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Magnetic Resonance Imaging (MRI) Characterization of Perianal Fistulous Disease in a Rural Based Tertiary Hospital of North India

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

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Summary

Background: To diagnose and characterize the perianal fistulous disease using Magnetic resonance imaging (MRI) in a hilly and rural area of North India.

Material/Methods: This prospective hospital based study was conducted for a period of one year from April 2014 to April 2015 in the departments of Radiodiagnosis and Surgery of our institute. A total of 50 consecutive patients presenting with perianal fistulous disease fulfilling the inclusion and exclusion criteria were included in the study and taken up for MRI. The perianal fistulae were classified according to St James University hospital classification and tracks were assessed with regard to anatomical plane, length, ramifications, abscess formation, enteric communication, external cutaneous opening, enhancement and suprasphincteric extension. Surgical correlation was done in 31 patients who opted for surgical treatment. Rest of the 19 patients preferred alternative medicine for treatment or chose to postpone their surgery.

Results: The disease was much more prevalent in males in comparison to females with male to female ratio of 24:1. Grade 4 was the most common type of fistula (34%) while Grade 5 was the least common type (4%).MRI showed a high sensitivity of 93.7% and positive predictive value (PPV) of 96.7% when correlated with surgical findings. A substantial number of patients (38%) preferred alternative medicine or non surgical form of treatment.

Conclusions: MRI is a very sensitive modality for the evaluation of perianal fistula. In our study group, the disease predominantly affected middle aged men. Ramifications and abscesses were commonly seen, affecting nearly half of the patients and majority of the patients had active fistulous tracks with posteriorly located enteric opening. Overall, transsphincteric fistulae were most common. Significant number of patients avoided surgery or showed preference for non surgical treatment.

MeSH Keywords: Anal Canal • Digestive System Fistula • Perianal Glands

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Background

Perianal fistula is an abnormal tract between an opening in the anal canal and the skin surface, and can result in significant morbidity. The prevalence of this condition is approximately 10 in 100,000, affecting males two to four times as frequently as females [1]. Typical symptoms include perianal discharge, local pain and mild discomfort. The primary underlying cause of fistulas is thought to be a blockage of an anal gland leading to abscess and fistula formation. However, there are also secondary causes such as Crohn's disease, malignancy or tuberculosis, which may also contribute to the development of perianal fistulas. [2]. The treatment of perianal fistulas is often challenging and most patients eventually require surgery. The surgical treatment generally yields good results in the majority of patients but in some cases can be complicated by recurrence or anal incontinence. A precise and

detailed preoperative assessment of the anatomy of the fistula track, including the presence of any ramifications or abscess formation, is vital for a successful surgical outcome [3].

Recently, MRI has become an effective and essential imaging method for the evaluation of perianal fistulas, as it provides accurate information on the anatomical plane in which the fistula is located as well as on the relationship between the the fistula track and anal sphincters, pelvic floor and the levator ani muscle. MRI also identifies additional tracks or ramifications, track infection and abscess formation, which is not possible on physical examination. This information is extremely useful when planning surgery and can help decrease postoperative complications, including fecal incontinence and recurrence.

In this article, we discuss the MRI features of perianal fistulous disease affecting the population of the North Western region of the Indian state of Himachal Pradesh. We also characterize the findings in detail according to the St. James classification, which includes secondary tracks, peritrack inflammation, and abscess formation. The correlation between MRI and surgical findings is also discussed.

Material and Methods

This prospective study was conducted from April 2014 to April 2015 in the departments of Radiodiagnosis and Surgery of our institute. A total of 50 patients who were clinically diagnosed with perianal fistulous disease were included in the study. Previously operated patients and patients with impaired renal function or contraindications for MRI were excluded. After obtaining a detailed history, patient's physical examination was performed and the number and location of cutaneous openings were documented. The patient was placed in a supine position and MRI of the perianal region was carried out on a 1.5-Tesla MRI machine (Signa Excite, GE Healthcare). Multiplanar images were obtained in all three orthogonal planes i.e the axial, sagittal and coronal planes. The following sequences were used in orthogonal planes: a) FSE T1; b) FSE T2; c) STIR; c) FSE T2 fat-saturation; c) Post-contrast T1 fat-saturation using I/V Gadolinium – a paramagnetic contrast agent, at a dose of 0.1 mmol/kg.

