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DIAGNOSTIC ACCURACY OF MAGNETIC RESONANCE IMAGING FOR FISTULA IN ANO, KEEPING FISTULOGRAM AS INITIAL INVESTIGATION

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Abstract

OBJECTIVE

To determine the diagnostic accuracy of magnetic resonance imaging for fistula-in-ano, keeping fistulogram as the initial investigation.

METHODOLOGY

This study was a cross sectional, registered at Jinnah Postgraduate Medical Centre (JPMC), Karachi with 270 patients between 18 to 65 years where clinical signs of fistula in ano were present. Patients were recruited utilizing non-probability convenience sampling who all underwent both MRI fistulography and X-ray fistulography for assessment. Statistical data analysis was conducted using version 26.0 of the SPSS software; sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of the main diagnostic parameters were calculated.

RESULTS

Among 270 patients, the mean age was 45.26 ± 12.86 years, with 85.6% males (n=231) and 14.4% females (n=39). MRI demonstrated a diagnostic accuracy of 92.96%, with 70.73% sensitivity, 96.94% specificity, 80.56% PPV, and 94.87% NPV. MRI detected more fistula tracts than X-ray fistulography, confirming its higher accuracy in diagnosing fistula in ano.

CONCLUSION

The results indicate that MRI provides clearer visualization of fistula tracts and secondary extensions, aiding in more precise surgical planning. While X-ray fistulography remains commonly used, its limitations in detecting complex cases highlight the need to prioritize MRI for improved diagnostic accuracy and reduced recurrence rates, ultimately enhancing patient outcomes.

INTRODUCTION

Anorectal fistula is a common pathologic entity involving an abnormal epithelialized tract that connects the anorectum and perianal skin [1]. According to a study, the prevalence of fistula in ano in Europe is around 18.37 per 100,000 [2]. Several lifestyle factors, particularly physical inactivity, obesity (66%), non-vegetarian diet (61%), alcohol (47%) and chronic smoking are responsible for

developing type 2 diabetes [3]. Additionally, pathological conditions such as perianal sepsis (62%), tuberculosis (6%) [3], anal fissures (8%) [4], perianal trauma (4%) and Crohn's disease are in favour of the disease [5]. The presenting complaints most often seen in the patients include pain (32%), discharge (30%), swelling (18%), pruritus (8%), constipation (6%), rectal bleeding (2%), and fever (4%) [4]. Park [5] classified fistula in ano into 4 types (intersphincteric, transsphincteric, suprasphincteric and extrasphincteric) for clinical decision and management. Depending on the type and severity of the fistula treatment involves fistulotomy, fistulectomy, and placement of a seton [6].

The decision for surgical intervention depends on several factors such as, the path of the main tract, whether there are secondary extensions, the location of the internal and external openings and complications associated with it [7]. Diagnosis involves a detailed clinical examination, often complemented by proctosigmoidoscopy, as well as sophisticated imaging studies such as fistulograms, endoanal ultrasonography, and magnetic resonance imaging (MRI) [8]. Although it is more expensive and not widely available, MRI is critical in detecting secondarily extensions, which helps to prevent post-operational recurrence [9].

Several studies assessing the comparative performance of MRI and X-ray fistulography for the preoperative diagnosis of fistula in ano have been published, and all of them showed an advantage of MRI over X-ray fistulography. Research by Tripathi et al. It was found that the mean sensitivity of MRI for identifying fistula tracts was 93.3% which was significantly higher than X-ray fistulography (43.3%) [10]. Similarly, Tewar et al. MRI with 87.5% sensitivity and 94.4% specificity was positive for secondary tracts [11]. However, MRI showed a higher accuracy of 83.3%, compared to 37.5% for fistulography [12]. Minhas et al., in keeping with these findings, showed that the sensitivity and specificity of MRI was 95.5% and 81.8%, respectively, and concluded MRI as a reliable essential noninvasive tool for diagnosing fistula in ano [13].

MRI is more sensitive and specific for detecting fistula tracts, especially for those with secondary extensions or where the tract is incompletely obstructed. On the contrary, X-ray fistulography has an invasive nature and a higher risk of infection, which markedly limits its potential development, especially in immunocompromised patients [10–13]. Despite MRI being less available and costly, its high-detail image of complex fistula tracts leads to more accurate diagnoses, lower recurrence rates, and superior surgical outcomes. Fistulography has limitations, such as lower diagnostic proficiency, resulting in higher recurrent rates of surgical intervention causing added burden to health care facilities. Hence, using MRI as a first line investigation may improve treatment planning and final outcomes by adequately preparing for surgical approaches.

