**ORIGINAL RESEARCH**

# Role of MR fistulogram in preoperative assessment of anorectal fistulas and its correlation with intraoperative findings

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**Abstract**
**Introduction –** Accurate preoperative assessment of the perianal fistulous tract is the main purpose of the diagnostics and to a large extend determines surgery effectiveness. One of the useful diagnostic methods in perianal fistulas is magnetic resonance imaging. The present study was conducted with an aim to correlate MRI findings with intra operative findings in assessment of patients with anorectal fistulas.
**Material and methods-** The prospective study was conducted 60 among patients of perinatal fistula who visited to department of surgery and was referred to department of Radiodiagnosis, St. Stephen's Hospital, Delhi during the study duration of one year. Demographic and clinical characteristics of patients were noted and results were analyzed using SPSS version25.0.
**Results –** The age group of the patients included in the study ranged from 20 to 70 years. 39 patients were males (65%) and 21 patients were females (35%). The most prevalent type of fistula was intersphincteric type which was seen in 32 of the patients (53.33%). Contrast enhancement was present in 46.67% of patients. Grade I fistulas were the commonest which was seen in 20 patients (33.33%). The sensitivity and specificity of MRI for grade I and II fistulas were in the order of100%, 91.66% and 78.94%, 100% respectively. For the other grades, the sensitivity and specificity were 100% and 100%.
**Conclusion –** Due to its accuracy in the assessment of the perianal fistulous tracts in soft tissues, MRI fistulography becomes a useful and recommended diagnostic method in this pathology. It shows the location of the fistula regarding the system of anal sphincters, and identifies the internal orifice and branching of the fistula. It enables precise planning of surgical treatment. Authors suggest that this diagnostic method should be improved and applied more commonly.

**Introduction**
A perianal fistula is an abnormal connection between the epithelised surface of the anal canal and the skin.(1) Fistulisation is the result of a chronic inflammation of the perianal tissues . (2) Perianal fistulas have a prevalence of approximately 0.01% and affect young adults predominantly, with a male-to-female ratio of approximately 1.8:1 (3 ).

The most common cause of perianal fistulas is infection of the anal glands and crypts. The disease usually begins as an abscess and in chronic stages develops into a fistula in 60% of cases (4) .Other causes are Crohn's disease, previous surgery, tuberculosis, trauma during childbirth, radiation therapy or pelvic malignancy (5). Parks classification describes perianal fistulas in the coronal plane according to the course of the fistula and its relationships to the internal and external sphincters(6) .

Radiologists have developed a MR imaging–based grading system for perianal fistulae. It consists of five grades and relates the Parks surgical classification to anatomy seen at MR imaging in both axial and coronal planes .It deals with the demonstration of the primary fistulous track along with secondary ramifications and associated abscesses. This grading system is known as St James's University Hospital Classification (7).

 Initially contrast enhanced fistulography was used to evaluate the fistula but correct diagnosis were achieved in only 16% of the patients demonstrating that this approach was inaccurate and unreliable (8). The assessment of secondary extensions and relationship of fistula with the sphincters, both of which are important pre-operative details, is not possible with this technique.

 Computed tomography (CT) with rectal and intravenous contrast material can be used to analyse anal fistulas, particularly those in the rectal area. While useful for evaluation of perirectal inflammatory disease and suspected perirectal abscesses, CT usually fails to define subtle fistulas and abscesses owing to poor resolution of soft tissue (9)

Magnetic resonance imaging (MRI) has emerged as an important imaging modality in the management of perianal fistulas. MRI with its superior contrast resolution and multiplanar capability provides excellent anatomical detail and relations of the fistulous tract with the sphincter complex, levator ani and ischioanal fossa (10,11) .It also allows accurate assessment of associated abscesses and secondary tracks thus alerting the surgeon about the complex nature of the disease and providing an excellent road map prior to surgery. This is very important to ensure that chances of recurrence are less (12-15) .

Hence the present study was conducted with an aim to correlate MRI findings with intra operative findings in assessment of patients with anorectal fistulas. The primary objective was to identify the extent and nature of disease by visualising fistulous tracks, internal openings and the relationship of perianal fistulas with anal sphincter complex and secondary objective was to grade the fistulas according to St. James University Hospital Classification.