Image analysis was done independently by two experienced radiologists and in case of a discrepancy between them, the senior radiologist's findings were considered final.

Perianal fistulas were assessed with regard to the following features: location (plane) of track, length of track, ramifications/secondary tracks, abscess formation, site of enteric communication and cutaneous opening, enhancement and suprasphincteric extension

The track was classified radiologically according to St. James' University Hospital Classification of perianal fistulas.

The operative findings were documented by a senior surgeon. Data were entered into MS Word and Excel 2007 and the individual MRI sequences were compared with respect to the detection of perianal fistulas. Comparison between MRI and operative findings was made for the patients who underwent surgery.

Table 1. Age wise distribution of patients.

Decade	Number of patients	Percentage of patients
10–19	2	4%
20–29	8	16%
30–39	14	28%
40–49	18	36%
50–59	6	12%
60–69	2	4%
Total	50	100%

Table 2. Prevalence of perianal fistule according to St. James's University Hospital classification.

St. James's University Hospital Grading	Number of patients	Percentage
Grade 1	15	30%
Grade 2	6	12%
Grade 3	10	20%
Grade 4	17	34%
Grade 5	2	4%

Results

The mean age of patients in our study was 39 years, and their age distribution (Table 1) according to decade of life was: 10–19 years (4%, n=2), 20–29 years (16%, n=8), 30–39 years (28%, n=14), 40–49 years (36%, n=18), 50–59 years (12%, n=6) and 60-69 years (4%, n=2). Out of 50 patients, 48 (96%) were male patients and 2 (4%) were female patients giving a male-to-female ratio of 24: 1. A history of perianal discharge was present in 36 patients (72%), and 14 patients (28%) had a history of both discharge and pain. Fifteen patients (30%) had grade 1 fistulas, 6 patients (12%) grade 2 fistulas, 10 patients (20%) grade 3 fistulas, 17 patients (34%) grade 4 fistulas and 2 patients (4%) grade 5 fistulas (Table 2). Eleven patients (22%) had ramifications, 4 patients (8%) had evidence of abscess formation and 9 patients (18%) had both ramification and abscess formation. Peritrack inflammation was seen in 19 patients (38%). Eleven patients (22%) had an internal opening anteriorly and 39 patients (78%) posteriorly, respectively. We correlated operative findings of 31 patients who underwent surgery with MRI findings Out of these 31 patients, the diagnosis was confirmed in 30 patients during surgery. One patient with an MRI diagnosis of a perianal fistual had a perianal sinus found during surgery. Two patients who were reported to have a perianal sinus on MRI were found to have a perianal fistula during surgery.

