Original Article
DOI: https://doi.org/10.70749/ijbr.v3i6.1456

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://induspublishers.com/IJBR
ISSN: 2960-2793/ 2960-2807

Crossref

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To Evaluate Magnetic Resonance Imaging's (MRI) Diagnostic Accuracy in the Pre-Operative Assessment of Peri-Anal Fistula

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ARTICLE INFO

Keywords: Peri-anal Fistula, Magnetic Resonance Imaging, Sensitivity.

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Declaration
Authors' Contribution
All authors equally contributed to the study and approved the final manuscript

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History
Received: 05-03-2025 Revised: 06-06-2025
Accepted: 17-06-2025 Published: 30-06-2025

ABSTRACT

Introduction: Because a misdiagnosis could result in a recurrence of the disease or potential surgical side effects including fecal incontinence, the goal of this study was to precisely detect and describe the perianal fistula and assist surgeons in selecting the optimal surgical treatment. **Study design:** Cross-sectional (validation) study. **Settings:** Radiology department of JPMC, Karachi. **Methodology:** The study comprised 269 patients aged 18 to 70 years presenting to the radiology department of JPMC, Karachi, and who had frequent anal pain and swelling around anus with bowel movements. The study excluded patients with recurrent peri-anal disease, those who had undergone surgery, those who were on anti-inflammatory medications for any reason, and those who had undergone surgery. The 1.5 Tesla system (GE HDXT medical system) was used to examine every patient in the MR unit. The MRI results were not disclosed to the surgeon, and the surgical findings were compared for PAF. The outcomes were verified and compared to the surgical results. **Results:** MRI sensitivity was (94.05%), specificity (86.14%), PPV (91.86%), NPV (89.69%), and diagnostic accuracy (91.08%) in the pre-operative evaluation of peri-anal fistula. **Conclusion:** According to the study's findings, MRI is an extremely sensitive and precise imaging technique for pre-operative evaluation of peri-anal fistula.

INTRODUCTION

An inflammatory condition of the ano-rectal region, peri-anal fistula (PAF) or fistula-in-ano is characterized by an aberrant tract that connects an internal opening, usually the anal canal, to an external cutaneous opening in the perianal region.[1] With a high prevalence of 1.2% and an incidence of 15–38%, it is the second most prevalent anorectal area problem in surgical surgery. It primarily affects adult males, with the highest incidence occurring between the third and fifth decades.[2]

The evaluation of fistula patients was done using a variety of radiological modalities. Conventional fistulography was employed, but its diagnostic yield was limited since it was difficult to identify the internal opening, particularly if it was occluded by debris. It has been shown that magnetic resonance imaging (MR) can precisely represent the architecture of the perianal region and the connection between fistulas and the ischiorectal fossae and pelvic diaphragm (levator plate).[3] Preoperative imaging will become more common in the future since magnetic resonance imaging (MR) results have been demonstrated to impact surgery and significantly reduce the risk of recurrence. Magnetic resonance imaging has recently emerged as the gold standard method for assessing PAF prior to surgery.[4] Finding the connection between fistulous track and the sphincter complex is one of the goals of the MRI research for perianal fistulas. The track is used to determine whether the sphincter is implicated, whether it passes through both layers of the sphincter or just the internal sphincter, as well as to locate any abscess cavities and secondary fistulous tracks. Relapse and consequent therapy failure may result from a failure to identify and eliminate them.[5] The supra-levator space, the ischiorectal fossa, or the inter-sphincteric plane might all contain secondary tracks or ramifications. In these planes, "horseshoe" tracks may cross the midline and travel around in a circle.[6] Radiologists have created a new grading system for PAF that combines abscesses and secondary expansions and is based on the St. James University Hospital Classification into 5 classes (Annexure I) based on the axial plane landmarks.[7] Algazzar et al. 8 found that preoperative MRI had a 75% sensitivity, 92% specificity, and 84.6% accuracy rate in predicting the degree of perianal illness. According to a different study by Kulvinder et al., MRI's sensitivity and specificity for accurately identifying and classifying the primary tract were 95.56% and 80%, respectively; for abscesses, they were 87.50% and 95.24%.[8]

Because a misdiagnosis could result in a recurrence of the disease or potential surgical side effects including fecal

incontinence, the goal of this study was to precisely detect and describe the perianal fistula and assist surgeons in selecting the optimal surgical treatment.

METHODOLOGY

This descriptive, cross-sectional study was conducted on 269 patients aged 18 to 70 years presenting to the radiology department of JPMC, Karachi from June 2022 to December 2022, and who had frequent anal pain and swelling around anus with bowel movements. A sample size of 269 cases with a 95% confidence level, a prevalence of 16.0%[8], and a 2.8% intended precision for sensitivity of 87.50%[13] and specificity of 95.23%[8]. Using a non-random consecutive sampling strategy, patients were chosen. The study excluded patients with recurrent peri-anal disease, those who had undergone surgery, those who were on anti-inflammatory medications for any reason and those who had undergone surgery.

