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Fistula in Ano—A 2-Year Prevalence Study on North Indian Rural Population

Neeru Kapur[1] Rajiv Kapur[2] Meghna Varma[1] Chakshu Batra[1] Bharat Bhushan Sharma[1]

[1] Department of Radiodiagnosis, Shree Guru Gobind Singh Tricentenary Hospital Medical College and Research Institute, Gurugram, Haryana, India
[2] Department of Radiodiagnosis, Rajiv Gandhi Cancer Institute and Research Centre, Delhi, India

Address for correspondence Rajiv Kapur, MBBS, MD, DNB, MBA, J-218, Vijay Rattan Vihar, Sector 15 Part 2, Gurugram, Haryana 122001, India (e-mail: kaprajiv@gmail.com).

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Abstract

Perianal fistula (PF) is a common inflammatory condition affecting the perianal region including the sphincter muscles, ischioanal fossae, and the perianal skin. It is notorious to recur and, as a result, causes significant morbidity in both urban and rural population. Magnetic resonance imaging (MRI) has revolutionized imaging in PFs as it provides excellent anatomical visualization of the fistulous tracts, their origin, course, number, chronicity, opening in the external and internal anal sphincter, length of sphincter, evidence of active disease and abscess formation along the tract. It is also very useful in presurgical mapping and reduce the chances of recurrence. Most of the studies done on PFs are based on the urban population. Rural population have a completely different lifestyle which makes them susceptible to various diseases, less prevalent in the urban population. Hence, the purpose of this article is to find the prevalence of different grades in North Indian rural region close to the NCR (National Capital Region). In the study including 98 patients, the maximum number of patients were classified into grade 1 and grade 4 by MRI according to St. James' University Hospital MRI classification. This is the second reported study on prevalence of different grades of PFs in rural population in India. The higher prevalence of grade 4 PFs in our study might be secondary to illiteracy, social stigma, poor hygiene, or higher recurrence rate. Closely understanding the difference in dynamics of urban and rural population, our goal of the study is to determine the prevalence of different grades of PFs in the rural population. We also aim to familiarize physicians, radiologists, and surgeons with the MRI evaluation and grading of PF to help in presurgical mapping and thus, reducing the chances of recurrence. We also recommend further studies to evaluate psycho-social factors as a barrier in seeking early medical care in rural population.

Keywords
- perianal fistula
- magnetic resonance imaging
- intersphincteric fistula
- transsphincteric fistula

Introduction

Perianal fistulas (PFs) are tracts in the perianal region that connect an infected collection to an opening on the skin surface around the anus. These are common, inflammatory conditions affecting the perianal region including the sphincter muscles, ischioanal fossae, and the perianal skin.[1] Causes which predispose to fistula formation include clogged anal

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glands and anal abscesses due to an underlying infection, Crohn's disease, tuberculosis, diverticulitis, cancer, radiation therapy, and sexually transmitted diseases.[2] Perianal fistula (PFs) are notorious to recur and, as a result of repetitive surgeries, cause significant morbidity. Magnetic resonance imaging (MRI) evaluation and grading of the PF is very useful in presurgical mapping and reduce the chances of recurrence.[3] Most of the studies done on PFs, till date are based on the urban population.[4–6] Rural population have a completely different lifestyle as compared with urban population. A different lifestyle makes them susceptible to various diseases which are less prevalent in the urban population due to good hygiene practices. Closely understanding the difference in dynamics of urban and rural population, our goal of the study is to determine the prevalence of different grades of PFs in the rural population.

Aim

The aim of this article is to study the prevalence of different grades of PFs in the North Indian rural population close to the NCR. It also aims to familiarize the radiologist with the MRI grading of FIA.

Materials and Methods

Study Population

The study included adult (>18 years of age) patients who were referred by the surgical department of our institution for MR imaging to evaluate the extent of PFs from May 2019 to April 2021. During the past 2 years, we studied 98 adult patients referred by surgical department in rural population near NCR. The patients who were visiting relatives in rural area but resided in cities were excluded from the study. The patients with life-limiting illness who were not deemed as suitable candidate for surgical procedure were excluded from the study. MR imaging was performed by using the Philips MULTIVA 1.5T system with a phased-array coil and no patient preparation. Proper written informed consent was taken before undergoing MR imaging.

MRI Procedure

FIA can be visualized on a 1.5 Tesla MRI scanner with a wider FOV (as used in our study) and requires only a few basic sequences to map out the primary, secondary, or exotic tracts if present. MRI examination is performed using body or phased array coils. No patient preparation is required. Endoanal coils have proven to not give any added information. Also, endoanal coils have the disadvantage of low patient tolerance due to local pain and inflammation associated with PFs.[7] In our institution, we use the MR sequences given in ►**Table 1**.

