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Diagnostic Accuracy of Magnetic Resonance Imaging in Detecting Perianal Fistula, Taking Surgical Findings as Gold Standard

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ABSTRACT

Objectives: To determine the diagnostic accuracy of magnetic resonance imaging in detecting perianal fistula, taking surgical findings as gold standard. **Study design:** Cross-sectional (validation) study. **Settings:** Department of Radiology, Madinah Teaching Hospital, Faisalabad. **Study Duration:** 15th June 2024 to 14th December 2024. **Methodology:** The study comprised 140 patients aged 18 to 70 years presenting with complaints of perianal discharge with or without perianal pain. Patients who had surgery for perianal fistula, history of perianal fistulectomy, cardiac pacemakers and indwelling metallic stents were excluded. After that, MRIs were taken of each patient using a 1.5 T MR scanner. A phased-array coil was employed in all methods to capture images under all conditions. The distal rectum, anal canal, and subcutaneous tissues were all included in the imaging volume. Images of fat saturation were captured in the coronal, oblique, and axial planes. A radiologist examined the pictures and noted whether or not there was a perianal fistula. After that, the patients had surgery, and the results were recorded. Operative and MRI results were contrasted. **Results:** The peri-anal fistula was detected by MRI with sensitivity of 92.86%, specificity of 85.71%, PPV of 90.70%, NPV of 88.89%, and diagnostic accuracy of 90.0%. **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

A fistula-in-ano is a hollow passageway or cavity that has granulation tissue lining it. This fistula has two ends, one of which opens in the anal canal and the other in the perianal region.[1] Whereas the perianal aperture is referred to as the secondary or exterior opening, the anal canal opening is known as the primary or internal opening. The same primary opening in the anal canal may give rise to one or more subsidiary apertures. Usually, perianal abscesses are followed by these fistulae. The quality of life is greatly impacted by fistula-in-ano, which has a propensity to be chronic.[2] The main issue with an ano fistula is the discomfort that comes from the constant draining from the fistula, which can lead to hygiene issues and, in certain situations, catastrophic complications including septicemia.[3]

Accurate preoperative anatomical mapping is essential for the successful management of a fistula, and imaging helps accomplish this. Magnetic resonance imaging (MRI), endoanal ultrasonography, and contrast fistulography are the three primary imaging modalities that are employed.[4,5] Every one of these approaches has benefits and drawbacks. The gold standard for evaluating perianal fistulas, identifying anatomy, and directing surgery is magnetic resonance imaging (MRI). Standard anatomical sequences (T1 or T2), edema evaluation (T2/fat-saturated MRI image (T2/FS) or short tau inversion recovery (STIR)), abnormal contrast enhancement evaluation (T1/fat-saturated MRI image (T1/FS) post-contrast), abnormal diffusion evaluation, or a combination of these are the main methods. These MRI methods are essential, yet.[6] According to a local study, 69.3% of people have perianal fistulas, and MRI has a sensitivity, specificity, and diagnostic accuracy of 87.7%, 70.2%, and 82.40%, respectively.[7] Using surgical findings as the gold standard, another local investigation indicated that the sensitivity, specificity, PPV, NPV, and diagnostic accuracy of STIR as limited protocol MRI pelvis in identifying perianal fistulae were 96.6%, 67.7%, 92.0%, 84.0%, and 90.6%, respectively.[8] According to Bayrak M et al., MR imaging had a diagnostic accuracy of 97.8% and 97.5% in recognizing the internal opening and fistula tract, respectively.[9] A study revealed that 41.3% of people had perianal fistulas.[10]

The goal of this research is to determine how well MRI detects perianal fistulas so that it can be added to the standard protocol for this condition and replace other modalities like CT scans and fluoroscopic fistulography,

which both expose patients to ionizing radiation, as well as more invasive transperineal or endoanal ultrasounds. Furthermore, a sizable sample size would be used in the investigation, thus the findings might be sufficiently trustworthy. Furthermore, there isn't any local proof of this. Therefore, we want to carry out this study since it will aid in assessing the diagnostic precision of MRI in a local context.

METHODOLOGY

This descriptive, cross-sectional study was conducted on 140 patients aged 18 to 70 years presenting to the radiology department of Madinah Teaching Hospital, Faisalabad, and who had complaints of perianal discharge with or without perianal pain. Sample size of 140 cases has been calculated with 95% confidence level, prevalence of perianal fistula as 41.3%[10] and 10% desired precision for 87.70% sensitivity and 70.20% specificity of MRI in detecting perianal fistula. Using a non-random consecutive sampling strategy, patients were chosen. Patients who had surgery for perianal fistula, history of perianal fistulectomy, cardiac pacemakers and indwelling metallic stents were excluded.