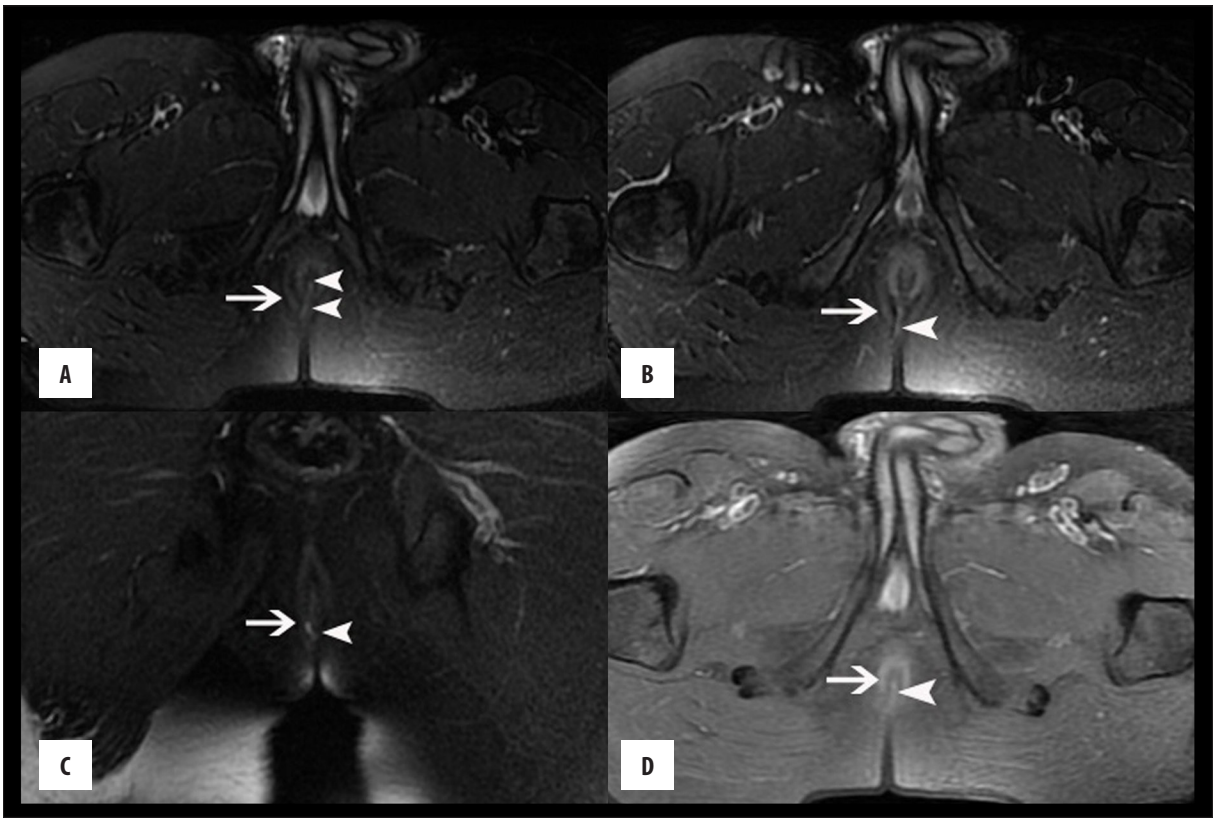

Figure 1. Simple intersphincteric grade 1 fistula: Axial T2 fat-saturated (**A, B**), coronal T2 fat-saturated (**C**) and axial post-contrast T1 images (**D**) show the fistulous track (arrowheads) medial to external anal sphincter (arrows).

Disscussion

The perianal fistulas have been described for centuries and were known to Hippocrates. This condition received more attention when Frederick Salmon started the St. Mark's Hospital in London in 1835, which was dedicated exclusively to patients suffering from perianal fistulas and other rectal diseases.

Perianal fistulas occur in approximately 10 out of 10,000 people [4]. They usually occur in adult men with a maximum incidence between the third and fifth decades [5,6]. In our study, the mean age of participants was 39 years, and the age group between 40–49 years accounted for the largest proportion of patients (36%). There was an overwhelming male predominance, and the male-to-female ratio was 24:1. This ratio is at variance with the earlier studies, as it has been previously reported to be approximately 2:1[2]. The reasons for this discrepancy are likely to be social or cultural rather than medical, as females tend to feel embarrassed about this disease and try to conceal it.

Anal crypt glands which lie at the level of the dentate line can extend into the intersphincteric plane after penetrating the internal sphincter. According to the cryptoglandular hypothesis, fistulas occur as a result of an initial infection or abscess formation in the anal glands. The infection of glands in the intersphincteric plane leads to the obstruction of the draining duct and subsequent fistula formation. The internal sphincter constitutes a barrier, and pus travels along the intersphincteric plane or may cross the external sphincter into the ischioanal fossa forming the intersphincteric and transsphincteric fistulas, respectively [2]. An important role in the pathophysiology of fistula formation is also played by the location and the number of perianal glands specific for that region. This is also determines the direction in which the infection spreads along anatomical planes. Rarely, fistulas can also develop in the course of inflammatory diseases of the gut such as ulcerative colitis, Crohn's disease or tuberculosis. Patients who are immunocompromised are considered to be more prone to complications.