Pelvic MR protocol for PFs include planning for the oblique plane and the acquisition of T1- and T2-weighted sequences without fat saturation. This helps delineating the pelvic anatomy, muscle groups and their relationship to the fistulous tract. T2-weighted images with fat suppression are used to evaluate the fluid content within the tracts and/or cavities and presence of any associated tissue edema. The fluid within the tracts and abscess cavities is seen as bright signal intensity against a background of low signal intensity fat. Fat suppressed T1-weighted sequences (both unenhanced and contrast enhanced) help identify the presence of abscess cavities and reveal small residual abscesses if present. An important advantage of MR imaging in fistula evaluation is the study of

Table 1 The characteristics of MR imaging sequences used in our institution and in the study to evaluate and grade perianal fistula

	NSA	FOV	Imaging plane used	Acquisition matrix	Slice thickness	Repetition time/echo time
Axial high-resolution T2-weighted turbo spin-echo (fast spin-echo)	1.8	180 × 180	Right–left × anterior–posterior	200 × 179	3 mm	2,745/100
Coronal T2-weighted turbo spin-echo (fast spin-echo)	1	170 × 234	Foot–head × right–left	188 × 253	3 mm	5,119/100
Axial T2-weighted turbo spin-echo (fast spin-echo) with fat suppression	1.5	180 × 180	Right–left × anterior–posterior	164 × 44	3 mm	3,304/70
Coronal STIR	1	170 × 234	Foot–head × right–left	172 × 206	3 mm	3,842/65
Axial T1-weighted turbo spin-echo (fast spin-echo)	2	180 × 180	Right–left × anterior–posterior	256 × 215	3 mm	492/10
Axial T1-weighted with fat suppression post contrast	2	180 × 180	Right–left × anterior–posterior	180 × 157	3 mm	520/8
Sagittal T1-weighted with fat suppression with IV contrast agent (optional)	2	220 × 220	Foot–head × anterior–posterior	220 × 182		548/7
Coronal T1-weighted with fat suppression with IV contrast agent	2		Foot–head × right–left	200 × 163		470/7

Abbreviations: FOV, field of view; NSA, number of signal averages.

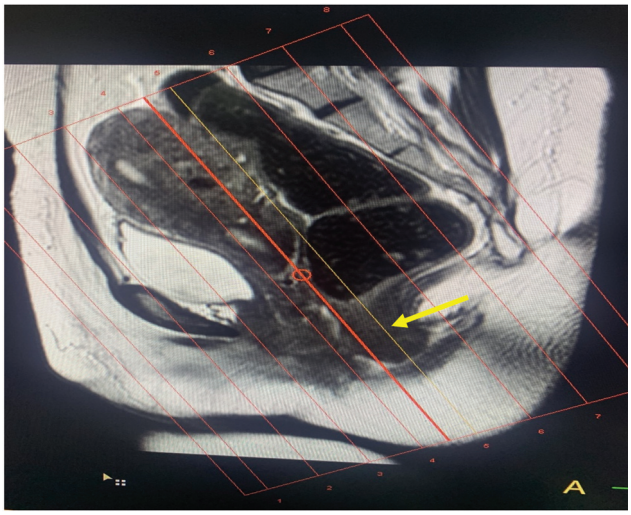

Fig. 1 The figure shows a sagittal MRI with the imaging planes aligned parallel to the long axis of the anal canal (*yellow arrow*).

the anorectal sphincteric complex in multiple planes relevant to grading of fistulas and surgical planning. The imaging planes are correctly aligned with respect to the long axis of the anal canal as shown in ►**Fig. 1**. The normal forward tilt seen in the anal canal is 45 degrees from the vertical in the sagittal plane. The axial and coronal planes are obtained obliquely oriented orthogonal and parallel to the long axis of the anal canal, respectively.[7,8]

Further, the coronal plane may be used to assess the distance traversed by the fistulous tract from its external opening. Presence of secondary tracts and their extensions in the extrasphincteric plane may be delineated with their respective distances from the external opening. This may aid the surgeon in performing an adequate surgery so that no fistulous tract is missed. Additional sequences which can be obtained are 3D T2WI, diffusion sequences and ADC values, which are useful to detect abscesses.

MRI Interpretation and Fistula Classification

The initial classification of fistulas was based on surgical anatomy of the pelvis.[9] With the advent of MR imaging, a more comprehensive fistula classification came into use which we now know as the St. James' University Hospital MRI classification or simply MRI Classification of PFs.[1] This classification takes into consideration the integrity of the sphincteric complexes, presence of secondary tracts and/or abscesses and any extensions present cranial to the levator muscle. The St. James' University Hospital MRI classification classifies the fistulous tracts into five grades. They have been described below.[8]

Grade 1: Simple Linear Intersphincteric Fistula

Grade 1 PF has its external opening in the perianal skin and ascends within the intersphincteric plane while being limited by the external anal sphincter throughout its entire course (►**Fig. 2**). There are no secondary fistulous tracts and/or abscess present. There is no disruption of the external anal sphincter or the levator ani muscle.

