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DIAGNOSTIC ACCURACY OF DIFFUSION WEIGHTED IMAGING IN DETECTION OF PERIANAL FISTULA TAKING SURGICAL FINDINGS AS GOLD STANDARD

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Abstract:
Introduction: DWI MRI is useful in assessing anal fistulas because it allows detecting small and multiple tracks simultaneously and assessing their degree of inflammation and can be used for monitoring.
Aim: To determine the diagnostic accuracy of the diffusion-weighted image for the diagnosis of perianal fistula, taking the surgical results as the gold standard.
Study design: Descriptive, cross-sectional.
Study time: From August 30, 2017 to February 29, 2018.
Location: Department of Radiology, United Military Hospital, Lahore
Materials and methods: The study included 218 patients aged 20 to 60 years with symptoms of rectal fistula. Patients with recurrent fistula who were unable to perform MRI were excluded from the study. DW-MRI was performed in all patients and a rectal fistula was sought. DW-MRI results correlated with surgical results.
Results: The mean age was 46.51 ± 9.82 years. Of these 218 patients, 132 (60.55%) were male, 86 (39.45%) were 2.5: 1 women, DW-MRI positive, true positive were 123 cases and false positive were 12. Of the 83 DW-MRI negative patients, false negative cases were 10 and true negative cases were 73. Overall specificity, sensitivity, positive, negative predictive value, predictive value and diagnostic accuracy of diffusion weighted imaging for the diagnosis of perianal fistula taking surgical findings as gold standard was 92.48%, 85.88%, 91.11%, 87.95% and 89.91% respectively.
Conclusion: This study showed that DW-MRI is a very sensitive and precise method of preoperative detection of perianal fistula.
Key words: perianal fistula, weighted diffusion image, non-invasive, sensitivity.

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INTRODUCTION:

A fistula is defined as an abnormal connection between two epithelial surfaces of the body. In the case of a rectal fistula, this is the connection of the anal canal with the skin of the fairy. 1 Placement of DE novo in the anal area is a rare process. The incidence of abscesses and anal fistulas in the general population is probably much higher than observed in clinical practice because most patients do not seek medical attention. The incidence of anal fistula due to anal abscess ranges from 26 to 37%. 22 Anal fistulas are very common in Croan's disease and occur in 25% of patients. About half of them are complex. Complex anal fistulas often occur in a significant proportion of patients with anal abscesses and anal narrowing. 3

Rectal fistula may be the result of inflammation due to inflammatory bowel disease, sequelae of the rectal abscess, or other conditions such as rectal or rectal cancer and trauma. 4 In one study, 8 in 1000 perianal fistulae were found in patients presented in the surgical ward of the tertiary care hospital

Although the de novo perianal fistula causes significant morbidity, it is a rare process with a frequency of 0.01% 6. This mainly affects young men, with a M:F ratio of 2: 1.6. Requires appropriate surgical treatment. Preoperative assessment and classification of this condition.

Therefore, the role of the image is to identify all concealed tracks and describe the association of the fistula with the anal sphincter. Unintentional anal sphincter damage may cause anal incontinence; therefore, it is important to know the relationship between the anal sphincter and fistula. (1) There are three main radiological imaging techniques in anal fistulae that are necessary to assess the extent of the fistula, the type of tissue involved, and the presence of additional inflammation or slag foci, locations of the internal and external fistula openings and the course of the main channel and possible additional branches. They include: contrast fistulography, endorectal ultrasound and magnetic resonance imaging. (8)

DWI MRI is useful in assessing anal fistulas because it allows detecting small scars and multiple scars simultaneously and assessing their degree and degree of inflammation and can be used for monitoring. (9) One study showed that DWI had 95.7% sensitivity and a 50% specificity in the perianal fistula diagnosis (n = 24). (10)

The reason for this analysis was to assess the DWI diagnostic accuracy in the diagnosis of perianal fistula, so that CT scans could be included in the standard MRI sequence protocol for this disease and make other methods such as fluoroscopic fistulography unnecessary. , both in the case of radiation ionization and more invasive procedures. (transperineal or endoanal). However, there is only one study in the literature that indicates a sensitivity> 95%, but the specificity was low, i.e. 50%. In addition, this study was conducted in small samples (n = 24), so the results may not be reliable enough. In addition, there is no local evidence. Therefore, we would like to carry out this study, because it helps to determine DWI diagnostic accuracy in the local environment and reduce the time of MRI scanning. In addition, we can determine the local occurrence of the disease.

Objective:

The objective of the study was to assess the diagnostic accuracy of diffusion weighted imaging for the diagnosis of perianal fistula taking surgical findings as gold standard.

OPERATIONAL DEFINITIONS:

Perianal fistula: On DWI fistulae manifest as tracks showing restricted diffusion which appears hyperintense and will have reduced apparent diffusion coefficient. It was labeled as positive for fistula if ADC≤1.109. If ADC value>1.109, then it was labeled as negative. Intraoperatively, it was labeled as positive, if there was opening of the fistula onto the skin, redness, area of induration, thickening due to chronic infection and pus discharge from site of fistula. It was labeled as negative if no fistula or opening present on the skin is seen during surgery.

