgical management of anal fistulas. The purpose of this study was to diagnose and classify pre-operative perianal fistulas.

METHODS

This is a cross-sectional study at Department of Radiodiagnosis in a tertiary level hospital of southern Rajasthan from November 2018 to November 2020. The study included a total of 50 patients referred to department of radiology for magnetic resonance imaging (MRI). Statistical analysis was done using chi square test and student t test.

RESULTS

Out of these patients, 56 % were having secondary tract on MRI, 12 % patients were having abscess and 4 % were having horseshoe abscess on MRI. The commonest type of ano-rectal fistula encountered in the study was Grade -II seen in 32 %.

CONCLUSIONS

MRI is a highly accurate, rapid and non-invasive tool in pre-operative evaluation of the perianal and anal fistulas. MRI evaluation and classification of perianal fistulae has a high degree of diagnostic accuracy. The use of MRI for the diagnosis and classification of perianal fistula can provide reliable information which has both pre-operative and prognostic value. St James University Hospital classification, which is an MR imaging-based grading system for perianal fistula is very useful for effective radiological-surgical communication thus contributing to improved patient care and reduced rate of recurrence.

KEYWORDS

MR Fistulogram, Perianal Fistula, Anal Fistula, Fistula Classification, Fistulography

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BACKGROUND

A fistula is defined as an abnormal communication between two epithelium lined surfaces. Perianal and anal fistulas are abnormal connections between the epithelialized surface of the skin and anal canal and are usually in continuity with one or more external opening in the perianal skin.[1] 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 fourth decades of life.[2-4] Cryptoglandular hypothesis states that idiopathic fistulas are most likely to represent the chronic phase of intramuscular anal gland sepsis.[4]

Other causes of fistula include trauma during childbirth, tuberculosis, Crohn's disease, pelvic infection, pelvic malignancy, and radiation therapy. The definite treatment of perianal and anal fistulas is surgery. Though this is successful in most cases, it is also associated with a significant prevalence of recurrence.[5]

Perianal fistulas account for a substantial discomfort and morbidity to the patient thus affecting productive man hours and quality of life. Although many fistulas are easily recognized and treated, others can be complex and difficult to treat. For successful surgical management of anal fistulas, accurate pre-operative assessment of the course of the primary fistulous track and the site of any secondary extension or abscesses is required.[6]

Now a days, imaging techniques, notably magnetic resonance imaging plays a vital and diagnostic role in evaluation of perianal fistulas as compared to past when imaging techniques played a very limited role.

MRI is a highly accurate, rapid and non-invasive test in pre-operative evaluation of the anal fistulas. It provides high resolution anatomical details of the anorectal region with precise definition of the fistulous tracts, their associated secondary tracts, horseshoe extension and abscesses. MRI imaging is capable in identifying infected tracks and abscesses that would otherwise remain undetected and unclassified. Additionally, it allows surgeons to choose the best surgical approach because radiologists can provide comprehensive anatomic details of the relationship between the fistula and the anal sphincter complex. It reduces recurrence of the disease or possible secondary effects of surgery such as fecal incontinence.[7,8]

Aim

To assess the importance of MRI in the diagnosis and pre-operative staging of perianal fistulas as compared to intra-operative surgical findings.

Objectives

- To classify type of the fistula using Saint James University hospital classification based on MR imaging.
- To correlate the pre-operative MRI findings with clinical examination under anaesthesia and surgical findings to assess the validity of MRI as a diagnostic test for perianal and anal fistulas.

METHODS

This is a cross-sectional study at Department of Radiodiagnosis in a tertiary level hospital of southern Rajasthan from November 2018 to November 2020.

Sample Size

- $n = \frac{\left(Z\alpha_{/2} + Z_{1-\beta}\right)^2}{E^2} [\sigma]^2$
- $n = \frac{(1.96+0.8413)^2}{[0.10]^2} (0.25)^2 = 50$
- Thus, minimum sample size was 50.
- $\sigma = \pm 0.25$ (standard deviation)
- E = 10% (Absolute error)
- $Z\alpha_{/2} = 1.96$ at 95% confidence level and $Z_{1-\beta} = 0.8413$ at 80% power of study

Inclusion Criteria

The adult patients of both gender who were clinically suspected/clinically diagnosed to have anal or perianal fistulas.