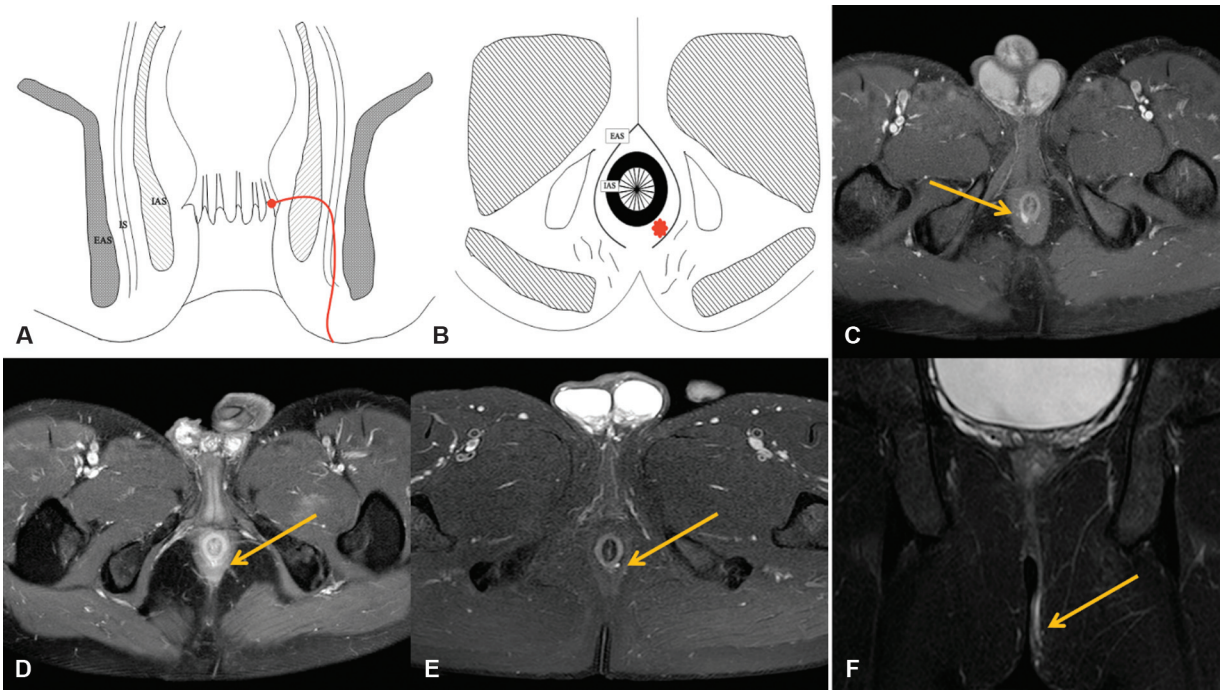

Fig. 2 Grade 1: simple linear inter-sphincteric fistula. (**A**) Drawing of the anal canal in the coronal plane shows the simple inter-sphincteric fistula to the left of the anal canal. (**B**) Drawing of the anal canal in the axial plane shows the simple inter-sphincteric fistula to the left of the anal canal. (**C**) Axial contrast-enhanced fat-suppressed T1-weighted MR image shows the highly enhancing inter-sphincteric fistula (*yellow arrow*) confined by the external sphincter with no associated secondary tracts and/or abscesses. (**D**) Axial contrast-enhanced fat-suppressed T1-weighted MR image shows an inter-sphincteric fistula (*yellow arrow*) with its internal opening seen at 6 o'clock. (**E**) The internal opening in this inter-sphincteric fistula (*yellow arrow*) is around 4 to 5 o'clock. (**F**) Coronal contrast-enhanced fat-suppressed T1-weighted MR image shows the inter-sphincteric fistula (*yellow arrow*) confined by the external anal sphincter. Inter-sphincteric fistula has been shown with yellow arrows.

