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Diagnostic Accuracy and Clinical Effectiveness of MRI in Evaluating Perianal Fistula: A Comparison With Surgical Findings as the Gold Standard

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Author`s Contribution

[1,6]Substantial contributions to the conception or design of the work; or the acquisition, Final approval of the study to be published [2,3,4]Drafting the work or revising it critically for important intellectual content, analysis, or interpretation of data for the work, [3,5]Active participation in active methodology,

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ABSTRACT

Objective: To evaluate MRI's diagnostic validity and effectiveness in detecting perianal fistula, using surgical findings as the gold standard.

Methodology: This cross-sectional validation study was conducted at the Radiology Department of KRL Hospital from January 5, 2022, to March 25, 2023. A non-probability consecutive sampling method was used to select participants, including all successive patients meeting the inclusion criteria. Sensitivity and specificity were evaluated to evaluate the diagnostic performance of MRI. Variables including patient characteristics, clinical traits, and imaging data were examined to uncover possible correlations with diagnostic accuracy. SPSS 21 software was used for statistical analysis. P-value <0.05 was considered significant.

Results: Among the 49 study participants, MRI was able to detect perianal fistulas with a sensitivity of 92.3%. The level of specificity was high, at 90%. Diagnostic accuracy of MRI was 91.8% for the presence of abscesses and complex fistulous tracts.

Conclusion: Based on the positive overall diagnostic performance in this small sample, this research implies that MRI has the potential as a diagnostic tool for detecting perianal fistula. But the small sample size could have affected how statistically significant the results were. It is necessary to do more research with larger sample numbers to confirm these findings and assess the effect of variables, such as abscesses and intricate fistulous tracts, on the precision of MRI.

Keywords: Magnetic Resonance Imaging, Peri Anal Fistula, Fistula, Effectiveness

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Introduction

A perianal fistula is a channel between the anal region and the anorectal canal, It is a pathological condition. The most frequent cause of anal fistulas is infection and obstruction of the anal glands, located in the intersphincteric plane and produce a cryptoglandular abscess.[1]

Fistula in ano is typically thought to be rather uncommon, with an annual frequency of 1–8 per 10,000 people.[2] The chance of developing a fistula appeared to be higher in patients under the age of 40 and in non-diabetic patients.[3] Stress impairs the immune system and encourages anal sepsis, whereas excessive smoking makes anal fistula recurrences more likely. Anal fistulas typically have idiopathic causes; however, they are considered to be the chronic stage of intramuscular anal gland infection. If the draining duct becomes blocked, it results in the creation of an intersphincteric fistula track or an abscess. A persistently discharge-producing fistula or recurrent abscess results from chronic infection at the primary location in the intersphincteric plane.[5]

The likelihood of recovery is drastically decreased as soon as the fistula formation becomes advanced. Anal fissures, trauma, anal carcinoma, inflammatory bowel disease (IBD), and radiation exposure are some of the

potential reasons.[6] A viable cure is offered by surgical treatment. Preoperative magnetic resonance imaging (MRI) can be used in difficult instances to help decide the best course of treatment. In cases when the sphincter is heavily involved, great consideration must be given to symptoms palliation.

When it comes to diagnosing anal fistula, many institutions use magnetic resonance imaging (MRI). Anal sphincter injury that occurs after the operation to close an anorectal fistula increases the risk of recurrence or stoma incontinence. To lessen these issues, preoperative evaluation of the anatomical structure of the anal sphincter and the fistula tract is necessary. Anal endosonography (AES) and magnetic resonance imaging (MRI) are the recommended methods for identifying anorectal fistula because they can reveal a number of fistula components that surgeons must take into account when determining a course of treatment.[9]

Due to its exceptional soft tissue resolution, magnetic resonance imaging (MRI) became the preferred imaging technique. MRI is helpful not only for the early diagnosis of anal/perianal diseases but also for the ongoing monitoring of these conditions. [10] In a retrospective study; two radiographers ran an investigation searching major fistula tracts in 20 patients with clinically proven anovaginal fistula. T2-weighted MR scans of all 20 patients showed anovaginal fistula to be primarily high-signal-intensity linear anomalies extending between the anal canal and the vagina. [11]

Another prospective research was conducted on 45 individuals who had an external perianal hole that was actively draining. Multiple planes of MRI were conducted utilizing non-contrast and contrast-enhanced sequences. The statistical correlation between surgical and MRI findings was examined using surgery as the gold standard. Non-contrast MRI was seen as being equally effective as contrast imaging. [6] The study's goal was to assess the diagnostic efficacy of magnetic resonance imaging (MRI) in perianal fistula.

Given the importance of precise diagnosis for successful treatment, there is a need to evaluate MRI's diagnostic performance, including its sensitivity, specificity, and overall effectiveness compared to surgical findings. This study aims to address these gaps in knowledge by examining the role of MRI in diagnosing perianal fistulas and providing further insights into its clinical utility.