The institutional ethical review board gave its clearance for this investigation to be carried out. Prior to their assignment to the trial, all patients gave their informed consent. Height, weight, BMI, age, gender, and length of symptoms were recorded. After that, MRIs were taken of each patient using a 1.5 T MR scanner. A phased-array coil was employed in all methods to capture images under all conditions. The distal rectum, anal canal, and subcutaneous tissues were all included in the imaging volume. Images of fat saturation were captured in the coronal, oblique, and axial planes. A radiologist examined the pictures and noted whether or not there was a perianal fistula. After that, the patients had surgery, and the results were recorded. Operative and MRI results were contrasted. A freshly created proforma was used to record all of the data.

Software called SPSS 25.0 was used to evaluate the data that was gathered. The data's normality was examined using the Shapiro-Wilk test. The mean ± SD or median (IQR) were calculated for age, BMI, and symptom duration. Frequency and percentage were calculated for gender, perianal fistula on MRI, and surgery (present or absent). A 2x2 contingency table was used to determine the sensitivity, specificity, NPV, PPV, and diagnostic accuracy of magnetic resonance imaging in detecting perianal fistulas, with surgical findings serving as the gold standard. Stratification was used to adjust for effect modifiers such as age, gender, duration of symptoms, and BMI. Additionally computed were the MRI's post-stratification sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy. Additionally, the likelihood ratio was computed.

Table

Perianal fistula on MRI		Perianal fistula on surgery	
		Present	Absent
	Present	**True Positive**	**False Positive**
	Absent	**False Negative**	**True negative**

RESULTS

With a mean age of 48.77 ± 10.02 years, the study's participants ranged in age from 18 to 70. Table I shows that 85, or 61.43%, of the patients were between the ages of 45 and 70. The male to female ratio of these 140 patients was 1.5:1, with 162 (60.22%) being male and 107 (39.78%) being female. The average duration of the sickness was 4.97 ± 2.15 months. The distribution of patients with various factors is shown in Table I.

Eight patients (False Positive) had no peri-anal fistula on surgical findings, but 78 patients (True Positive) had one after testing positive for it on MRI. Table II shows that of the 54 patients with negative MRI results, 6 (False Negative) had peri-anal fistula on surgery, while 48 (True Negative) did not (p=0.0001). The peri-anal fistula was detected by MRI with sensitivity of 92.86%, specificity of 85.71%, PPV of 90.70%, NPV of 88.89%, and diagnostic accuracy of 90.0%. The diagnosis accuracy stratification by age, gender, duration, and BMI is shown in Table III.

Table I

Distribution of patients with other confounding variables (n=140)

Confounding variables		Frequency	%age
Age (years)	18-45	54	38.57
	46-70	85	61.43
Gender	Male	82	58.57
	Female	58	41.43
Duration of disease (months)	≤6	81	57.86
	>6	59	42.14
BMI (kg/m^2)	≤30	60	42.86
	>30	80	57.14

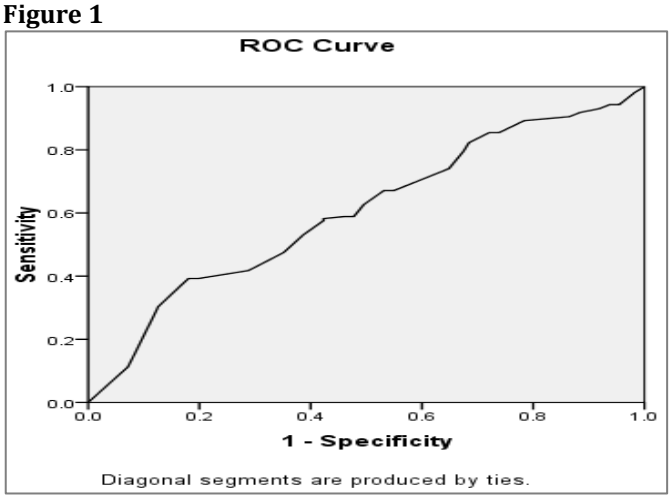
Table II

Diagnostic accuracy of magnetic resonance imaging in detecting perianal fistula, taking surgical findings as gold standard.