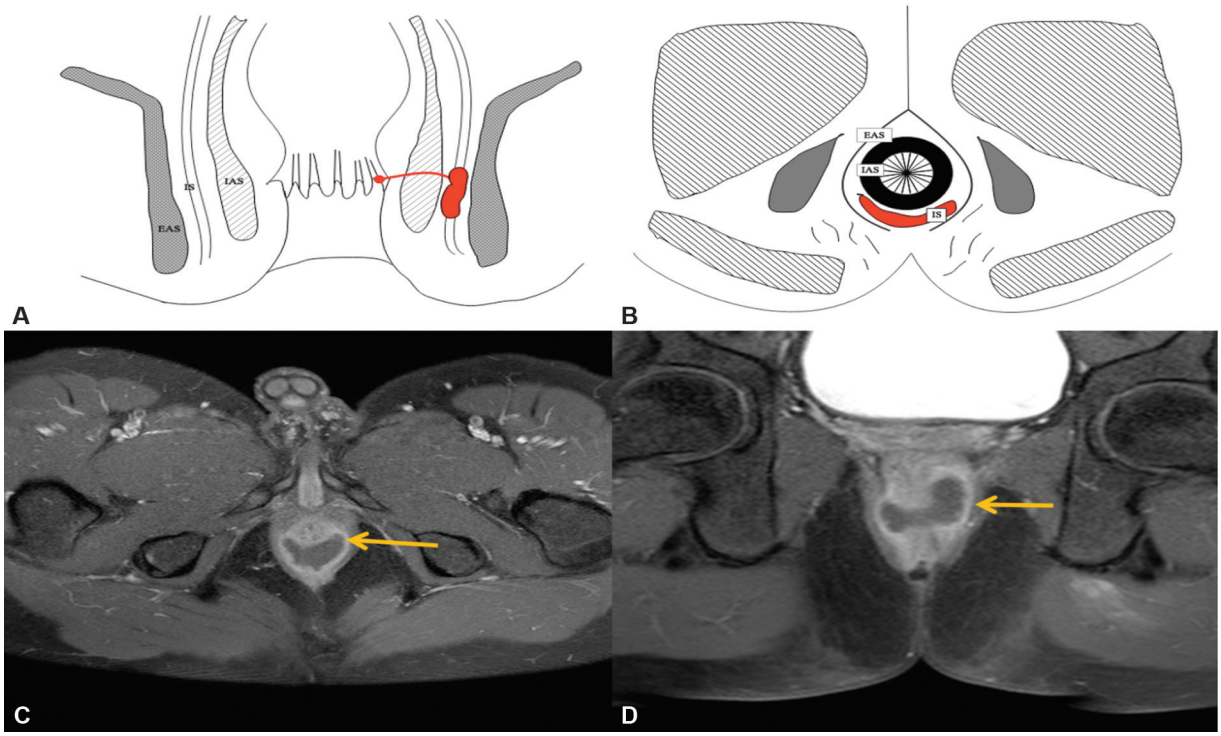

Fig. 3 Grade 2: Inter-sphincteric fistula with an abscess (**A**) coronal drawing of the anal canal shows the abscess in the inter-sphincteric space, bounded by the external sphincter. (**B**) Axial drawing of the anal canal shows the abscess in the inter-sphincteric space, bounded by the external sphincter. (**C, D**) Axial and coronal contrast-enhanced fat-suppressed T1-weighted MR image shows the inter-sphincteric abscess (*yellow arrow*) crossing the midline forming the characteristic "horseshoe abscess" without evidence of a fistulous tract or abscess in the ischiorectal fossa.

Grade 2: Intersphincteric Fistula with Intersphincteric Abscess or Secondary Fistulous Tract

Grade 2 fistula has its external opening in the perianal skin and ascends within the intersphincteric plane while being limited by the external anal sphincter through its entire course (►**Fig. 3**). There may be presence of an abscess or a secondary fistulous tract within the intersphincteric plane, which may cross the midline, characteristically known as the "horse shoe abscess."

Grade 3: Transsphincteric Fistula

Grade 3 fistula arises from the anal canal and transcends through the external and internal anal sphincter to lie in the extrasphincteric plane and finally open into the perianal skin. There are no associated secondary tracts and/or abscesses or extensions above the supralevator muscle (►**Fig. 4**).

Grade 4: Transsphincteric Fistula with Abscess or Secondary Tract Within the Ischioanal or Ischiorectal Fossa

Grade 4 fistula is similar to grade 3 fistula but with associated secondary tracts and/or abscesses either within the intersphincteric plane or in the extrasphincteric plane. However, no extension above the supralevator muscle is present (►**Figs. 5** and **6**).

Grade 5: Supralevator and Translevator Disease

Any type of fistulous tract with extension above the levator muscle is a grade 5 fistula. The levator extension may either be in a supraphincteric or an extrasphincteric plane. Suprasphincteric fistulas continue within the intersphincteric plane to reach the supralevator space. The fistula then pierces the levator muscle to travel through the ischioanal fossa to open as an external opening in the perianal skin. Extrasphincteric fistulas result from a pelvic pathology, wherein the fistulous tract may descend from the pelvic source caudally, through the levator ani muscle, traversing the ischioanal fossa to terminate at the cutaneous opening. There is no disruption of the external or internal anal sphincters (►**Fig. 7**).

Others (Not Specifically Described in the Parks or St. James' Classification)

Some tracts do not involve the external or internal anal sphincters and are present only in the submucosal plane. Blind ending tracts like Pilonidal sinus which do not have an opening in the anal canal are classified as sinus tracts. Pathophysiology and location of these tracts differ from fistula in ano.[5]

Results

Pilonidal sinus was identified in ten of these patients and local inflammation without the presence of fistulous tract was present in one patient.