This study was conducted after the approval of institutional ethical review board. Informed consent was taken from all the patients before assigning them to study. Data was collected on prescribed proforma. The 1.5 Tesla system (GE HDXT medical system) was used to examine every patient in the MR unit of the Radiology and Imaging Department at JPMC, Karachi. A 32-channel body coil with a phased array was employed. The first three plane photos were acquired. Both the T1-weighted fast spin echo with fat suppression and the T2-weighted fast spin echo with fat suppression showed axial slices that were in line with the pelvic diaphragm on the sagittal pictures. The coronal slices were then planed onto the same sagittal plane parallel to the anal canal and slanted forward from the vertical by around 45 degrees using T1-weighted fast spin echo with fat suppression images and T2-weighted fast spin echo with fat suppression images. The contrast material (GdDPTA) (Magnevist) was administered intravenously following the acquisition of the axial and coronal images. The T1-weighted images were then acquired for the axial and coronal regions. Axial pictures were used to locate the internal opening. The purpose of acting and interpreting is to assess them according to the classification provided, MR images were used to identify the principal track, its orientation with regard to the anal clock, and its path and relationship with respect to the anal sphincter complex. Images were analyzed for connection between the tracts when there were several of them. The MRI results were not disclosed to the surgeon, and the surgical findings were compared for PAF. The outcomes were verified and compared to the surgical results.

Software called SPSS 25.0 was used to evaluate the data that was gathered. For age, height, weight and symptom duration, the mean and SD or median (IQR) were computed. The frequency and proportion of gender, diagnosis of PAF on MRI and surgical findings (positive/negative) were displayed. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of MRI will be calculated comparing with surgical findings. Stratified variables included age, gender, BMI, residence and duration of symptoms.

RESULTS

The study's age range was 18–70 years old, with a mean age of 48.77 ± 10.02 years. According to Table I, the majority of the patients—165, or 61.34%—were in the 45–70 age range. Out of these 269 patients, 162 (60.22%) were males and 107 (39.78%) were females with male to female ratio of 1.5:1. The illness lasted 4.97 ± 2.15 months on average. Table I displays the distribution of patients with different variables.

Of the patients who tested positive for peri-anal fistula on MRI, 158 (True Positive) had peri-anal fistula, while 14 (False Positive) had no peri-anal fistula on surgical findings. Of the 97 patients who tested negative for MRI, 10 (False Negative) had peri-anal fistula on surgery, but 87 (True Negative) did not (p=0.0001), as Table II demonstrates. MRI sensitivity was (94.05%), specificity (86.14%), PPV (91.86%), NPV (89.69%), and diagnostic accuracy (91.08%) in the pre-operative evaluation of peri-anal fistula. Table III displays the diagnosis accuracy stratification by age, gender, duration, BMI and residence.

Table I

Distribution of patients with other confounding variables (n=269)

Confounding variables		Frequency	%age
Age (years)	18-45	104	38.66
	46-70	165	61.34
Gender	Male	162	60.22
	Female	107	39.78
Duration of disease (months)	≤6	211	78.44
	>6	58	21.56
BMI (kg/m²)	≤30	140	52.04
	>30	129	47.96
Residence	Rural	156	57.99
	Urban	113	42.01

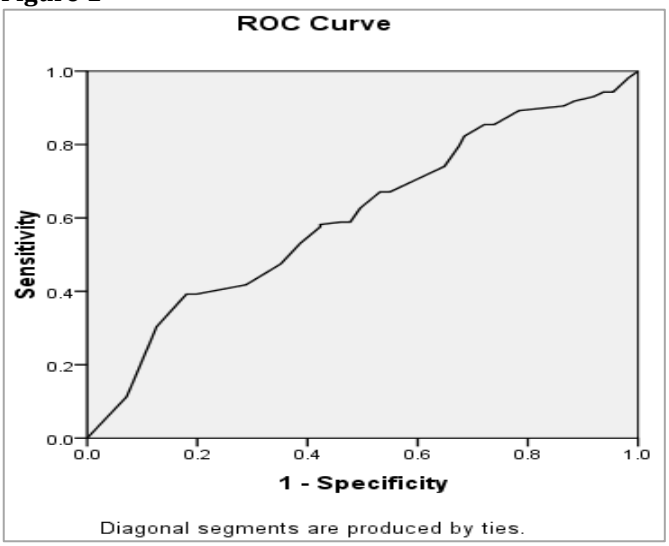
Table II

Diagnostic accuracy of magnetic resonance imaging (MRI) in the pre-operative evaluation of peri-anal fistula.

	Surgical findings (+ive)	Surgical findings (-ive)	P-value
MRI (+ive)	158 (True positive)	14 (False Positive)	0.0001
MRI (-ive)	10 (False negative)	87 (True Negative)	

Sensitivity: 94.05%
Specificity: 86.14%
Positive Predictive Value (PPV): 91.86%
Negative Predictive Value (NPV): 89.69%
Diagnostic Accuracy: 91.08%

Figure 1



Area under the curve = 0.605

Table III

Stratification of diagnostic accuracy with respect to age, gender, duration of disease, BMI and residence.