True Positive: When case was positive on both; DWI and intraoperative findings.

True Negative: When case was negative on both; DWI and intraoperative findings.

False Positive: When case was positive on DWI but negative on intraoperative findings.

False Negative: When case was negative on DWI but positive on intraoperative findings.

Sensitivity: TP/(TP+FN) x 100

Specificity: TN/ (TN+FP) x 100

PPV: TP/(TP+FP) x 100

NPV: TN/(TN+FN) x 100

STUDY DESIGN:
Descriptive, Cross-sectional study.
SETTING:
Department of Radiology, Combined Military Hospital, Lahore.

DURATION OF STUDY:
30th August 2017 to 29th February 2018.

SAMPLE SIZE:
The sample size of 218 cases was calculated at 95% confidence level and the expected incidence of perianal fistula was 45.58% and DWI 95.7% accuracy and 4% error and specificity. DWI, ie, 50%, with 9% error taking surgical findings as the gold standard.
SAMPLE TECHNIQUE:
Non-probability, consecutive sampling.

SAMPLE SELECTION:
a. Inclusion Criteria:
• Patients of any sex from 20 to 60 years of age (temperature> 99oF) with signs of skin irritation around the anus, persistent and stabbing pains while defecating, odorous anal discharge, pus or blood, swelling and redness around the febrile anus.
b. Exclusion Criteria:
•   Recurrent fistula (on history)

    •   Inability to fit in MRI machine.

DATA COLLECTION PROCEDURE:
218 total patients who met the selection criteria were recruited to the CMH Lahore Radiology Department. Informed written consent was obtained. Demographic details (name, age, gender, BMI and duration of symptoms) were also recorded. Then, all patients underwent DWI sequence using Phillips 1.5 T MRI machine, using 0 and 1000 s / mm (2) b values. Maps of the (ADC) apparent diffusion coefficient were generated and ADCs of the lesions were measured. All scans were reported by a consultant radiologist with the help of a researcher. Surgical treatment was performed by a surgical team under spinal anesthesia and perianal fistula was confirmed intraoperatively.

Patients were confirmed to be positive or negative. All this information was recorded with proforma (attached).
DATA ANALYSIS PROCEDURE:
Using SPSS 21.0; the data was analyzed. The standard deviation and mean were recorded for quantitative variables, including BMI, age and interval of symptoms. For qualitative variables; percentage and frequency were calculated, ie sex, presence of perianal fistula in DWI and surgical findings. For the diagnosis of perianal fistula, a 2 x 2 probability table was used to record the specificity, sensitivity, negative predictive value, positive predictive value, and diagnostic accuracy of the diffusion-weighted image, and the surgical findings were taken as Gold standard.

The effect modifiers such as age, sex, BMI and length of symptoms were organized by stratification and 2×2 post-stratification probability table was used to calculate specificity, sensitivity, negative predictive value and positive predictive value and diffusion-weighted image diagnostic accuracy was used for diagnosis for perianal fistula, taking operative findings as the gold standard.

RESULTS:
In this study, the age range was 20-60 years, and the average age was 46.51 ± 9.82. Most of the 150 patients (68.81%) were 41-50 years old, as shown in Table I.

Of these 218 patients, 132 (60.55%) were male and 86 (39.45%) were 2.5: 1 women.
DW-MRI showed perianal fistula in 135 patients (61.93%). Surgical results confirmed perianal fistula in 133 (61.01%) cases in which 85 (38.99%) patients did not have perianal fistula. 123 positive and 12 false positive were found in patients with DW-MRI positive. Of the 83 DW-MRI negative patients, true negative cases were 73 and false negative cases were 10 as given in Table II. Overall specificity, sensitivity, negative predictive value, positive predictive value and diffusion weighted imaging diagnostic accuracy for the perianal fistula diagnosis taking surgical findings as gold standard was 85.88%,92.48%, 87.95%, 91.11% and 89.91% respectively (Table II).

The classification of diagnostic accuracy by age groups is presented in Table III.

Table-I: Distribution of patients according to Age.

Age (years)	No. of Patients	%age
20-40	68	31.19
41-60	150	68.81
Total	218	100.0

Mean ± SD = 46.51 ± 9.82 years

Table-II: Diagnostic accuracy of diffusion weighted imaging for the diagnosis of perianal fistula taking surgical findings as gold standard.

	Positive result on Surgery	Negative result on Surgery	P-value
Positive result on MRI	123 (TP)*	12 (FP)***	
Negative result on MRI	10 (FN)**	73 (TN)****	0.0001

*-TP=True positive **-FP=False positive ***-FN=False negative ****-TN=True negative

Sensitivity: 92.48%
Specificity: 85.88%
Positive Predictive Value (PPV): 91.11%
Negative Predictive Value (NPV): 87.95%
Diagnostic Accuracy: 89.91%

Table III: Stratification of age 20-40 years (n=68).