Exclusion Criteria

1. Patients having history S/O and/or objective evidence of fistulas due to carcinoma of the rectum or previous radiation therapy and any history or evidence of congenital fistulas.
2. Patient who refused surgical interference.
3. Patients having history S/O and/or objective evidence contraindications for MRI (claustrophobia, pacemaker implant etc).

MRI Protocol

The applied MRI protocol was revised to make it compatible with the study requirements. All patients received no bowel preparation. MRI was performed using 1.5T body MRI system (Magnetom Avanto, Siemens, Germany) and a pelvic-phased-array coil. MRI protocol consisted of T2-weighted sequence which was obtained in the axial, coronal, and sagittal planes with TR/TE of 5600/95 ms, section thickness of 3 mm, interslice gap of 0.75 mm, matrix size of 256 × 100, field of view (FOV) of 210 × 210 mm, received bandwidth of 19 kHz, and scan time of 3 min and 49 s. A STIR-weighted sequence was also obtained in the three planes with TR/TE of 4410/33 ms, section thickness of 3 mm, interslice gap of 0.75 mm, matrix size of 320 × 332046, FOV of 210 × 210 mm, received bandwidth of 16 kHz, and scan time of 4 min and 30 s. A T1-weighted non-contrast-enhanced fat-suppressed sequence (T1/FS) was also obtained in axial, coronal, and sagittal planes with repetition time/echo time (TR/TE) of 650/13 ms, section thickness of 3 mm, interslice gap of 0.75 mm, matrix size of 256 × 100, field of view of 210 × 210 mm, received bandwidth of 15.5 kHz, and scan time of 4 min and 20 s.

Parameters Assessed

Type of Fistula

Hyperintense track on T2W and fat sat images related to the sphincter complex in anal and perianal region were considered as primary tract and hyper intensity extending beyond the tract as adjacent inflammation.[9,10]

Location of the Internal Opening

Using the anal clock with the 12 o' clock position located anterior and 6 o'clock position located posterior, the location of the internal openings was identified on axial images.

The Presence or Absence of Secondary Tracts, Abscesses and a Horseshoe Component

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 contralateral side.[11]

Fistulous tracts were differentiated from abscesses by using the criteria of Lunniss et al.[12] in which fistulas were defined as being fluid filled tubular structures with a diameter smaller than 10 mm and abscesses were larger than 10 mm.

Possible supralevator extension was documented. Location of external opening of the fistula if present on the skin will be noted in all the cases. The type of fistula was evaluated according to the St. James's University Hospital MRI classification system.

Surgical Management

- The nature of the primary fistula and any secondary fistulous tracks or associated abscesses decides the surgical management of perianal fistulas.
- The surgeon performs a fistulotomy or fistulectomy, for simple intersphincteric fistulas, in which the internal sphincter is divided to lay open the track.[13,14] On the other hand, the surgeon performs a simple incision and drainage first in patients with perianal abscess.
- Fortunately, majority of fistulas are of this type. More complex diseases can be treated with several different approaches.
- The treatment strategies aim to preserve the integrity of the external sphincter as preservation of fecal continence is of utmost importance.

St. James's University Hospital Classification of Peri-Anal Fistula

- This system is easy to use because it utilizes axial anatomic landmarks familiar to radiologists.
- Grade 1: Simple linear intersphincteric fistula — In a simple linear intersphincteric fistula, the fistulous track extends from the skin of the perineum or natal cleft to the anal canal, and the ischiorectal and ischioanal fossae are clear.[4]
- Grade 2: Intersphincteric fistula with abscess or secondary track — Intersphincteric fistulas with an abscess or secondary track are also bounded by the external sphincter. Secondary fistulous tracks may be of the horseshoe type, crossing the midline or they may ramify in the ipsilateral intersphincteric plane.[4]
- Grade 3: Trans-sphincteric fistula — Trans-sphincteric fistula pierces through both layers of the sphincter complex and then arcs down to the skin through the ischiorectal and ischioanal fossae.[4]
- Grade 4: Trans-sphincteric fistula with abscess or secondary track within the ischiorectal fossa - A trans-sphincteric fistula can be complicated by sepsis in the ischiorectal or ischioanal fossa[15]
- Grade 5: Supralevator and translevator disease - In rare cases, perianal fistulous disease extends above the insertion of the levator ani muscle.[4]