## Material and methods

The prospective study was conducted among patients of perinatal fistula who visited to department of surgery and was referred to department of Radiodiagnosis, St. Stephen's Hospital, Delhi during the study duration of one year. Ethical permission was taken from institutional ethical committee before commencement of study. Patients were asked to sign an informed consent form after explaining them the complete procedure of study.

60 adult patients , irrespective of gender ,and clinically suspected of having perianal fistula were choose through consecutive sampling on the basis of  following inclusion and exclusion criteria.

## Inclusion Criteria

• The study included patients presenting with acute or chronic perianal fistulas, perianal sepsis, perianal abscess and external opening with discharge.
• Patients of all age groups and both sexes.

## Exclusion Criteria

• Patient having history of claustrophobia.

- Patient having history of metallic implants insertion, cardiac pacemakers (non titanium), implanted electrodes and metallic foreign body in situ

An adequate history with regard to dietary habits, constipation, tuberculosis, inflammatory bowel disease (Crohn's disease), traumatic child birth and pelvic malignancy was elicited. A focused clinical examination and number and location of cutaneous opening/s were documented. Relevant laboratory investigations of every patient were done prior to MR fistulogram . A brief account of the procedure was explained to the patients with emphasis on reassuring them prior to the procedure. Informed and written consent was taken from the patients. Subsequently the patients were screened before entry into scanning room for ferromagnetic objects, pacemaker and aneurysm clips etc. Then patients were taken up for MRI scan. All the cases did undergo MRI scan for perianal fistulas using using GE Optima 360 1.5 Tesla MRI Machine with phased-array external coils in a supine position .Post contrast studies using gadolinium based IV contrast agent with a dosage of 0.1mmol/kg body weight was administered by manual injection in all the patients. The most appropriate protocol used at our institution for evaluation of perianal fistulas consists of the following sequences: oblique axial T1-weighted FSE, oblique axial T2-weighted FSE, and oblique axial and oblique coronal fat-suppressed T1-weighted FSE with gadolinium-based contrast material, oriented perpendicular or parallel (in the case of the latter) to the long axis of the anal canal.

**Parameters of Pulse Sequences**

| Parameters | T2W FSE | T1W FSE | T2W FSE | FS T1W FSE | FS T1W FSE |
|---|---|---|---|---|---|
| Imaging plane | Sagittal | Oblique axial | Oblique axial | Oblique axial | Oblique coronal |
| TR/TE (msec) | 4500/110 | 450/12 | 4500/110 | 450/12 | 450/12 |
| FOV (cm) | 29 × 29 | 26 × 26 | 26 × 26 | 26 × 26 | 24 × 24 |
| Section thickness (mm) | 2.5 | 4.0 | 4.0 | 4.0 | 4.0 |
| Intersection gap (mm) | 0 | 0.8 | 0.8 | 0.8 | 0.8 |
| Matrix | 320 × 256 | 384 × 224 | 320 × 256 | 384 × 224 | 512 × 224 |
| NSA | 2 | 2 | 4 | 2 | 2 |

**The perianal fistula was assessed with regard to:**
- Location (plane) of track
- Length of track
- Ramifications/secondary tracks
- Abscess formation
- Site of enteric communication and cutaneous opening
- Enhancement
- Suprasphincteric extension
- Classification and the accuracy of MRI findings was correlated with intra operative findings

The recorded finding were entered in Microsoft excel and results were analyzed using SPSS version 25.0 keeping level of significance at $p < 0.05$. The data was in the form of frequency (5) and mean± SD. The values were compared using chi square test and t test.