Methodology

This cross-sectional validation study was conducted from January 5, 2022, to March 25, 2023, at the Radiology Department of KRL Hospital, following ethical approval from Ethical Review Committee KRL Hospital, Ref No: KRL-ERC-2021-045-3634.A non-probability consecutive sampling method was used for participant selection. The sample comprised consecutive patients who met the inclusion criteria and were attended by the Radiology department during the research period. The inclusion criteria consisted of all patients who presented with symptoms of a perianal fistula, such as swelling and drainage. Additionally, all participants provided their written consent and were scheduled to undergo surgical intervention. The exclusion criteria included patients with claustrophobia, abscess development or anal stenosis, or implants, as these factors could interfere with the accuracy of MRI results. Patients experiencing fecal incontinence were also excluded, as it could impact the MRI findings. Moreover, individuals who were unable to provide written consent or chose not to undergo surgical intervention were excluded from the study.

MRI was used as the imaging modality to identify and assess the presence of fistulous tracts in the perianal area. The MRI procedure included T1-weighted, T2-weighted, T2 Fat Suppression (FS), and T1-weighted post-contrast sequences, all conducted using the Philips Multiva 1.5 Tesla MRI machine. After the examination, the Capsule Evion was used as a marker to identify the site of the fistula opening. The patients underwent a body coil MR imaging examination, which included the following sequences: T2-weighted coronal, STIR (cranial, sagittal, and coronal), T1-weighted axial, and T1-weighted Dixon after the administration of contrast (0.1 ml/kg of Gadovist 1.0 mmol/ml injection). The MRI scans were then interpreted by a senior radiologist with extensive experience in body MRI imaging.

The following criteria were present in the positive MRI results, indicating the existence of fistulous tracts: A fistulous tract was observed across, next to, or between the anal sphincters. On T1-weighted images, active fistulous tracts appeared iso-intense to muscle. On T2-weighted images, the fistulous tracts exhibited higher signal intensity than fat. Additionally, T1-weighted post-contrast images showed enhancement in the fistulous tracts. As part of the data collection process, the MRI scans of the individuals included in the study were reviewed. Based on the positive results criteria outlined above, experienced radiologists assessed the presence of

fistulous tracts. The data were then collected and securely stored for further analysis.

The data analysis was conducted using SPSS 21 software to summarize the frequencies and percentages of categorical variables through descriptive statistics. The primary outcome of the study was the identification of fistulous tracts on MRI scans. The analysis provided a clear overview of the distribution of the variables, offering insights into the prevalence and characteristics of fistulous tracts observed through imaging, which were crucial for understanding the clinical context and implications of the findings.

Results

Total number of participants was 49; the number of females was significantly lower than that of males. The participants were predominantly male with 79.6% of them being male participants while 20.4% of the participants were females.

As for the BMI of the participants, they were scored in the range of 18 to 34. These BMI values were then categorized into different groups depending on the standard weight status for the purpose of comparison. In the above-mentioned categories, only two percent (n=1) of the participants were underweight, that has BMI less than 18.5. The largest proportion of the participants was in the normal weight category according to BMI that was defined as 18.5-24.9; they were 14 (28.6%). Among all the respondents, more of the respondents fell in the overweight category with a BMI of 25 to 29.9 kg/m, this was 51.0 %, (n = 25). In addition, 18.4% of participants (n = 9) were categorized as obese with a BMI > 30).

These demographic characteristics provide further information about the participants' background and reveal that most of them are currently overweight. This distribution therefore brings to light BMI as one of the causes of perianal fistulas and their diagnosis. Understanding of these demographic trends is valuable in the context of generalizability of the study's findings and the performance of MRI in identifying this disease in such patients.

It is therefore important to provide a demographic background of the participants which will form the basis of understanding the physical characteristics and the possible impact they may have towards the overall clinical results of the study.

Table I: Demographic Characteristics of Study Participants.

Characteristic	**n (%)**
Gender	
Male Participants	39 (79.6%)
Female Participants	10 (20.4%)
BMI Categories	
Underweight (BMI < 18.5)	1 (2.0%)
Normal Weight (BMI 18.5 – 24.9)	14 (28.6%)
Overweight (BMI 25 – 29.9)	25 (51.0%)
Obese (BMI ≥ 30)	9 (18.4%)