The most frequent clinical presentation is either discharge (seen in about 65% patients) or pain in the perianal region[4]. In our study, discharge was present in 36 patients (72%), while 14 patients (28%) had a history of both discharge and pain in the perianal region.

Before the advent of MRI, several other imaging techniques were used for the evaluation of perianal fistulous disease, with somewhat disappointing results. The fistulas were traditionally imaged by conventional fistulograms, which involved cannulation of the external opening and injection of a water-soluble contrast into the fistula. Fistulography has largely been abandoned due to major limitations, including failure to delineate secondary tracks due to inadequate contrast opacification and non-visualization of the sphincter complex.

Computed tomography (CT) evaluation of perianal fistulas requires both intravenous and rectal contrast administration. CT may prove beneficial in cases of perirectal

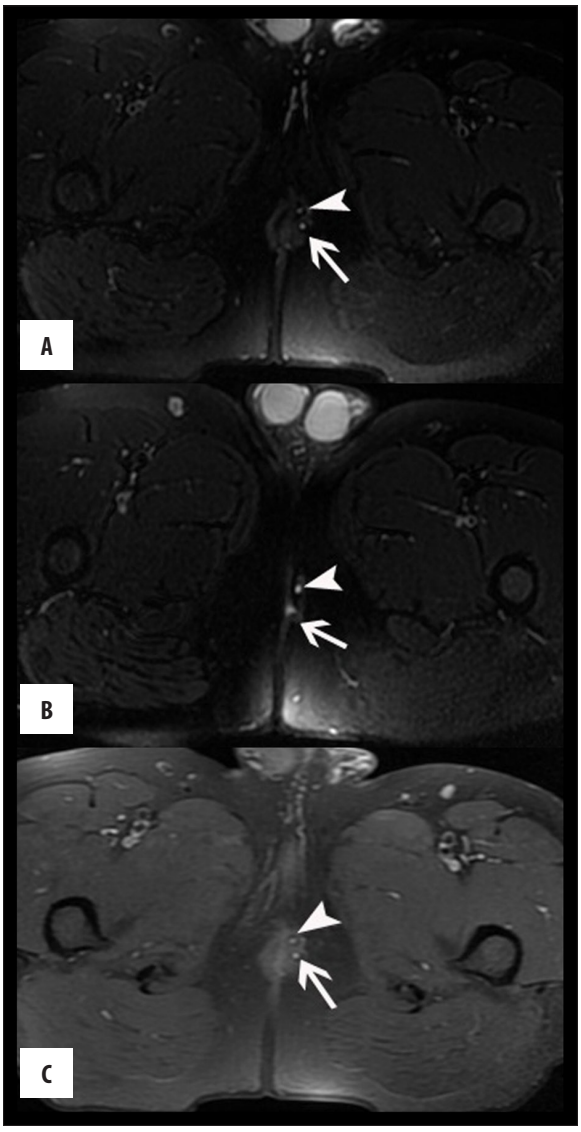

Figure 2. Intersphincteric grade 2 fistula with ramification: Axial T2 fat-saturated (**A, B**) and axial post-contrast T1 (**C**) images show a fistulous track (arrow) with its ramification (arrowhead) in the intersphincteric plane.

inflammation or abscess formation in which drainage is anticipated. However, small isolated fistulas may not be appreciated due to a poor soft tissue contrast.

Endoanal ultrasonography is an imaging technique which requires passage of a high frequency transducer into the anorectum. It can identify the primary fistulous track and the internal opening with a high degree of accuracy [7]. However, this technique is hampered by a small field of view which makes the identification of secondary tracks or a supra-levator extension of the primary track very difficult [2].

MRI is increasingly gaining importance in recent years for the evaluation of perianal fistulous disease, primarily because of its ability to provide exquisite and detailed information on the track anatomy, its relationship to the surrounding structures and sphincters. It can also identify abscess formation and infected track, which is not otherwise possible. These special capabilities of MRI are of immense importance when planning surgery, as they can help reduce postoperative complications, including fecal incontinence and recurrence. Currently, MRI is the study of choice for the evaluation of perianal fistulas, especially when surgical treatment is considered.