**Results**

A total of 60 patients who were sent for MRI fistulogram to St.Stephen's Hospital were studied with gadolinium enhanced MR fistulogram. They were followed upto surgery and the

operative findings were correlated with the the preoperative MRI findings. The age group of the patients included in the study ranged from20 to 70 years. 7 patients were below 30 years of age(11.68%). 20 patients were in the age group of 31- 40 years (33.33%). 19 patients were in the age group of 41- 50 years (31.66%).8 patients were in the age group of 51- 60 years (13.33%). There were 6 patients aged more than 60 years (10%). 39 patients were males (65%) and 21 patients were females (35%). The most prevalent type of fistula was intersphincteric type which was seen in 32 of the patients (53.33%). Trans sphincteric type of fistulawas seen in 23 patients(38.34%) and extra sphincteric type of fistula was seen in 5 patients(8.33%). The fistulous tracts were observed, a majority of the patients (52 out of 60) had a single external opening (86.67%). Multiple external openings were seen in 8 patients (13.33%). Most commonly the opening was located between 4'o clock and 6'o clock positions. The next common location was7 to 9'o clock position which was found in 10 patients. When analysing the internal opening, it was single in 85% of patients (51 out of 60) and multiple in about 6 patients (10%) (table 5, figure 5). Most commonly, the internal opening was found in 6'o clock position in 13 patients (26%).The operative findings were correlating well with the study with regard to the site of the openings as shown in table 1.

**Table 1 Demographic and clinical characteristics of patient**

| Variable | | Frequency (%) |
|---|---|---|
| Age (years) | <30 | 7 (11.6) |
| | 31-40 | 20 (33.3) |
| | 41-50 | 19 (31.6) |
| | 51-60 | 8 (13.3) |
| | >60 | 6 (10) |
| Gender | MALE | 39 (65) |
| | FEMALE | 21 (35) |
| Type of fistula | INTERSPHINCTERIC | 32 (53.3) |
| | TRANS SPHINCTERIC | 23 (38.3) |
| | EXTRA SPHINCTERIC | 5 (8.3) |
| External opening | SINGLE | 52 (86.6) |
| | MULTIPLE | 8 (13.4) |
| Single External opening | 1-3 o'clock | 6 (11.5) |
| | 4-6o'clock | 30 (57.7) |
| | 7-9o'clock | 10 (19.3) |
| | 10 -12 o'clock | 6 (11.5) |
| Internal opening | SINGLE | 51 (85) |
| | MULTIPLE | 6 (10) |
| | OTHERS | 3 (5) |
| Single internal opening | 1°-3° | 13 (24) |
| | 4° -6° | 22 (8) |
| | 7°-9° | 12 (10) |
| | 10°-12° | 4 (26) |

In our study, 16 out of total 60 patients had secondary tracts according to MRI finding and 20 patients had secondary track according to surgical finding. The abscess was present in 11 subjects both according to MRI and surgical findings as shown in table 2.

**Table 2 Clinical characteristics of patients on the basis of MRI finding and Surgery**

| Secondary track | No of patients Based on MRI findings | No of patients based on surgical findings | MRI-surgery concordance |
|---|---|---|---|
| PRESENT | 16 | 20 | Sensitivity-80% |
| ABSENT | 44 | 40 | Specificity-100% |
| **Abscess** | **Number Of Patients based on MRI** | **Number Of Patients based on Surgery** | **MRI-surgery concordance** |
| Present | 11 | 11 | Sensitivity-100% |
| Absent | 49 | 49 | Specificity-100% |

Contrast enhancement was present in 46.67% of patients whereas it was absent in 53.33% of patients as shown in figure 1