	Positive result on Surgery	Negative result on Surgery	P-value
Positive result on MRI	32 (TP)	04 (FP)	
Negative result on MRI	06 (FN)	26 (TN)	0.001

Sensitivity: 84.21%
Specificity: 86.67%
Positive Predictive Value (PPV): 88.89%
Negative Predictive Value (NPV): 81.25%
Diagnostic Accuracy: 85.29%

DISCUSSION:

Magnetic resonance imaging (MRI) is considered the ultimate preoperative technique for detecting fistulas and abscesses and related secondary pathways. Preoperative magnetic resonance imaging can affect surgical organization, reduce the likelihood of recurrence, and change the surgical results of fistulas. (11-16) Although magnetic resonance imaging with contrast gave better detection results, there is a recognized risk of nephrogenic systemic fibrosis (NSF) among other contrast-related side effects (17,18, 19). It is required to progress alternative magnetic resonance imaging approaches that offer better information.

DWMRI reflects changes in water mobility. (20) Recently, it has been used for body images mainly to detect and characterize tumors. (21) Inflammatory tissues can often be seen as high signal areas in DW images (22). This may be auspicious sequence for the anal fistulas detection. Further, this procedure does not require additional costs and does not pose a greater risk to patients.

In this study, the age range was 20-60 years, and the average age was 46.51 ± 9.82. Most of the 150 patients (68.81%) were 41-50 years old. Of these 218 patients, 132 (60.55%) were male and 86 (39.45%) were female 2.5: 1. DW-MRI showed perianal fistula in 135 patients (61.93%). Surgical results confirmed perianal fistula in 133 (61.01%) cases in which 85 (38.99%) patients did not have perianal fistula. 123 positive and 12 false positive were found in patients with DW-MRI positive. Of the 83 DW-MRI negative patients, true negative cases were 73 and false negative cases were 10. The DWI diagnostic accuracy in the perianal fistulas diagnosis, specificity, sensitivity, negative predictive value and positive predictive value was 89.91%, 85.88%, 92.48%, 87.95% and 91.11%. One study showed that DWI has 95.7% sensitivity and 50% specificity in the diagnosis of perianal fistula (n = 24). (10) In   our

study, conventional magnetic resonance imaging sensitivity was 92.94%, specificity 85.89%, PPV 91, 86%, NPV 86.76%, and diagnostic accuracy 92.35%. These results can be compared with a study of 25 patients, which showed the specificity and sensitivity of MRI in peri-diagnosis of anal fistula at 100% and 88%, respectively. (23) A same study was conducted in 42 patients with suspected anal fistula. This study compared digital anal examination, improved magnetic resonance imaging with dynamic contrast, and surgical results. Magnetic resonance imaging was superior to digital rectal examination with or without surgery. MRI sensitivity and specificity in fistula detection was 97% and 100%, respectively. (24) Another study was performed to see the accuracy of MRI in primary fistula track and abscess pathways, and it was found that the MRI specificity and sensitivity were 86% and 100%, respectively. The specificity and sensitivity of abscesses were 96% and 97%, respectively. (25) Imaadur Rehman et al. Similar results were obtained in the diagnosis of the type and extent of perianal fistula, showing that MRI has 90% sensitivity, 100% specificity and 90% diagnostic accuracy. (26) In one study, the specificity and sensitivity of MRI to accurately identify and classify primary pathways were 95.56% and 80%, respectively. (27) In another study, the specificity and sensitivity of MRI detected abscesses in 87.50% and 95.24%, respectively. (28) The real MRI potential in the anal fistulas assessment was significant in the study of sixteen patients with cryptogranular fistulas compared to the results of magnetic resonance imaging under anesthesia. (29) The writers suggested that magnetic resonance imaging is the utmost perfect method for defining the course and presence of anal fistulas and may benefit decrease relapse due to incorrect surgical evaluation. These results were established in a control study of thirty five patients who reported accurate magnetic resonance imaging in thirty three cases (94%), including 2 patients where the evaluation under anesthesia did not show distant sepsis. MRI of the perianal fistula depends on the inherently high resolution of soft tissue contrast and the multifaceted visualization of anatomy and this modality. MRI is a non-invasive image of the perianal fistula and helps in accurate classification of the fistula for effective treatment. MRI ensures the exact location of the rigorous pathway and its association to the pelvic floor and sphincter complex, and helps identify secondary pathways and abscess. (31)

CONCLUSION:

The study found that diffusion weighted magnetic resonance imaging (DW-MRI) is a very sensitive and precise method that not only improves our ability to detect the perianal fistula path, but also improves patient care. With proper and appropriate surgical treatment that reduces complications. Therefore, we recommend that every patient receive clinical tests DW-MRI for perianal fistula and clinically tested for early and accurate detection of perianal fistula.

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