We classified the fistulas using the St. James University Hospital MRI classification into grades ranging from grade 1 to grade 5. Of the 87 patients, 36 (41.3%) patients were identified to have a grade 1 or simple linear intersphincteric

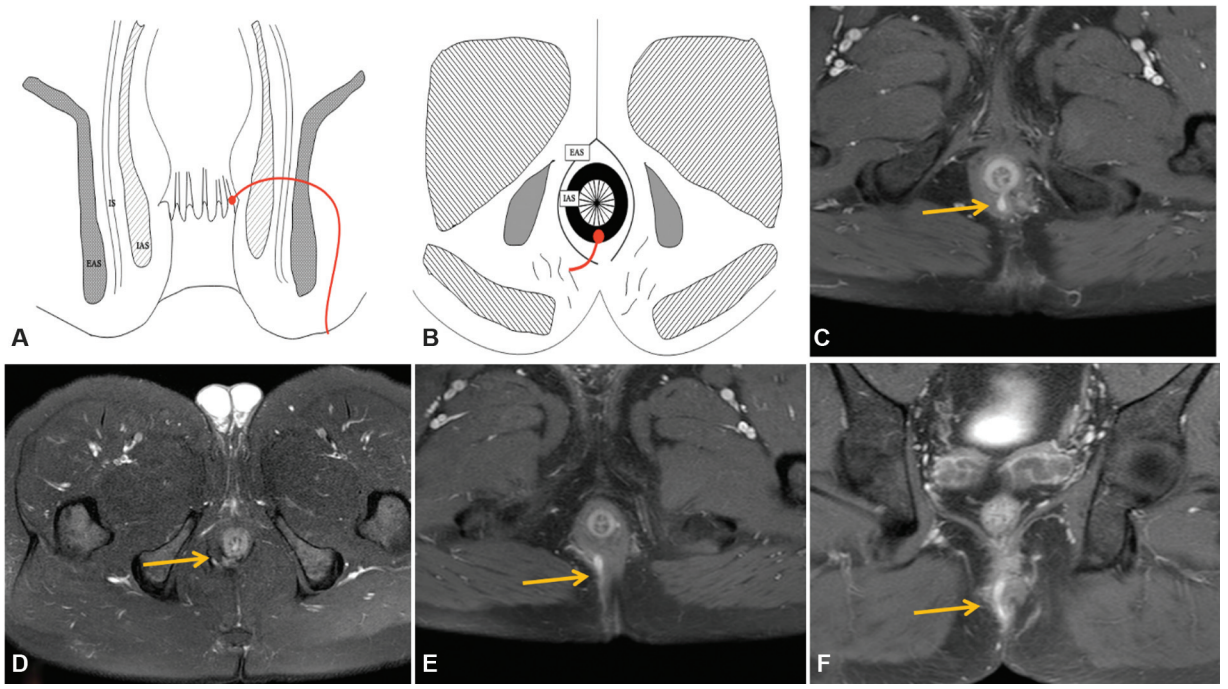

Fig. 4 Grade 3: trans-sphincteric fistula. (**A**) Coronal drawing of the anal canal shows the left trans-sphincteric fistula. (**B**) Axial drawing of the anal canal shows the transsphicteric fistula with no evidence of secondary tracts and/or abscesses. (**C**) Axial contrast-enhanced fat-suppressed T1-weighted MR image shows the trans-sphincteric fistula without evidence of any secondary tracts and/or abscesses. (**D–F**) Contrast enhanced images showing transsphincteric fistula.