**Figure 1 Distribution of patients on the basis of contrast enhancement**
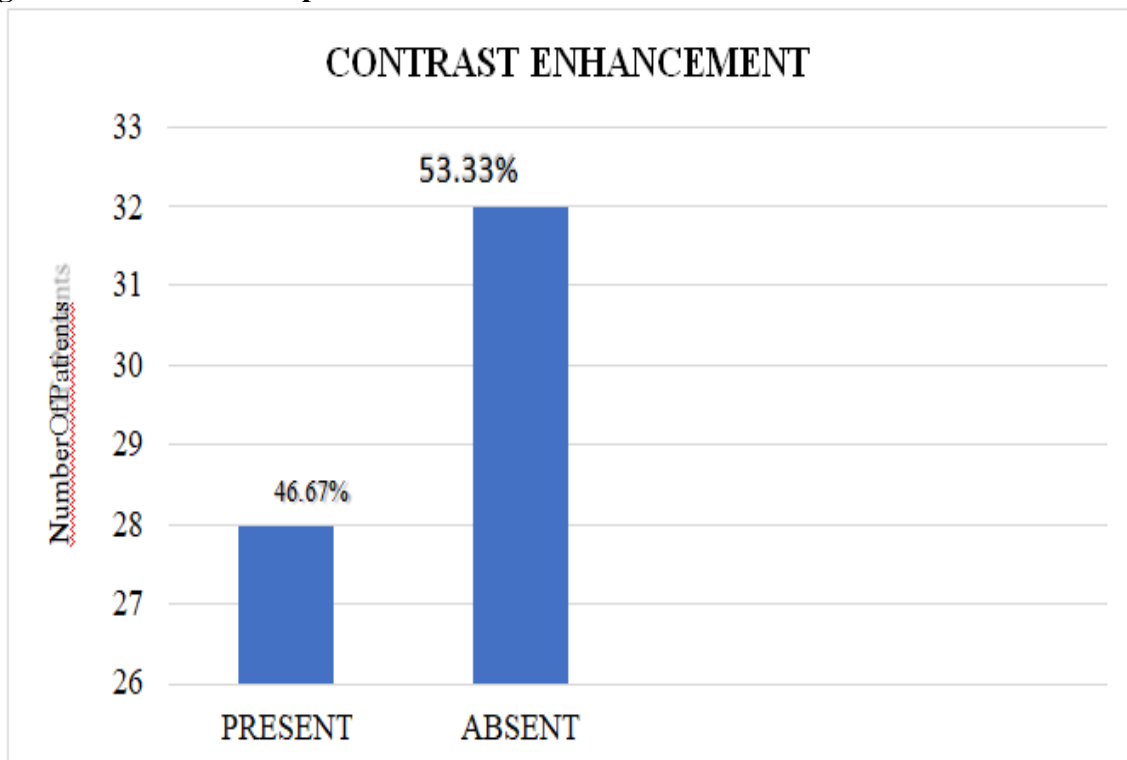


Grade I fistulas were the commonest which was seen in 20 patients (33.33%). The second most common type are the Grade III fistulas which are found in 16 patients (26.66%). Grade II fistulas were found in 11 patients (18.33%). Grade IV and grade V fistulas are relatively uncommon and were found in 8 patients (13.33%) and 5 patients (8.35%) respectively as shown in figure 2.

**Figure 2 Distribution of patients on the basis of St. James hospital grading**
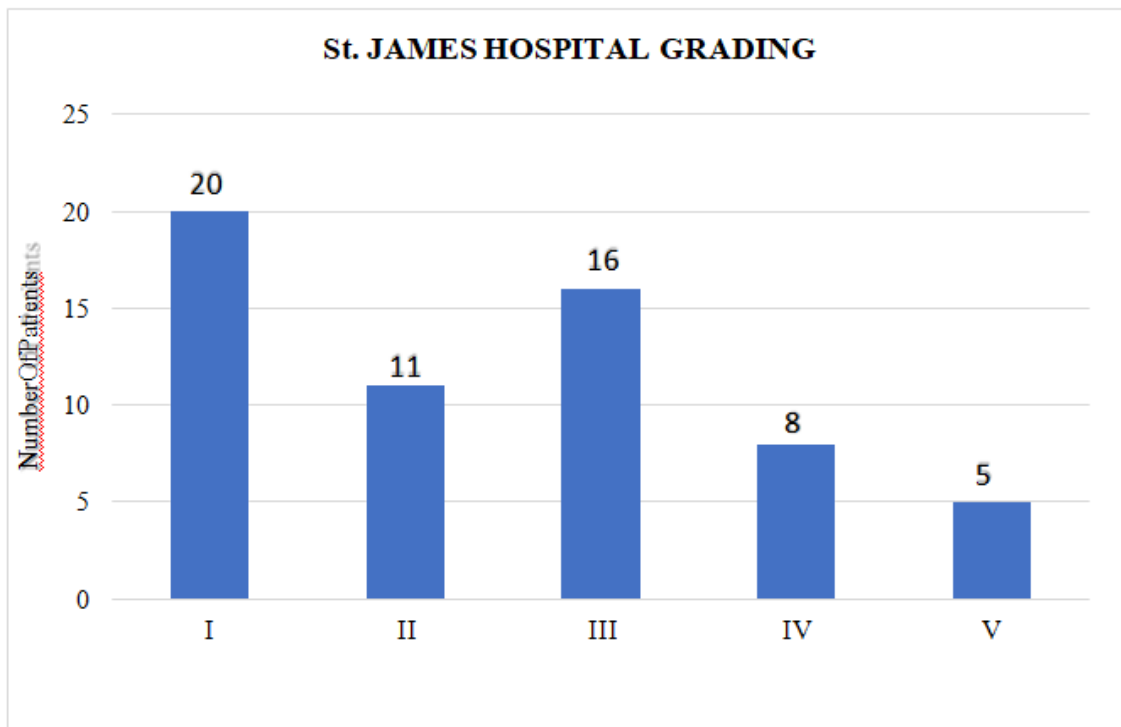