	Surgical findings (+ive)	Surgical findings (-ive)	P-value
MRI (+ive)	78 (True positive)	08 (False Positive)	
MRI (-ive)	06 (False negative)	48 (True Negative)	0.0001

Sensitivity: 92.86%
Specificity: 85.71%
Positive Predictive Value (PPV): 90.70%
Negative Predictive Value (NPV): 88.89%
Diagnostic Accuracy: 90.0%

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**

DISCUSSION

The disorder known as perianal fistula is rather frequent. The most commonly discussed etiological cause in the literature is cryptoglandular inflammation. However, other illnesses like Crohn's disease can also cause it. MRI provides a comprehensive understanding of the anatomy of the anal sphincter and fistulous tract. Preoperative assessment and characterization of the fistulous tract and associated comorbidities are critical for favorable surgical results. Our study comprised 140 patients with suspected perianal fistulas.[11,12] Most patients were male adults, with a mean age of 48.77 +/- 10.02 years, according to studies by Halligan et al.[13] and Rehman et al.[14] Our experience has shown that combining the appropriate sequences increases diagnostic accuracy. Our findings showed that the intersphincteric form is the most prevalent, which is consistent with the majority of previous studies.[15,16]

The total MRI accuracy in our analysis with respect to surgical outcomes was 90.0%, which was consistent with the 93.9% accuracy seen in the Elzawawi MS study.[17] The reported MRI sensitivity of 92.86% in detecting the fistulous tract was consistent with a previous study by Ishfaq[18] (sensitivity of 92.94%). The specificity of 86.14% in our case was comparable to Phan et al.'s (85%).[19] A cross-sectional validation study involved 19 121 patients. The average age of the patients was 43±12.77 years. Of the patients, 68% were men and 32% were women. The MRI has a 95.04% diagnostic accuracy, 95.72% sensitivity, 75% specificity, 99.11% PPV, and 37.50% NPV for assessing perianal fistulas. The MRI's diagnostic accuracy for abscess, based on surgical findings, was 90.08%, with a sensitivity of 91.45%, a specificity of 50%, a PPV of 98.16%, and an NPV of 16.66%.[20]

Because of its high picture resolution and capacity to highlight crucial details for treatment planning, magnetic resonance imaging (MRI) is still the most widely utilized radiological method for researching and diagnosing the many kinds of fistulas and their characteristics.[21] Non-contrast MRI has demonstrated comparable diagnostic efficacy in detecting perianal fistulas, particularly in patients with renal insufficiency, even though contrast-enhanced MRI gives radiologists more confidence.

In a different study with 50 patients, 14 of them had 100% fibrotic fistulas on post-treatment MRI. All of them had long-term clinical closure, indicating the usefulness of MRI in monitoring post-operative recovery. Deep abscesses and intricate fistulas can be precisely identified with MRI thanks to its excellent spatial resolution and range of view.[22] Our study showed a diagnostic accuracy of 90.0% for identifying alimentary fistulas, which is in line with prior research that found MRI accurately predicted surgical anatomy in 85.71% of instances.[23] One local trial involved ninety participants. Of these, 90,83 were men (92%), and 7 were women (8%). The mean was 43+/-16SD. Of the 90 patients, 74 developed a perianal fistula following surgery, and 76 had one identified by imaging. 93% was the calculated diagnostic accuracy, 94.9 was the sensitivity, 83.3% was the specificity, 97% was the positive predictive value, and 71% was the negative predictive value.[24]

Using surgical findings as the gold standard and offering high sensitivity (92.86%) and specificity (85.71%) for MRI in detecting perianal fistulas are among the study's highlights. The dependability of the data is supported by the sample size of 140 patients, and comprehension is improved by the distinct classification of fistula kinds. The significance of MRI in treatment planning is highlighted by the statistical analysis and its capacity to diagnose complex fistulas.[25] For patients with renal insufficiency, the contrast-enhanced and non-contrast MRI comparison provides useful information.

The small sample size, absence of long-term follow-up data, and exclusive dependence on MRI without taking into account alternative imaging modalities such anal endosonography are some of the study's drawbacks. The results' comprehensiveness is limited by the lack of clinical criteria including medical history and the ambiguity of the patient selection process, which could create bias. Furthermore, the study ignores contrast-agent usage variability, which may affect the diagnostic precision of MRI.

CONCLUSION

In order to guide preoperative assessment and surgical approach of perianal fistulas and to reduce complications and recurrences, magnetic resonance imaging (MRI) is a highly accurate way to show 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.

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