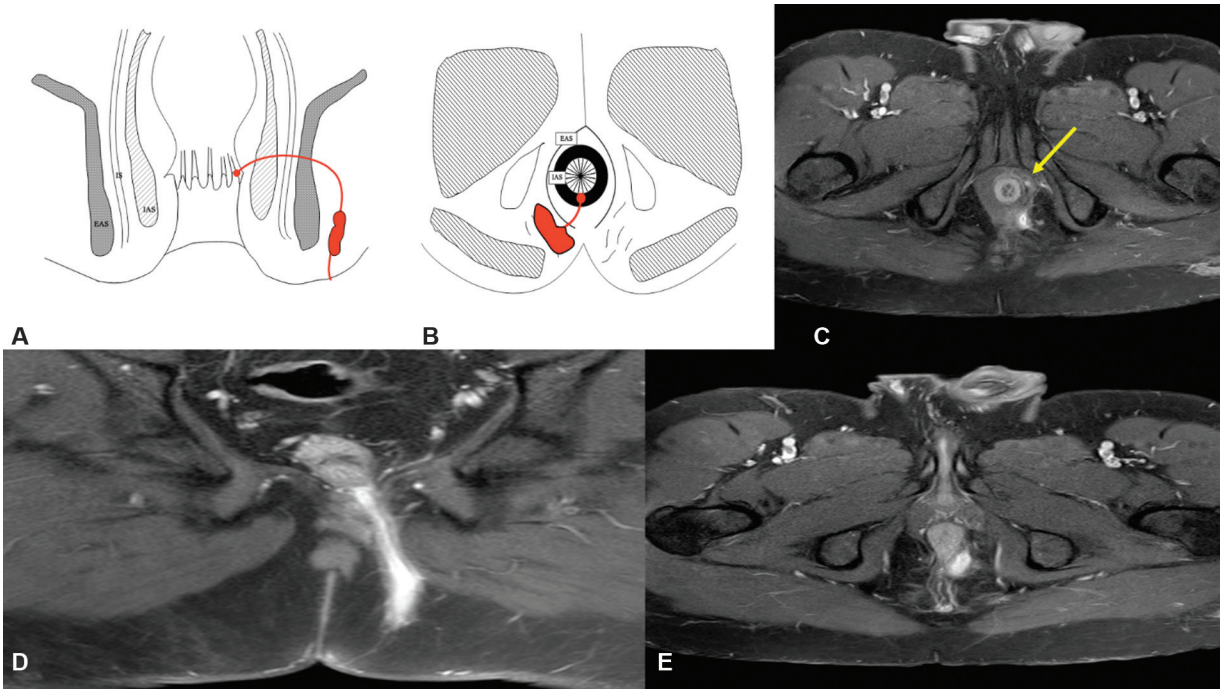

Fig. 5 Grade 4: trans-sphincteric fistula with an abscess or secondary tract in the ischiorectal or ischioanal fossa. (**A**) Coronal drawing of the anal canal shows the left trans-sphincteric fistula with abscess in the left ischio-anal fossa. (**B**) Axial drawing of the anal canal shows the transsphicteric fistula with an abscess in the right ischio-anal fossa. (**C**) Axial contrast-enhanced fat-suppressed T1-weighted MR image shows the trans-sphincteric fistula with its internal opening at 2 o'clock (*yellow arrow*). (**D**) Coronal contrast-enhanced fat-suppressed T1-weighted MR image shows the same trans-sphincteric fistula. (**E**) Axial contrast-enhanced fat-suppressed T1-weighted MR image shows an abscess in the left ischiorectal fossa in the same patient.

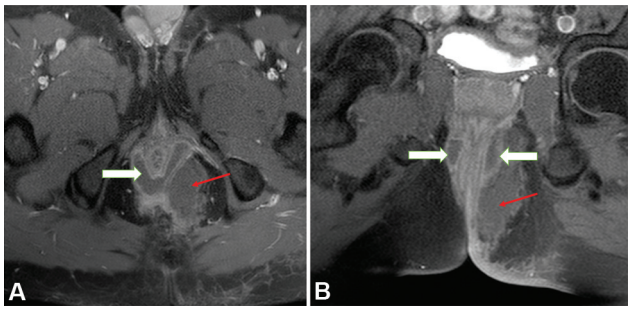

Fig. 6 (**A**) Axial contrast-enhanced fat-suppressed T1-weighted MR image shows a left ischiorectal abscess (*red arrow*) with an associated horse shoe abscess (*open arrow*). (**B**) Coronal contrast-enhanced fat-suppressed T1-weighted MR image shows the left ischiorectal abscess (*arrow*) with a horseshoe abscess (*open arrows*).

Table 2 The prevalence of different grades of PFs in the study population depending on St. James University Hospital MRI classification

	Number of patients	Percentage
Pilonidal sinus	10	10.20
Local inflammation with no fistulous tract	1	1.02
Grade 1	36	36.73
Grade 2	7	7.14
Grade 3	8	8.16
Grade 4	34	34.69
Grade 5	2	2.04
Total	98	100

fistula; seven patients (8%) were identified to have a grade 2 or intersphincteric fistula with an abscess or secondary tract; eight patients (9.1%) had a grade 3 or transsphincteric fistula; 34 patients (39%) had a grade 4 or transsphincteric fistula with an abscess or secondary tract in the ischiorectal or ischioanal fossa; and two patients (2.3%) had grade 5 or supralevator and translevator disease (►**Table 2**).

In our study, the maximum number of patients were classified into grade 1 and grade 4. MRI evaluation helped identify the disease at an earlier stage in patients with grade 1 fistula. The large number of patients with grade 4 classification may be attributed to the recurrence of fistulous tracts due to residual disease.