In patients who underwent surgery, the per operative findings correlated well with the MRI findings for grades III to V. Correlation between the surgical and MRI findings was significant in our study with a "p value"of 0.008 as shown in table 3.

**Table 3 Correlation of patients through surgery**

| Correlation in Surgery | Frequency (%) | P value |
|---|---|---|
| DONE | 52 (86.65) | 0.008 |
| NOT DONE | 3 (5) | |
| OTHER | 5 (8.35) | |

The correlation between MRI finding and operative findings for different Grades as per the St James's University Hospital MRI grading was different. The correlative value was tebest for the fistulas of grades III, IV and V. It was noted that 16patients has Grade III fistulas, 8 patients had Grade IV fistulas and 5 patients had Grade V fistulas. It was noted that only 16 out of 20 patients who were labelled as Grade I fistula on MRI had this type of fistula. The remaining 4 patients belonged to grade II based on the per operative finding. All the 4 patients had secondary tracts as an additional per operative finding which changes the grading to Grade II. The sensitivity and specificity of MRI for grade I and II fistulas were in the order of100%, 91.66% and 78.94%, 100% respectively. For the other grades, the sensitivity and specificity were 100% and 100%. MRI is a very effective in imaging primary tracts of inter-sphincteric fistulas but can miss some of the secondary tracts which contributes to reduced sensitivity for MRI in grade II fistulas as shown in table 4.

**Table 4 Distribution of patients on the basis of MRI Grading and Surgical Concordance**

| St James grade category | No of patients graded as per MRI | No of patients with concordant surgical findings | No of patients not operated | MRI-surgical concordance |
|---|---|---|---|---|
| I | 20 | 15 (4 patients preoperatively categorized as grade II) | 1 | Sensitivity-100% Specificity-91.66% |
| II | 11 | 11 | - | Sensitivity-100% Specificity-100% |
| III | 16 | 15 | 1 | Sensitivity-100% Specificity-100% |
| IV | 8 | 8 | - | Sensitivity-100% Specificity-100% |
| V | 5 | 4 | 1 | Sensitivity-100% Specificity-100% |

**Discussion**

Perianal fistulas constitute a heterogenic group of pathologies of the terminal part of the gastrointestinal tract and perineal area, jointly termed as anorectal malformations (16). These are canals filled with granulation tissue and surrounded by thick fibrous tissue. Most of the fistulas are of glandular origin – cryptogenic – and a relatively straight, slightly elliptical tract starting in the perianal area, with the internal orifice in the anal canal, at the level of the crypt. Very rarely fistulas develop in the course of colitis ulcerosa, Leśniowski-Crohn disease, or tuberculosis. The portals of infection may include anal fissure, postoperative wounds, anal injuries, and neoplasms of that area. Their course and natural history are frequently untypical. The main role in pathophysiology of fistula formation is played by the location and the number of perianal glands specific for that region, as well as the direction in which the infection spreads along anatomical planes (17,18).

The present study was conducted among 60 patients who were referred for MRI fistulogram were studied with gadolinium enhanced MR fistulogram. The fistulas were divided into different Grades according to the St. James University Hospital Classification and correlations with different parameters were established. They were followed up to surgery and the operative findings were correlated with the preoperative MRI findings.