On MRI, active fistulous tracks appear as hypointense, linear structures on T1-weighted images and hyperintense on T2-weighted images (best visualized with fat saturation) relative to the muscle. Moreover, contrast enhancement is also seen. Fluid or granulation tissue with increased vascularity is thought to account for the T2-weighted hyperintensity. Inactive tracks are also hypointense on T1-weighted imaging but lack the associated T2-weighted imaging hyperintensity and contrast enhancement, which is attributed to the presence of secretions or pus, with subsidence of surrounding inflammation along with fibrotic changes.

It is difficult to differentiate a healed fibrotic track from an open inactive track, however, the MRI appearance of a healed fibrotic track typically lacks the hyperintense signal of fluid inside the active fistula track [8]. In our study, active fistulous tracks were seen in 41 patients (82%) and 9 patients (18%) showed inactive or fibrosed tracks.

We classified the fistulas according to St. James's University Hospital Classification of perianal fistulas, which is based on MRI findings and grades them into five groups (Figures 1–5):
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 and Grade 5: Supralevator or translevator disease.

The distribution of fistulas in our study according to the St James Classification was as follows:
Grade 1: 15 patients (30%); Grade 2: 6 patients (12%); Grade 3: 10 patients (20%); Grade 4: 17 patients (34%) and Grade 5: 2 patients (4%).

Therefore, grade 4 fistulas were most common (34%) followed by grade 1 (30%), frade 3 (20%) and grade 2 (12%) fistulas. Grade 5 fistulas were the least common type accounting for only 4% cases.

The incidence of transsphincteric (Grade 3 and 4) fistulas was the highest in our study, accounting for 54% of cases. These observations corroborate the study by Sofic et al. and Daabis et al., who reported the transsphincteric fistulas as the most frequently encountered fistula type [9,10]. However, these findings are not in agreement with the study by Parks et al., and Morris et al., who reported intersphincteric fistulas as the most common type in their studies. [2,11] The reason for the higher incidence of transsphincteric fistulas in our study is probably due to a long and protracted course of the disease in our patients and reluctance to undergo surgical management at the early stages.