		Sensitivity	Specificity	PPV	NPV	DA	
Age (years)	18-45	88.14%	88.89%	91.23%	85.11%	88.46%	0.001
	46-70	97.25%	80.43%	92.17%	92.50%	92.26%	0.001
Gender	Male	91.84%	87.50%	91.84%	87.50%	90.12%	0.001
	Female	97.14%	83.78%	91.89%	93.94%	92.52%	0.001
Duration (months)	≤6	92.91%	88.10%	92.19%	89.16%	90.99%	0.001
	>6	97.56%	76.47%	90.91%	92.86%	91.38%	0.001
BMI (kg/m²)	≤30	92.78%	90.48%	93.75%	89.06%	91.88%	0.001
	>30	95.77%	78.95%	89.47%	90.91%	89.91%	0.001
Residence	Rural	93.20%	88.68%	94.12%	87.04%	91.67%	0.001
	Urban	95.38%	83.33%	88.57%	93.02%	90.27%	0.001

DISCUSSION

A somewhat common condition is perianal fistula. Cryptoglandular inflammation is the etiological cause that is most frequently addressed in the literature. But it can also happen as a result of other conditions, such as Crohn's disease.[9] Anal sphincter and fistulous tract anatomy can be thoroughly understood by MRI. For successful surgical outcomes, preoperative evaluation and characterization of the fistulous tract and related comorbidities are essential.[10-12]

269 patients having suspected perianal fistula were included in our study. According to research by Halligan et al.[13] and Rehman et al.[14], the majority of patients were adult males, with a mean age of 48.77 +/- 10.02 years. According to our experience, the diagnostic accuracy is increased when the right sequences are combined. Similar to the bulk of earlier research, our results revealed that the intersphincteric type is the most common type.[15,16]

Our study's overall MRI accuracy in relation to surgical results was 91.08%, which was in line with Elzawawi MS study[17] who showed 93.9% accuracy. The stated 94% MRI sensitivity in identifying the fistulous tract was in line with a prior Ishfaq's study[18] (sensitivity of 92.94%). In our instance, the specificity of 86.14% was similar to that of Phan et al. (85%).[19]

121 patients participated in a cross-sectional validation research. The patients were 43±12.77 years old on average. 32% of patients were female, and 68% of patients were male. For evaluating perianal fistulas, the MRI's diagnostic accuracy is 95.04%, its sensitivity is 95.72%, its specificity is 75%, its PPV is 99.11%, and its NPV is 37.50%. Based on surgical findings, the MRI's diagnostic accuracy for abscess was 90.08%, with a sensitivity (91.45%), a specificity (50%), a PPV (98.16%), and a NPV (16.66%).[20]

One hundred patients participated in a different descriptive, cross-sectional study[11]. 87 patients had perianal fistulas detected by MRI. Eleven patients had no perianal fistula, while 89 individuals had one verified by operational results. When MRI was used to diagnose perianal fistulas, its overall sensitivity (Sn), specificity (Sp), positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy (DA) were 95.5%, 81.8%, 97.7%, 69%, and 94%, respectively. Intersphincteric grade 1 fistulas were the most prevalent kind. Grade 3, 4, and 5 fistulas were more likely to develop an abscess. Most frequently, the internal fistulous track opening was found posteriorly in the midline at six o'clock.[11]

Ninety participants participated in one local trial.[21] Of these, 7 were female (8%), and 90,83 were male (92%). 43+/-16SD was the mean age. Of the 90 patients, 76 had a perianal fistula detected by imaging, and 74 had one after surgery. The determined diagnostic accuracy was 93%, the sensitivity was 94.9, the specificity was 83.3%, the positive predictive value was 97%, and the negative predictive value was 71%.[21]

For perianal fistulas, magnetic resonance imaging has surpassed endoanal ultrasonography, CT, and fistuography and has the best agreement with clinical and surgical findings. Dynamic MRI, which assesses the fistulous tract in the arterial, venous, and delayed phases, is one of the recent approaches added to the MR protocol that have been described in the literature. Nevertheless, the innovation has not yet been included into the protocol in our configuration. The added use of an endoanal coil to illustrate sphincter injury and atrophic alterations is another novel technique that has been addressed in the literature; nevertheless, it has limitations related to range of vision, expense, and pain.[22]

The current study has several drawbacks. First, only primary cases were taken into consideration, and second, scans are expensive. Recurrent or previously operated instances where scar tissue or fibrosis distorts the anatomy and presents an uncommon challenge are not applicable to our investigation.

CONCLUSION

MRI is highly accurate in showing the primary fistulous tract and its types, as well as its relationship to the internal sphincter, pelvic diaphragm, and ischiorectal fossa, as well as any associated abscesses, to help guide preoperative assessment and surgical approach of perianal fistulas and to minimize complications and recurrences.

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