The age group of the patients included in the study ranged from 20 to70 years.Mostof them were in the age group of 30-50 years.Of the total 60 patients included in the study, 39 patients were males (65%) and 21 patients were females (35%). The males to female ratio is 1.8 :1,which is almost the same ratio as was seen in the study by Sainio P, et al (1984) (3)

Among the 60 patients included in the study group, the most common type of fistula was intersphincteric type followed by the transsphincteric type. This correlates well with the results of study done by Parks et al(1976) who also reported intersphincteric type of fistula to be the commonest type of fistula in their study.(19) The results were also consistent with the study done by Morris etal.(2000) who in their study showed that about 70% of all perianal fistulas were intersphincteric fistulas, while transsphincteric fistulas constituted 20% of the total. (7)

Our study showed that majority of patients (52 out of60) had a single external opening and most commonly the opening was found between 4 and 6'o clock position. The next common location being7 to 9'o clock position. When analysing the internal opening, single internal opening was seen in majority of patients (51 out of 60). Most commonly, the internal opening was found in 6'o clock position.The operative findings were well correlating with the study with regard to the site of the openings.

We classified perianal fistulas on the basis of St James's University Hospital Classification. This showed that Grade I fistulas were the commonest and was found in 20 patients. The second most common type is grade III fistulas which was found in 16 patients. This is in accordance with the study done by Ozdil Baskan et al (20) .

In our study, 16 out of 60 patients had secondary tracts. Identification of all these tracts is very essential for complete eradication of the disease. Failure of preoperative identification of secondary tracts is the most common cause for recurrence of the disease. (21) As is already known, active fistulous tracts enhance well with Gadolinium contrast. This helps in better visualisation the of fistulous tract. So, it was concluded that contrast study is essential part of the management. This is in concordance with the study done by Dariusz et al.(22)

In our study, abscesses were identified in 11 out of the 60 patients. Out of these simple abscess was seen in 6 patients, horse shoe abscess in 4and1 patient had abscess in the ischiorectal fossa. This is superior to the result given by Maier et al in his study who showed a 84% sensitivity of MRI for the identification of perianal fistulas and abscesses.(23) His study had a 15% false positive results which were eliminated in our study. The better results of our study are attributed to the use of contrast enhanced imaging. So, contrast enhanced imagingshould be routinely included in MRI protocols of anal fistula examination, even with no abscess or collection seen at the pre contrast images. This was in correlation with the study done by M.E.Agha etal.(24)

In our study, there was significant correlation between MRI findings of fistulous tracts and the surgical findings. Fistulotomy was done in 52 out of 60 patients and preoperative findings correlated very well with the MRI findings for grades III to V. Grade I and II fistulas showed some discrepancies in identification of tracts. The secondary tracts in grade II intersphincteric type were missed in 4 patients and wrongly classified as grade I. Abscess drainage was also done in 5 patients and the findings were also in accordance with MRI findings. The result obtained (86.78%) was comparable with the result obtained from the previous study conducted by Lunniss et al which reported concordance rate of 86- 88% between MRI and surgical findings. (25) In another study by Beets- Tan et al, who compared the results of MRI with intraoperative findings, the sensitivity and specificity were 100% and 86% respectively. The sensitivity and specificity were 100% and 100% for a horse shoe abscess. (14)

The limitation of the study include small sample size and single center study hence the future recommendation is to conduct the same study taking multiple centres to get more accurate results.

## Conclusion

Perianal fistula, though an uncommon problem may be chronic and recurrent. It may present with numerous complications like secondary tracks and abscess cavities. Incomplete evaluation of these complications can result in residual and recurrent disease. So, complete preoperative evaluation of perianal fistulas is warranted. Also to prevent injury to external sphincter and resultant fecal incontinence, it is necessary to establish the relationship of sphincter with the fistulous tracks. MRI satisfies all these needs of surgeons and helps in planning of surgery . MRI provides finer anatomic details of fistula and also identifies secondary tracks and abscesses. Contrast enhanced MRI can identify active inflammation of tracks. It can also distinguish between scar and granulation tissue. Correct identification of perianal fistulae and proper grading of fistulae are necessary for ensuring optimum surgical outcome.

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