Statistical Analysis

MRI findings and surgical findings were recorded on a pre-designed performa and were managed using Microsoft Excel. OpenEpi and MedCalc online software packages were used for statistical analysis. Sensitivity, specificity, positive and negative predictive values of MRI in diagnosing perianal fistula, its anatomical location on anal clock, abscess, secondary tracks and supralevator extension were assessed. To evaluate the agreement between MRI and surgical findings, Cohen's Kappa coefficient was used. Surgical findings were the diagnostic standard of reference in all cases.

RESULTS

We studied 50 patients of fistula in ano, age ranging from 11 - 70 years. Mean age was 39.20 ± 11.32. 16 % were female and 84 % were male.

Clinical Diagnosis of Study Population

Out of these patients, 56 % were having secondary tract on MRI, 12 % patients were having abscess and 4 % were having horseshoe abscess on MRI. Six percent patients were having supralevator extension. External opening was visualised in 86 % patients in MRI.

Internal Opening was Visualised in 92 % of Patients in MRI

Secondary tract was found in 48 % patients during surgery. Abscess was found in 10 % patients during surgery. Horseshoe abscess was found in 4 % patients during surgery. Supralevator extension was seen in 6 % patients during surgery. Internal opening was visualised in 62 % patients at surgery.

Diagnosis / Grade on MRI	%
Abscess	2.0 %
Fistula in ano grade 1	30.0 %
Fistula in ano grade 2	32.0 %
Fistula in ano grade 3	18.0 %
Fistula in ano grade 4	6.0 %
Fistula in ano grade 5	6.0 %
Sinuses	6.0 %

Table 1. Gradings of Perianal Fistula

Secondary Tract on MRI		Secondary Tract at Surgery	
No	22	No	26
Yes	28	Yes	24
Abscess on MRI		**Abscess at Surgery**	
No	44	No	45
Yes	6	Yes	5
Horseshoe Abscess Given at MRI		**Horseshoe Abscess Given at Surgery**	
No	48	No	48
Yes	2	Yes	2
Supralevator Extension on MRI		**Supralevator Extension at Surgery**	
No	47	No	47
Yes	3	Yes	3

Table 2. Correlation between MRI and Surgical Findings

Figure 1. Grade 1 Fistula in Ano

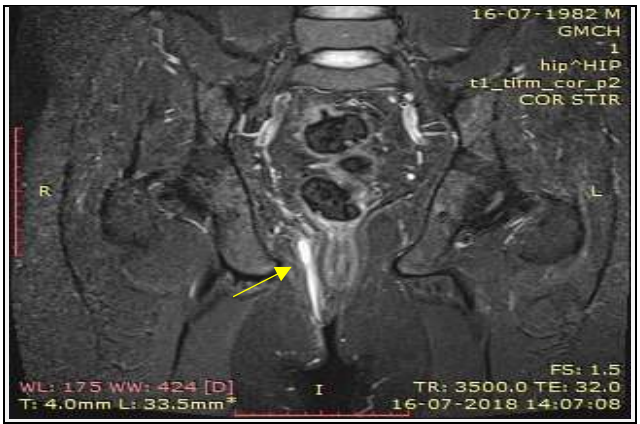

Figure 2. Grade 3 Fistula in Ano

MRI and Surgical Correlation for Secondary Tracks

For secondary tracts MRI shows sensitivity of 100 %, specificity of 84.6 %, positive predictive value of 85.7 %, negative predictive value of 100 % and accuracy of 92 %

MRI and Surgical Correlation for Abscess

For abscess, MRI shows sensitivity of 100 %, specificity of 97.8 %, positive predictive value of 83.3 %, negative predictive value of 100 % and accuracy of 98 %

MRI and Surgical Correlation for Horseshoe Abscess

For horseshoe abscess, MRI shows sensitivity of 100 %, specificity of 100 %, positive predictive value of 100 %, negative predictive value of 100 % and accuracy of 100 %.

MRI and Surgical Correlation for Supralevator Extension

For supralevator extension, MRI shows sensitivity of 100 %, specificity of 100 %, positive predictive value of 100 %, negative predictive value of 100 % and accuracy of 100 %.