Discussion

Anatomy

Knowledge of anatomy of the pelvic region is crucial in assessing the fistulous tracts (►**Fig. 8**). The anal canal measures around 2.5 to 5 cm in length.[10] It extends from the level of the levator ani muscle to the anal verge and is surrounded by the internal and external anal sphincter. The external anal sphincter is composed of striated muscle and merges proximally with the sling-like puborectalis muscle. The puborectalis muscle determines the anorectal junction. The internal sphincter is the distal extension of the inner circular smooth muscle layer of the rectum. An intersphincteric space containing loose

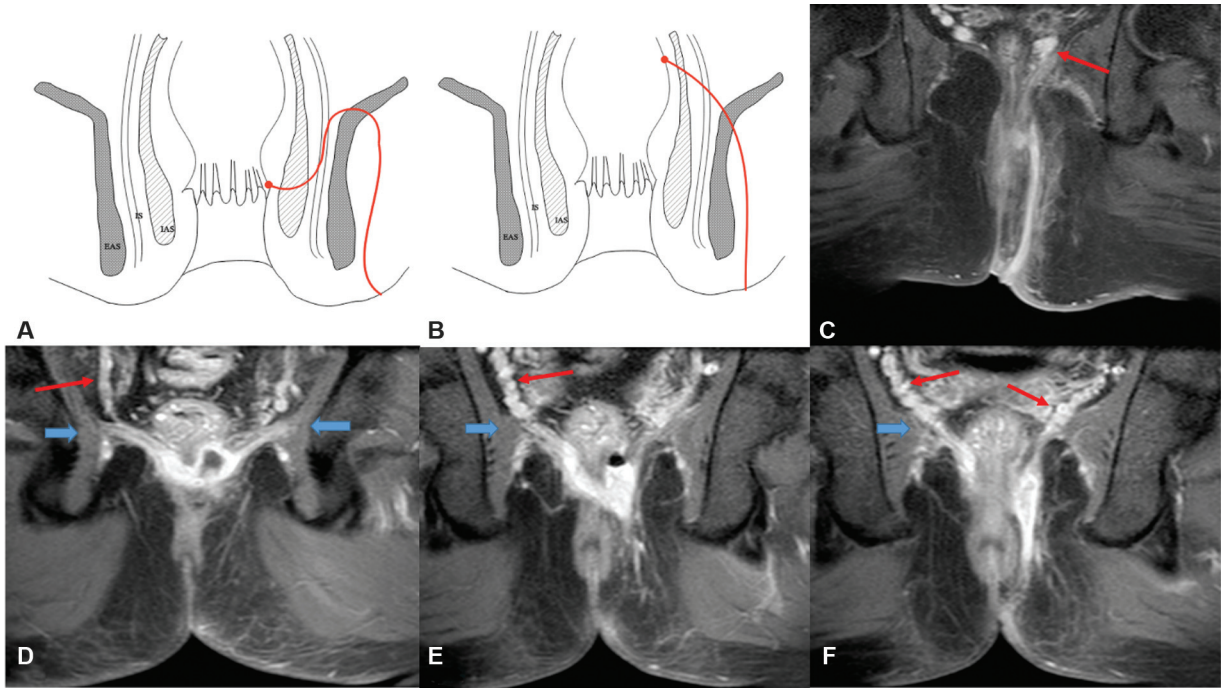

Fig. 7 Grade 5: supralevator and translevator disease. (**A**) Coronal drawing of the anal canal shows a trans-sphincteric fistula. (**B**) Coronal drawing of the anal canal shows a trans-sphincteric fistula. (**C**) Coronal post-contrast image shows supralevator extension (*arrow*) of a trans-sphincteric fistula on left side. (**D, E**) Coronal post-contrast image shows supralevator extension (*arrow*) of a trans-sphincteric fistula on the right side. (**F**) Coronal post-contrast image shows supralevator extension of a trans-sphincteric fistula on both sides (*denoted by arrows*). Levator ani has been denoted by open arrows.

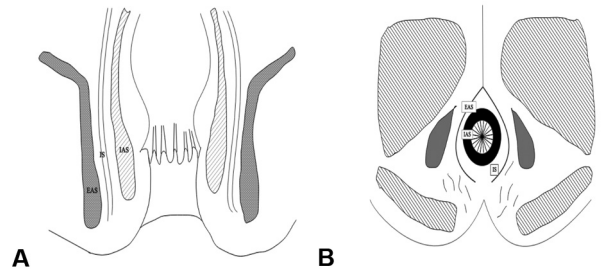

Fig. 8 (**A**) Coronal drawing of the anal canal showing normal anatomy. (**B**) Axial drawing of the anal canal showing normal anatomy. EAS, external anal sphincter; IAS, internal anal sphincter; IS, intersphincteric space.

fat exists between the internal and external sphincter muscles and is contiguous with the supralevator space superiorly. The intersphincteric space is an important anatomical plane as a majority of fistulas either stay limited to or transcend this plane. The fistulous tract may be complicated by secondary tracts and abscesses and present in the pelvic spaces, more commonly in the ischioanal space. The ischioanal space is present lateral to the external anal sphincter and is bounded by the levator ani superiorly. The abscesses may present in the deep post anal space which is continuous and surrounds both sides of the internal anal sphincter. When infected, the deep post anal space forms the characteristic "horse-shoe" abscess. The fistula may even have a supra levator extension into the peritoneum taking an extrasphincteric or a suprasphincteric route. Histologically, the anorectal mucosa is variable and is comprised of columnar epithelium in the rectum and stratified squamous epithelium in the anal region. The distal border of this anal transitional zone is called the dentate or pectinate line.[11] Longitudinal mucosal folds are present just proximal to the dentate line and are called the columns of Morgagni. These longitudinal folds are linked to each other through anal valves, which in turn form small pockets called crypts of Morgagni.[10] The dentate line lies approximately 2 cm proximal to the anal verge and is a crucial landmark in fistula in ano because the anal glands empty into the anal canal at this point.[12]