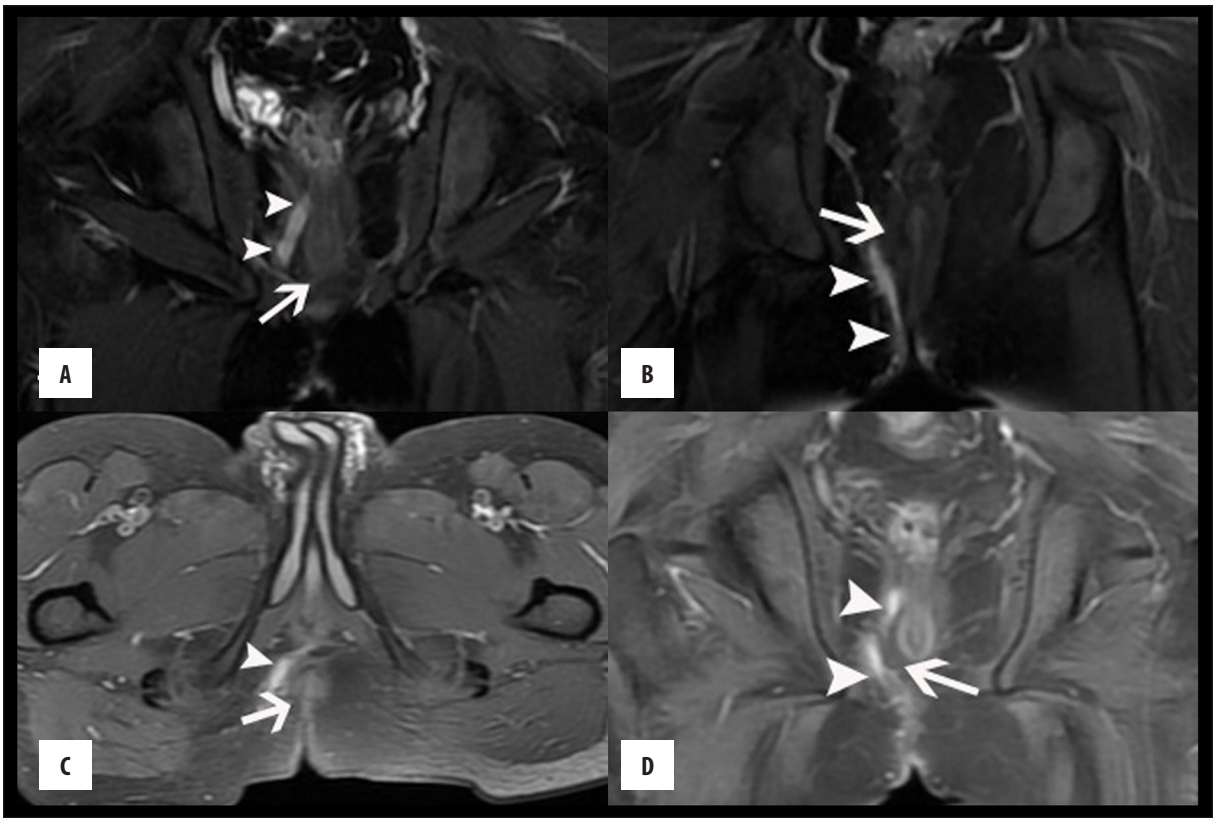

Figure 3. Simple transsphincteric grade 3 fistula: Coronal T2 fat-saturated (**A, B**), axial and coronal post-contrast T1 images (**C, D**) show the fistulous track (arrowheads) lateral to the external anal sphincter (arrows).