METHODOLOGY

This study was done in the Department of Radiology at Jinnah Postgraduate Medical Centre (JPMC), Karachi in which we included a total of 270 patients, aged between18-65 years, diagnosed with fistula in ano on the basis of clinical examinations. A non-probability convenience sampling technique was used to select participants. Participating patients had one month of persistent perianal discomfort (VAS >6), swelling > 2 cm, and purulent or feculent discharge requiring frequent dressing changes. Patients with past perianal surgical history, recurrent fistula, rectal malignancy, Crohn's disease, tuberculosis, immunosuppression, or pregnancy were excluded. Further, MRI was not performed in subjects who had cardiac implants, intraocular metallic fragments, cochlear implants, metallic orthopedic implants, or claustrophobia because of safety reasons.

At the JPMC Radiology Department, patients fulfilling selection criteria were enrolled after taking the informed consent and were subjected to X-ray fistulography and MRI fistulogram, respectively. Fistulography was performed by inserting a contrast agent into the external opening of the fistula, followed by a tracing of the tract on the X-ray. MRI scanning was conducted using multi sequences, and findings were classified following the St. James's University Hospital MR Imaging Classification to ensure standardized evaluation of fistula morphology.

Statistical analysis was performed using SPSS version 26.0. The diagnostic performance of MRI and X-ray fistulography was assessed by calculating key metrics, including sensitivity, specificity, positive predictive

value (PPV), negative predictive value (NPV), and overall diagnostic accuracy.

RESULTS

This study involved 270 participants, with 231 (85.6%) being male and 39 (14.4%) females. The average age of the study group was 45.26 ± 12.86 years, where 85 individuals (31.5%) fell within the 18–40-year age range, while 185 (68.5%) were above 40 years old. Regarding diabetes prevalence, 96 patients (35.6%) were diabetic, whereas 174 (64.4%) did not have diabetes. In terms of fistula classification, 82 cases (30.4%) were clinically suspected, while 131 cases (48.5%) were confirmed through X-ray fistulography, and 57 cases (21.1%) were diagnosed using MRI findings (TABLE 1).

A comparative analysis between MRI and X-ray fistulography in diagnosing fistula in ano revealed statistically significant differences (p=0.000). MRI successfully detected 29 cases (10.7%), all of which were also identified via X-ray fistulography. However, 7 cases (2.6%) were detected exclusively by MRI, with no corresponding X-ray findings. In contrast, 12 cases (4.4%) were identified through X-ray fistulography but not detected on MRI. The majority of cases (222 patients, 82.2%) were negative on both imaging techniques. The significant p-value highlights a clear diagnostic discrepancy between MRI and X-ray fistulography (TABLE 2).

The diagnostic accuracy of MRI for detecting fistula in ano was further assessed (n=270). The sensitivity of MRI was 70.73%, indicating that it correctly identified 70% of true positive cases. The specificity was 96.94%, demonstrating its effectiveness in ruling out false positives. MRI's positive predictive value (PPV) stood at 80.56%, meaning 80.56% of positive MRI cases were confirmed true positives, while its negative predictive value (NPV) was 94.87%, signifying that 94.87% of MRI-negative cases were truly negative. The overall diagnostic accuracy of MRI in detecting fistula in ano was 92.96%, affirming its reliability as a preferred imaging modality for this condition (TABLE 3).

DISCUSSION

The diagnostic performance of Magnetic Resonance Imaging (MRI) in the diagnosis of fistula in ano in our study was 92.96% (sensitivity = 70.73%; specificity = 96.94%; PPV = 80.56%; NPV = 94.87%). These results indicate that MRI is a good diagnostic test with a high specificity and moderate sensitivity. MRI imaging is an effective preoperative visualization tool that provides anatomic detail of complex fistula tracts.

Tripathi et al. compared the sensitivity of MRI and Fistulogram in detection of fistula in ano and they found MRI to be significantly more sensitive (93.3%) than Fistulogram (43.3%) [10]. This reinforces our conclusions since the increased sensitivity of MRI for identifying smaller, more complex fistula tracts may account for their higher detection rate compared to the standard fistulography. MRI is also more sensitive in cases of complex fistulas where there may be multiple or secondary tracts making it ideal for improved preoperative planning.

Tewar et al. reported that MRI has a sensitivity of 87.5% and specificity of 94.4% for detecting the secondary tracts in cases of fistula in ano [11]. These results confirm our study, especially the high specificity of MRI. This high specificity means that MRI correctly identifies patients not having a fistula who would otherwise undergo unnecessary intervention or false positive.

Sofic et al. Fistulograms have an accuracy of 37.5% and MRI has higher accuracy of 83.3%, for the detection of fistula in ano [12]. The 91.94% diagnostic accuracy with which we find on our study reiterates that MRI has better diagnostic potential than conventional imaging techniques like Fistulograms. MRI identifies the detailed anatomy of the fistula tracts clearly—an advantage that improves surgical planning and execution of more accurate, targeted surgical interventions.