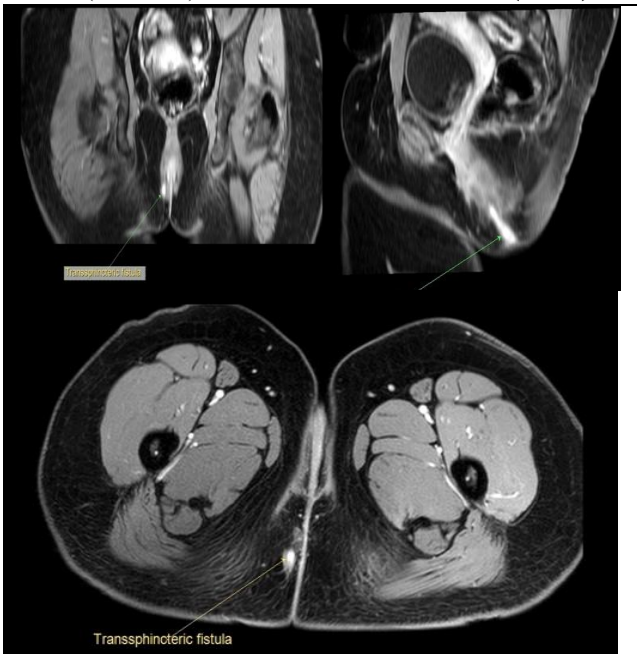

Figure I demonstrates the Linear tract is well marked in the right aspect of the natal cleft beginning from skin and passes through the external sphincter at 9-10 o'clock position outside the internal anal sphincter resulting into the diagnosis of Trans-sphincteric fistula.

In general, 93.9% of the 49 patients that were included in the study had prior history of surgery concerning perianal fistulas (n = 46). This has shown that majority of the patients required surgical intervention in the management of the condition. On the other hand, it was established that only 4.1percent (2) of the participants had no past experience in surgery and one participant skipped the questions concerning their surgeries.

MRI was employed and the outcome was compared with the other research on the abnormalities linked to perianal fistulas. MRI scans indicated that 79.5% (n = 39) of the patients had abnormal scans based on fistula or its complications. Nonetheless, one can only note that 20.5% of the 50 participants in the study had a negative MRI,

which meant that it was impossible to identify fistulous tracts or other related diseases in them.

Therefore, one must highlight the distribution of surgical history and MRI findings in this study indicating a high level of clinical complexity of perianal fistula patients. The high percentage of positive MRI indicates that MRI can be used in diagnosing and evaluating these conditions.

Table II: Clinical Characteristics of Study Participants.

Characteristic	n (%)
Surgical History	
History of Surgery	46 (93.9%)
No Surgery History	2 (4.1%)
Unreported Surgery History	1 (2.0%)
MRI Findings	
Positive MRI Findings	39 (79.5%)
Negative MRI Findings	10 (20.5%)

Such clinical data indicates the importance of MRI in diagnosis of perianal fistula and raises the question of the further management of these patients with reference to MRI results.

MRI findings in this research had a great diagnostic accuracy if the results obtained were compared to the surgical findings. MRI had high specificity at 92.3% that is the high ability of the technique in excluding clients with perianal fistulas. The sensitivity was at 90% as this depicted the accuracy of MRI in excluding the participants without the condition. The sensitivity of the MRI was as follows: 87.1% of patients with a fistula had a positive MRI, and the specificity was 99.2% of patients without a fistula had negative MRI; the PPV of the MRI was 97.3% of patients with positive M RI had the fistula. On the other hand, the negative predictive value which gives the percentage of patients without the disease given a negative MRI was 75%.

The average sensitivity obtained in this study was 91.8 % which supports the idea that MRI is useful in diagnosis of perianal fistulas. These findings endorse the fact that MRI is indeed a highly valuable diagnostic tool and as such should be incorporated in the diagnostic algorithm and surgical management of patients with perianal fistulas.

Of the patients, the number of fistulas around the rectum was determined to be within the range and the subjects were found to have intersphincteric fistula. This type was mentioned in 44.9% (n = 22) of the participants and was characterized by the presence of a fistulous tract between the internal and external sphincter. The transphincteric fistula was mentioned in 30.6% (n = 15) as a fistula that goes through the internal and external sphincters; therefore, it has a higher chance of leading to incontinence if not treated properly.

The rest of the respondents 24.5% (n = 12) had other forms of fistulas that were categorized as supra sphincteric and extra sphincteric. Such types may present some diagnostic challenges and are probably better handled through complicated operations.

Each of the patients had diagnostic imaging revealing details of the anatomical appearances of the fistula type as described in the following figures. The following is a case of a transphincteric fistula with a contrast-enhanced linear tract which lies in the line of the natal cleft and extends through the external sphincter at 9-10 position. Meanwhile, Figure II shows an intersphincteric fistula in which there is a straight track which extends through the sphincter at six o'clock position.

Table III: Distribution of Fistula Types.

Fistula Type	n (%)
Intersphincteric	22 (44.9%)
Transphincteric	15 (30.6%)
Other Types	12 (24.5%)

They also support the ability of MRI in the characterization of fistula subtypes, thus raising the preoperative evaluation, and subsequently, the treatment outcomes.