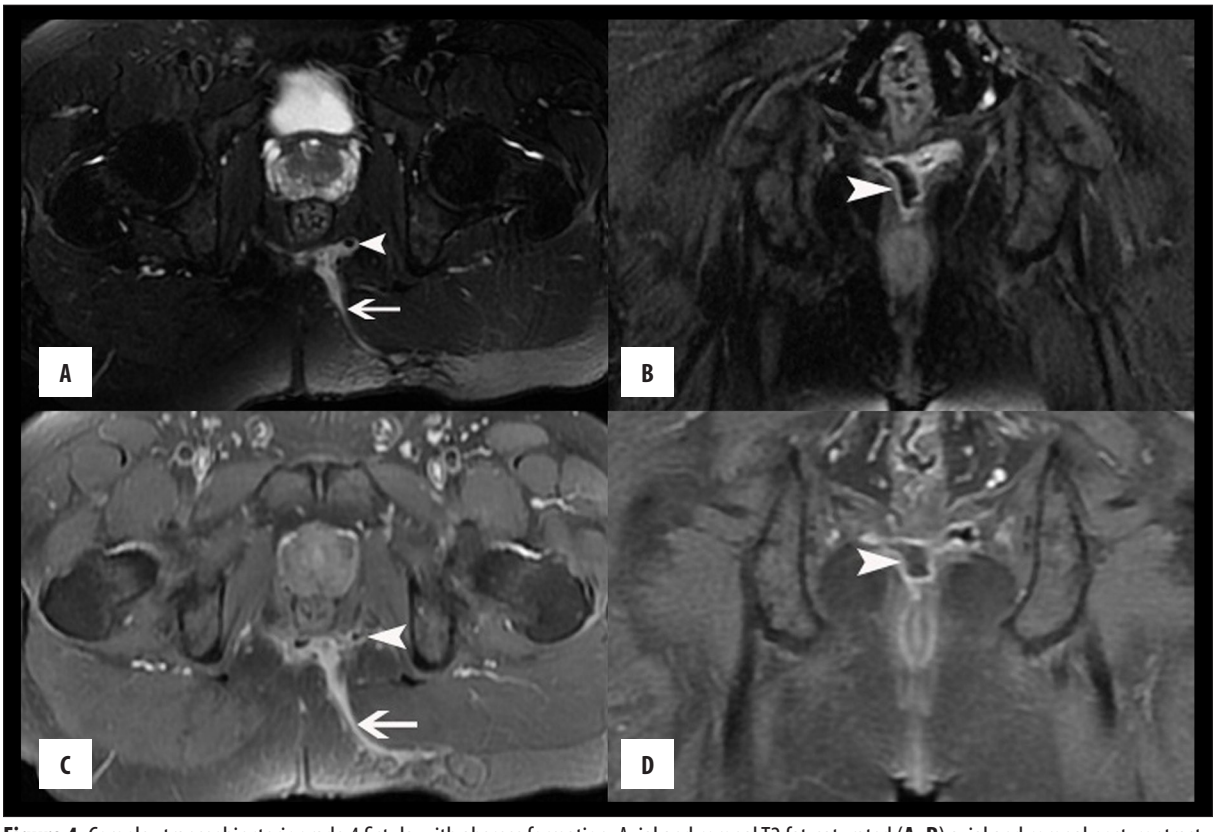

Figure 4. Complex transsphincteric grade 4 fistula.with abscess formation: Axial and coronal T2 fat-saturated (**A, B**) axial and coronal post-contrast T1 images (**C, D**) show abscess formation (arrowhead) in the transsphincteric fistulous track (arrow).

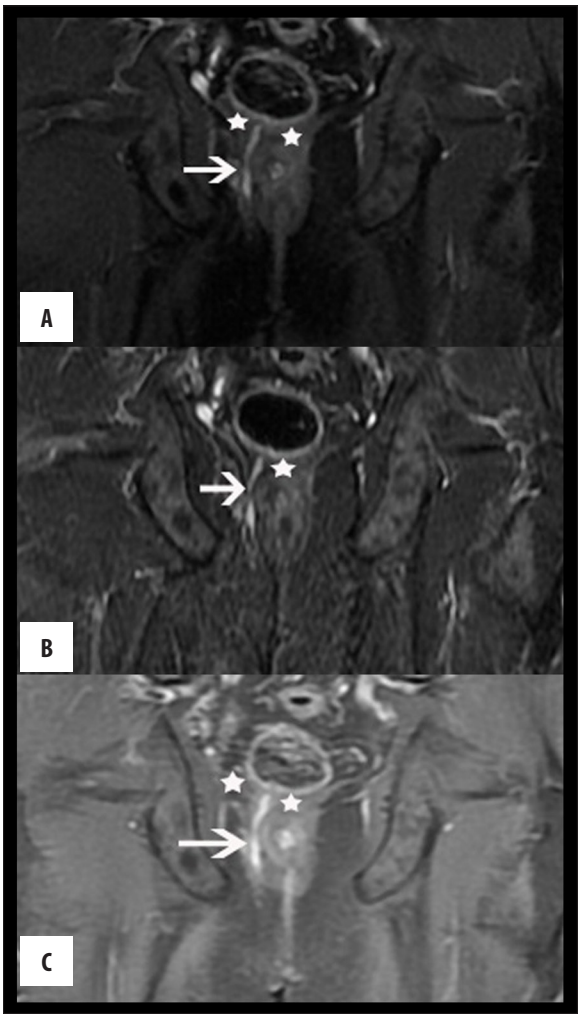

Figure 5. Supralevator grade 5 fistula. Coronal T2 fat-saturated (**A**), Coronal STIR (**B**) and coronal post-contrast T1 images (**C**) show the fistulous track (arrow) reaching up to the levator ani muscle (star).

Identification of ramifications or secondary tracks is equally important for good postsurgical outcomes. They have features similar to those of the primary track, and their course should be defined relative to the sphincters, levator ani and overlying skin. These appear as hyperintense regions on T2-weighted and STIR images and enhance if intravenous contrast material is used. Collateral inflammation can be present to a variable extent. Ramifications in a patient with an intersphincteric fistula may cross from one side to the other (horseshoe type) or may be visualized as a side track within the ipsilateral intersphincteric plane. In cases of transsphincteric fistulas, they may be seen as an extension into the ischioanal/ischiorectal fossae. In our study, 11 patients (22%) had ramifications. Of these, 10 patients (20%) had a single ramification and 1 patient (2%) had multiple ramifications.