Minhas et al. found a sensitivity of 95% and specificity of 82% for MRI in the detection of fistula in ano [13]. The high sensitivity found in our study is in keeping with previous reports confirming the role of MRI in preoperative evaluation. However, the specificity described by Minhas et al. is lower than in our study, the high sensitivity of MRI guarantees that MRI is a good tool to detect fistula tracts and making treatment decisions.

Halligan et al. stressed the use of MRI as the preferred and gold standard imaging surgery for fistula anatomy and surgical decision-making [14]. The several fistula types like the horseshoe fistula and the

secondary tracts are better evaluated in MRI, making it an essential tool for identifying the exact path of complex fistula tracts and preoperative planning. Garg et al. supported this by showing a high association between MRI findings and operative findings in more than 200 patients [15].

Sharma et al. described completing current imaging methods for measuring fistula in ano, with MRI excelling in visualising complex fistula anatomy superior to other modalities such as ultrasound or X-ray [16]. Thus, confirming the efficacy of MRI in prior imaging for surgical assessment with the aim of better surgical outcomes through accurate identification of fistula tracts.

Vo et al. described the importance of MRI in pre-operative assessment and concluded that, because MRI is able to demonstrate the extent and complexity of fistula tracts, it assists the surgeon in selecting the best surgical technique and decreases both the recurrence and morbidity rates [17]. Similarly, Halligan et al. emphasized by demonstrating how the information obtained from MRI can show clear representations of the anatomic pathways of fistulae in relation to surrounding structures and the use of this tool to avoid surgical errors[18].

Tang et al. investigated the possibility that artificial intelligence-assisted compressed sensing (ACS) for MRI could provide incremental improvements in anal fistula imaging, maintaining that although the degree of anatomical detail provided by MRI is unrivaled, ACS could further boost MRI diagnostic power through enhanced image quality and accelerated scan times [19]. Finally, Li et al. meta-analysis of 3D endoanal ultrasound for anal fistula, concluded it to be an accurate modality. On the other hand, MRI performs better than ultrasound in identifying complicated fistulae anatomy [20].

MRI is more accurate than X-ray fistulography in identifying the fistula tracts but since X-ray fistulography cannot detect secondary extensions and complex tracts, it might lead to higher recurrence rates if used alone. Even though it works well, MRI accessibility, availability, and high cost may result in the underutilization of this modality in resource limiting settings. But since the diagnostic accuracy of MRI is higher, prioritizing, when possible, benefits the patient and the probability of misdiagnosing.

The MRI diagnostic accuracy did not have substantial changes by various patient characteristics (age, gender and diabetic status), indicating that the MRI appears to remain diagnostic accuracy regardless of subgroups of patients. No obvious relationship between the sex of the patients or the age of the patients, though the majority of cases were male and over 40 years of age. This is consistent with previous studies where MRI consistently outperformed other tests in all sub-groups of patients.

In general, supporting these results, MRI should be considered as the primary imaging modality for fistula in ano particularly for cases where secondary extensions or recurrent tracts are suspected. X-ray fistulography is a very low-cost diagnostic tool that is still in widespread use, but it has a lower sensitivity and specificity, necessitating a more selective approach, using MRI when surgery will require accurate mapping of anatomy. Additional work is needed to increase accessibility of MRI and determine its effect on recurrence rates and surgical outcomes in the long-term.

CONCLUSION

The results indicate that MRI provides clearer visualization of fistula tracts and secondary extensions, aiding in more precise surgical planning. While X-ray fistulography remains commonly used, its limitations in detecting complex cases highlight the need to prioritize MRI for improved diagnostic accuracy and reduced recurrence rates, ultimately enhancing patient outcomes.

Table I: Demographic Characteristics of Study Participants (n=270)	
Variable	**n** (%)
Gender	
Male	231 (85.6)

Female	39 (14.4)
Age (Mean ± SD) = 45.26 ± 12.86	
18-40 years	85 (31.5)
>40 years	185 (68.5)
Diabetes Mellitus	
Diabetic	96 (35.6)
Non-Diabetic	174 (64.4)
Fistula Type	
Suspected fistula in Ano	82 (30.4)
Fistula in Ano on Fistulogram	131 (48.5)
Fistula in Ano on MRI	57 (21.1)

Table II: Comparison of MRI and X-Ray Fistulogram for Fistula in Ano (n=270)

MRI Diagnosis	X-Ray Fistulogram		P-Value
	Present	Absent	
Present	29 (10.7)	7 (2.6)	0.000
Absent	12 (4.4)	222 (82.2)	

Diagnostic Accuracy of MRI In Detecting Fistula in Ano (n=270)	
Diagnostic Variables	**MRI**
Sensitivity	70.73%
Specificity	96.94%
Positive Predictive Value	80.56%
Negative Predictive Value	94.87%
Diagnostic Accuracy	92.96%

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