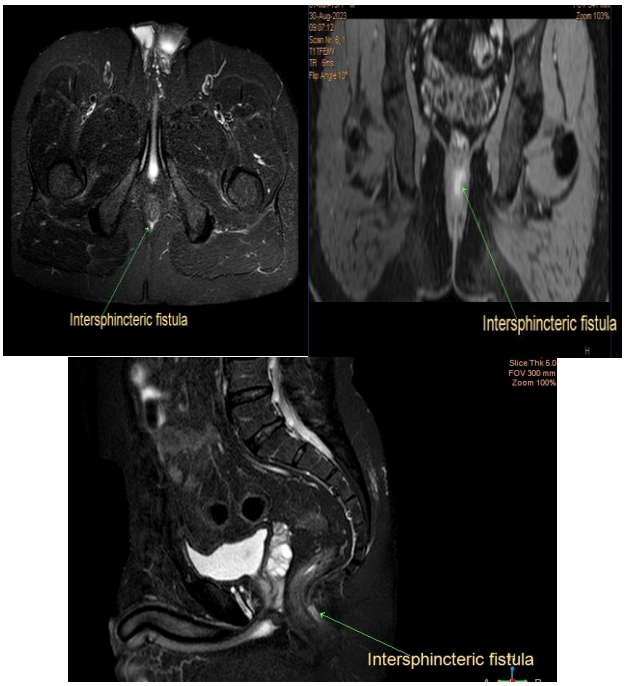

Figure II: An enhancing linear tract with external opening in the left natal cleft piercing the external sphincter at 6 o'clock position -Inter sphincteric fistula.

Discussion

Using surgical findings as the gold standard, the analysis of data from 49 patients revealed a sensitivity of 92.3% and specificity of 90% for the use of magnetic resonance imaging (MRI) in diagnosing perianal fistulas. MRI results were positive in 91.8% (n = 45) of the tests, indicating the presence of various diseases or anomalies, while 4.1% (n = 2) of the participants had negative results, suggesting no detectable issues. The intersphincteric fistula was the most common type, accounting for 44.9% (n = 22), followed by the transphincteric fistula, reported by 30.6% (n = 15). Other types of fistulas were less frequent. [3]

A chi-square test revealed a weak but positive correlation (correlation coefficient = 0.241) between fistula type and MRI findings. High-5 fistulas, which almost completely encase the external anal sphincter and extend to the levator muscle, are a complex type requiring advanced radiological techniques, particularly MRI, for accurate diagnosis.[2] These fistulas include supralevator, extrasphincteric, high intrarectal, and RIFIL fistulas.

MRI remains the most commonly used radiological technique for studying and identifying the various types of fistulas and their characteristics, offering excellent image resolution and the ability to reveal important features for treatment planning.[5] While contrast-enhanced MRI provides added confidence to radiologists, non-contrast MRI has shown equivalent diagnostic effectiveness in identifying perianal fistulas, especially in patients with renal insufficiency.

In another study involving 50 patients, 14 individuals had 100% fibrotic fistulas on post-treatment MRI, all of whom achieved long-term clinical closure, suggesting MRI's utility in tracking recovery after surgery. MRI's high spatial resolution and field of view make it an ideal tool for accurately identifying deep abscesses and complex fistulas.[7] These findings are consistent with other research showing that MRI accurately predicted surgical anatomy in 88% of cases, with our study demonstrating a diagnostic accuracy of 91.8% for identifying alimentary fistulas.[9]

The study's strengths include using surgical findings as the gold standard, providing high sensitivity (92.3%) and specificity (90%) for MRI in detecting perianal fistulas. The sample size of 49 patients supports the reliability of the results, and the clear categorization of fistula types enhances understanding. The statistical analysis and MRI's ability to diagnose complex fistulas highlight its importance in treatment planning.[3] The comparison of contrast-enhanced and non-contrast MRI offers practical insights for patients with renal insufficiency.

However, the study's limitations include a small sample size, lack of long-term follow-up data, and reliance solely on MRI without considering other imaging techniques like anal endosonography. The patient selection process is unclear, which may introduce bias, and the absence of clinical factors such as medical history limits the comprehensiveness of the findings. Additionally, the study does not address the variability of contrast-agent use, which could impact MRI's diagnostic accuracy.

Conclusion

In conclusion, MRI's sensitivity is moderate but its specificity is low when it comes to detecting perianal fistulas, as compared to surgical results. High-quality images and crucial data for treatment planning make it a valuable resource for studying and categorizing different types of fistulas. However, there is a marginally significant correlation between the type of fistula and the MRI results. The success of treatment for fibrotic fistula can be closely tracked using MRI. It is very useful for finding the location of deep abscesses and complicated fistula. While magnetic resonance imaging (MRI) can be helpful, the diagnostic accuracy will vary depending on the type of patient and the expertise of the radiologists.

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