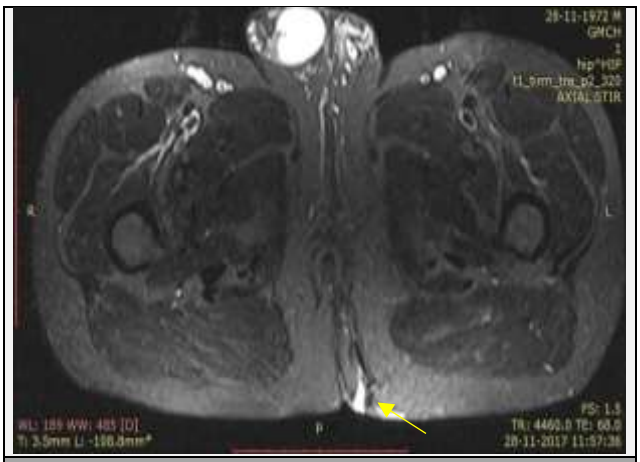

Figure 3. Grade 4 Fistula in Ano

Figure 4. Grade 5 Fistula in Ano [Supralevator Extension]

DISCUSSION

Pre-operative imaging of perianal and anal fistulas with magnetic resonance imaging is increasingly gaining popularity as it combines capabilities of X ray fistulography, endo-anal sonography and computed tomography in a single examination.[16]

In our study, 42 patients were males and 8 were females and their age ranged from 11 to 70 years with a mean value of 39.20 years. This was in agreement with Halligan et al.[17] who stated that the disease predominantly strikes young adults and men are more commonly affected. The average was 28 years in a study by H AI P Baddar,[18] the oldest was 42 years while the youngest was 10 years old.

Most of our patients presented with a complaint of pain and discharge in perianal region and most common clinical diagnosis was primary fistula in ano in 34 %. Mullen et al.[19] who studied the indications and contribution of MR imaging of fistula in ano to surgical assessment in 40 patients had perianal sepsis in 50 % of their study group.

7 out of 50 patients had undergone previous fistula surgery and had presented with recurrence. Khera et al.[20] in their retrospective study in 43 patients found recurrent perianal fistula in 3 patients and 8 patients had recurrence after previous fistula surgery.

The most common type of ano-rectal fistula seen in the study was Grade - II fistula seen in 32 %. Grade-I fistulas were seen in 30 %. 2 % patients had perianal abscess and 6% had perianal sinus. In a study done to evaluate the role of MRI in preoperative assessment of ano-rectal fistula in 24 patients, Rania E et al[21] have found 37.5 % Grade 1 fistulas, 12.5 % Grade 2 fistulas, 12.5 % Grade 3 fistulas, 20.8 % Grade 4 fistulas and 16.7 % Grade 5 fistulas. Grade 1 was the commonest type recognized in 9 patients. H AI P Badder[18] studied MRI findings in 50 patients with clinical evidence of anal fistulas and detected 30 % Grade 1 fistulas, 38 % Grade 2 fistulas, 10 % Grade 3 fistulas, 10 % Grade 4 fistulas and 12 % Grade 5 fistulas. Grade 2 was the commonest type followed by Grade 1 fistulas. In a prospective study by Naglaa D et al.[22] in 25 patients with perianal sepsis, 3 (12 %) were Grade 1, 2 (8 %) were Grade 2, 9 (36 %) cases were of Grade 3, 9 (36 %) cases were of Grade 4 and 2 (8 %) were of Grade 5.

External opening was not visualized in 8 patients. This may be due to early stage of fistula formation, thus supporting crypto-glandular hypothesis.[4] 5 & 6 o'clock location were the most common location of external opening in our study population and seen in 28 % and 22 % of the patients respectively.

In our study, internal opening was demonstrated in MRI in 46 patients (92 %). 7o'clock was commonest location of internal opening found in our study and was seen in 13 (26 %) patients. The next common location was 6 o'clock seen in 11 (22 %) patients. Rania E et al.[21] in their study found 6 o'clock location of internal opening as most common and was seen in 50 % of study group.