Pathophysiology

In 1880, Hermann and Desfosses suggested that infection of the anal glands could be a cause of fistula-in-ano. They described some small glands which ramify in the internal sphincter and anal canal submucosa, to finally discharge into the anal canal lumen at the muco-cutaneous junction. In 1934, Tucker and Hellwig[13] suggested that the chronicity of the condition is attributed to the ano-glandular nature of the epithelium present in part of the tract near the internal opening. Eisenhammer[14] described the cause of most anal abscesses and fistulae to the presence of infection in the intersphincteric space.[12]

According to the "cryptoglandular hypothesis," 90% of PFs are believed to result from impaired drainage of the anal glands.[3] Occlusion of the drainage pathways of the anal glands may lead to abscess formation. The abscess may either spontaneously drain into the anal canal via internal drainage or may need surgical incision and drainage.[15] Incompletely drained abscesses may take alternate pathways through the intersphincteric space, or across sphincters, thus creating fistulous tracts. Approximately 35% of patients develop recurrence after initial presentation for cryptoglandular perianal abscesses.[16,17] A small proportion of PFs result from other causes, such as Crohn's disease, tuberculosis, pelvic infection, diverticulitis, carcinoma, or radiation therapy.[4] In the presence of an extra-sphincteric fistula, the possibility of an underlying pelvic disease such as Crohn's should be considered.

MRI in the Evaluation of Perianal Fistulas

PF is a very common infective-inflammatory condition affecting the region around the anal canal and the anorectal region. The incidence of PF ranges from approximately 1 to 2 per 10,000 individuals with a 2:1 male to female predominance.[8] The most common presenting complaint is discharge from the external cutaneous opening with pain in the anorectal region.[18] Fistulous tracts are notorious for recurrence. Treatment is primarily surgical, and thus the importance of preoperative planning cannot be emphasized enough. Various imaging modalities have been used to image fistulous tracts and their secondary extensions, including conventional contrast fistulography, computed tomography (CT) fistulography, and endoluminal ultrasonography but with limited role.[1] In previous studies, MRI has proved to be a stronger predictor of postoperative outcome than information obtained from surgical exploration.[1,19] MRI examination provides detailed information about the pelvic structures including anatomy of the sphincteric complex, pelvic floor muscles, and the relationship of the fistulous tract with respect to the pelvic floor structures. The findings of age, sex distribution, clinical distribution, and etiopathogenesis were similar to many previous studies worldwide.[4–6] However, in our study we found that the maximum number of cases were of grade 1 (36.73%), followed by grade 4 (34.69%) PFs. This meant that simple noncomplicated fistulas-in-ano were most common in the rural population of North India close to the NCR . This was closely followed by grade 4 case and were cases which had previous history of multiple surgeries and recurrences. Most studies done in European nations and America had a high percentage of grade 1 up to 70% and a low percent of grade 4 anal fistulas.[1,6] To our knowledge, this is the second study in literature evaluating the prevalence of PF in the rural population. In the first published study by Sankar and Vidhya, PF was found to be more prevalent in males and reported mean age of 39.74 ± 11.92. Grade IV was the most common reported PF in 26.2% of patients followed by Grade III and Grade II PFs.[20]

In our study, we also found grade 5 PFs were found only in 2.04% of all patients. This is because prevalence of Crohn's disease is very less in our rural population. In the United Kingdom it is around 24% and rest of European nations around 8% which is significantly higher than in our rural population.[21] Our study, however, revealed a high prevalence of recurrence following surgery.

Conclusion

PFs are one of the oldest known diseases of mankind and surgery is the definitive treatment. Despite many advancements in surgical techniques recurrent fistulas are common. From our study, we concluded that there was a high prevalence of grade 4 anal fistulas in the rural population of our region largely due to recurrence and complicated fistulas.

Our recommendation from this study is that MRI evaluation of PFs is of great importance in presurgical mapping of the course of fistula as well as its relation with pelvic anatomy. This will ensure a more favorable outcome of the surgery, decrease the prevalence of grade 4 fistulas, and give a better quality of life to these patients. We also recommend prospective studies for evaluation of psycho-social factors contributing in delayed treatment seeking behavior as a contributing factor toward increased prevalence of late stage 4 type PF in rural population.

Funding
None.

Conflict of interest
None declared.

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