Perianal abscesses may occur anywhere along a fistula track and typically have a central hyperintense signal on T2-weighted and STIR images corresponding to pus, with isointense signal in the wall. The abscesses appear slightly hypo- or isointense on T1-weighted images, with peripheral rim enhancement secondary to the surrounding active granulation tissue, while fluid in the centre remains hypointense [12,13].In our study, 4 patients (8%) had evidence of abscess formation and 9 patients (18%) had both ramification and abscess formation.

Peritrack inflammation is characterized by mild T2 and STIR hyperintense signals surrounding the more hyperintense fistulous track. This is attributed to edema or inflammation. Mild enhancement is seen after contrast administration. The finding of peritrack inflammation was seen in 19 patients (38%) in the fat surrounding the fistulous track in the ischiorectal and ischioanal fossa region.

Out of 50 patients, 11 patients (22%) had the internal opening anteriorly, and 39 patients (78%) posteriorly. This is in agreement with earlier studies which stated that fistulous tracks originating posteriorly to the transverse anal line are seen most frequently [2,6].

In our study, the fistulous tracks were best visualized in fat-saturated T2-weighted sequences. Similar observation have been made in earlier studies as well [2,14]. Fat-suppressed T2-weighted sequences are considered better than conventional T2-weighted sequences, because in the latter sequence both the fat and the active track give a hyperintense signal, making the identification of the track difficult. On the other hand, in T2W images with fat suppression, the fluid, granulation tissue and pus appear hyperintense against the low signal intensity of the suppressed fat, making them more conspicuous [2,6,15–17].

In our study, T1-weighted images without contrast enhancement were noted to provide a good anatomical depiction of the levator ani, internal and external sphincters, and the ischioanal fossae, but the fistulous tracks, peritrack inflammatory changes and abscess pockets were difficult to identify from the normal surrounding structures, such as the sphincter complex and the levator plate due to their hypo- or isointense signals. Similar observations have been made in previous studies as well [2]. Gadolinium-enhanced T1W images are more useful and can differentiate a fluid-filled track or abscess from an area of inflammation [18]. On these contrast-enhanced images, the track wall is enhanced, whereas the central portion remianes hypointense. In case of an abscesses pocket, the central portion appears hypointense due to pus, whereas the periphery shows a rim of enhancement. STIR sequences are also good in delineating fistulous course and its ramifications; however they are overall inferior to T2-weighted fat-sat sequences. We observed that in a few cases, the STIR images showed a false or spurious track which was not confirmed in T2 fat-saturation or T1 post contrast fat-saturation sequences. In addition, it has also been noted in previous studies that this sequence may be unable to demonstrate small pockets of abscess cavities located within an area of inflammation. Such an observation was, however, not noted in our study.

Surgical follow-up of 31 patients (62%) was carried out and the remaining 19 patients opted for non-allopathic treatment or delayed their surgeries. One patient with a fistula reported on MRI turned out to have a perianal sinus during surgery (false positive 3.3%). Thus, out of 31 patients,

surgical and MRI finding were in accordance in 30 patients (true positive 96.7%).

Apart from these, two patients were reported on MRI as having a perianal sinus but during surgery they turned out to have trans-sphincteric fistulas.

Our study showed a high sensitivity of 93.7% and PPV of 96.7% when correlated with surgical findings. The results are in agreement with studies by Siddiqui et al., Singh et al. and Becklingham et al. who reported sensitivity of 95%, 95.5% and 97%, respectively [19–21]. PPV in our study is also comparable to a similar study by Singh et al. who reported a PPV value of 97.7% in their study [20].

Conclusions

MRI is a very sensitive modality for the evaluation of perianal fistulas. In our study performed among a rural population, the disease predominantly affected middle-aged men. Ramifications and abscesses were commonly seen, affecting nearly half of the patients and the majority of patients had active fistulous tracks with posteriorly located enteric openings. Overall, transsphincteric (grade 3 and 4) fistulae were most common. The T2 fat-suppressed sequence was the best for the evaluation of perianal fistulas and the contrast-enhanced fat-suppressed T1W sequence was excellent for the detection of abscesses or secondary tracks. A significant number of patients (38%) avoided surgery or showed preference for non-surgical treatment possibly due to the lack of availability of specialized services in the hilly area under evaluation.

Statements

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