MRI showed agreement with surgical findings with respect to internal opening in 31 out of 36 patients (62 %) who had undergone surgery. In the remaining 5 patients, internal opening was not found at surgery. Sometimes, the accurate location of the internal opening can be difficult to recognize at surgery due to local anatomical conditions as it is usually narrow, small or intermittently closed. The sensitivity, specificity, positive predictive value and negative predictive value of MRI in detecting internal opening were 100 %, 80 %, 96 % and 100 % respectively. Beets-Tan RG et al.[23] found that MR imaging is 96 % sensitive, 90 % specific with 90% positive predictive value and 96 % negative predictive value in detecting internal opening.

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.[24] stated that the internal opening was successfully depicted by T2WI and STIR images and were in agreement with the surgical findings.

In our study, patients who had perianal fistulas, secondary tracks in 28 (56 %) patients, abscess in 6 patients (12 %), horseshoe abscess in 2 patients (4 %) and supralevator extension in 3 patients (6 %). In Rania E et al.[24] study, simple non branching tracks were observed in 79.2 % patients, secondary tracks in 20.8 % patients, abscess in 20.8 %, and horseshoe abscess in 16.4 % and supralevator extension in 20.8 % patients.

4 out of 28 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. Sensitivity and specificity of MRI in detecting secondary tracks is 100 % and 84.6 % respectively with 85.7 % positive predictive value and 100 % negative predictive value.

5 out of 6 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 content before surgery.

Hence, sensitivity and specificity of MRI in detecting abscess is 100 % and 97.8 % respectively with 83.3 % positive predictive value and 100 % negative predictive value. Beets –Tan RG et al.[23] in their study found that MR imaging is 96 % sensitive, 97 % specific with 89 % positive predictive value and 99 % negative predictive value in detecting abscess. Villa C et al.[25] in their study stated that MRI is 96 % sensitive and 97 % specific for depiction of abscess.

Our study showed MRI has 100 % sensitivity and specificity with respect to horseshoe abscesses and supralevator extension. Beets-Tan RG et al.[23] also found similar result in their study in detecting horseshoe abscesses and supralevator extension. They also stated that the greatest additional value of MRI is its ability to detect horse shoe abscesses and supralevator extension.

Most of the comparative studies between MRI and other imaging studies like endoanal sonography agreed that MRI is significantly superior.[26] A recently published paper[27,28] has demonstrated that the accuracy of endosonography, MRI and surgical exploration was 91 %, 87 % and 91 % respectively and reached up to 100 % if two of these modalities were combined.

A prospective study by Gordon N et al.[29] summarized that MR imaging is the most accurate pre-operative technique for classification of fistula in ano and performs best in the evaluation of the primary track and any secondary extension. Anal endosonography, although inferior to MR findings, was always superior to clinical examination.

Darius W et al.[30] concluded that MRI is accurate in assessment of the perianal fistulous tracts in soft tissue and thus recommended it as diagnostic method of choice which should be improved and applied more commonly in this pathology.

CONCLUSIONS

Perianal fistula is a clinical condition associated with significant patient morbidity. Recurrence rates and the risk of faecal incontinence are important considerations in management.

MRI is a highly precise, rapid and non-invasive test in pre-operative evaluation of the perianal fistulas. It provides high

resolution anatomical details of the anorectal region with precise definition of the fistulous tracts, their associated secondary tracts and abscesses.

MR imaging allows identification of infected tracks and abscesses that would otherwise remain undetected and unclassified. Additionally, it allows surgeons to choose the best surgical approach because radiologists can provide comprehensive anatomic details of the relationship between the fistula and the anal sphincter complex.

Also, MRI evaluation and classification of perianal fistulae has high degree of diagnostic accuracy. The use of MRI for the diagnosis and classification of perianal fistula can provide reliable information which has both pre-operative and prognostic value. St James University Hospital classification, which is an MR imaging-based grading system for perianal fistula is very useful for effective radiological-surgical communication thus contributing to improved patient care.

The largest additional value of MR imaging is in assessing complex fistulas where the radiologist can alert the refereeing physician about supralevator and translevator extension that may require expert surgical management.

In recurrent fistula in ano, pre-operative MRI has a therapeutic impact with decreased recurrence rates.

Overall, MRI can be identified as the modality of choice for pre-operative evaluation of patients with perianal fistula.

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