COMPARISON OF MRI WITH SURGICAL FINDINGS IN THE DIAGNOSIS OF FISTULA-IN-ANO

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ABSTRACT

INTRODUCTION: An anal fistula is a connection between two epithelial lined spaces, one of which is the anus or rectum. In recent years, MRI has developed as a tool to diagnose and classify fistula-in-ano. The rationale for using MRI is to find a non-invasive procedure for classifying fistula-in-ano, thus directing proper management of the fistula, including surgical procedure. This can decrease hospital load in terms of patient follow-up. **OBJECTIVE:** To determine the diagnostic accuracy of MRI in classifying fistula-in-ano compared with surgical findings. **OUTCOME MEASURE:** Diagnostic accuracy of multi-dimensional CT scan **STUDY DESIGN:** Cross sectional study **SETTING:** Department of Radiology, Jinnah Postgraduate Medical Centre (JPMC), Karachi **SUBJECTS:** Patients clinically suspected of having fistula-in-ano due to presence of external opening around the anal region. **METHODS:** Patients meeting the inclusion criteria underwent MRI fistula-in-ano after taking consent from patients and maintaining all ethical considerations. The images were evaluated for the presence and site of the fistulous tract according to Parks and colleagues' Criteria for fistulas. All MRI and surgical findings were recorded on a MRI/Surgery fistula-in-ano form and statistically evaluated using SPS version 10.0. **RESULTS:** A total of 173 patients showing 201 fistulous tracts were enrolled in this study. The mean age of enrolled participant was 43.5 ±8 years. The overall sensitivity of MRI in diagnosing fistula in ano was 95 % and specificity 68.2 %. Positive predictive value for correctly diagnosing fistula in ano was 92.1 % and Negative predictive value, 77.7%. **CONCLUSION:** MRI is a very sensitive and specific modality for diagnosis and classification of fistula-in-ano. **Keywords:** Fistula-in-ano, Sensitivity, Specificity, MRI fistula-in-ano, Histopathology, JPMC

Introduction

An anal fistula is a connection between two epithelial lined spaces, with one of these spaces either the anus or the rectum. A peri-rectal inflammatory process can cause abscesses in acute phase, and fistula during the chronic phase. A study conducted in India has shown the incidence of fistula-in-ano following perianal abscess as 34.5%.[1] Another study in Finland found an incidence of 8.6 per 100,000 in the general population, with a male-to-female ratio of 1.8:1 and a mean age of 38 years.[2] Fistula-in-ano is caused in nearly all instancesby a previous anorectal abscess. An important cause in Pakistan, accounting for 11% of recurrent fistulas, is tuberculous fistula-in-ano.[3] Other fistulae develop secondary to trauma, Crohn's disease, anal fissures, carcinoma, radiation therapy, HIV infections and chlamydial infections.[4]

The anal canal is a cylindrical structure consisting ofan internal and external sphincter. The inter-sphincteric space is the plane of dissection between the two sphincters.The dentate line is approximately

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2 cm proximal to the anal verge and may act as a path for organisms to enter fatty spaces within muscles. This has a role in spread of the disease.[5] Patients often present with history of previous pain, swelling, and spontaneous or planned surgical drainage of an anorectal abscess. Management of fistula-in-ano needs an accurate diagnosis, followed by surgical removal of fistulae, while aiming to preserve continence of the anal sphincter.[6] Long-term antibiotic prophylaxis and infliximab may have a role in recurrent fistulae in patients with Crohn disease, but no definitive medical therapy is available.[7] Surgical methods include a fistulotomy or fistulectomy.[8] A seton, which is a cord placed through the fistula tract that allows for healing to take place while letting the tract drain can be placed alone, combined with fistulotomy, or be part of a staged procedure.[8] This technique is quite useful in patients with complex and recurrent fistulas. Another technique used is the mucosal advancement flap, which involves total fistulectomy, removal of the tracts, and excision of the internal fistulous opening.[8]

Radiologic studies and proctosigmoidoscopy are not performed for routine fistula evaluation because they do not give information about extra intestinal disease.[9] One of the radiological techniques is fistulography, which involves contrast injection through the internal opening followed by anteroposterior, lateral, and oblique X-rays to classify the tract.[10] However, the procedure is invasive and unpleasant, with the risk of infection secondary to manipulation as well as exposure to ionizing radiation.[10] Endoanalsono-graphy is an ultrasonography technique that is also available, but has been shown to be less accurate in detecting fistulous tracts compared to MRI.[11]

The predominant classification system for anorectal fistulae is that described by Parks et al, which classifies the fistula according to the primary tract's relation to the anal sphincters and the levatorani muscle.[12] There are four categories: intersphincteric, trans-sphincteric, supra-sphincteric and extra-sphincteric fistulae. Radiological criteria for fistulae are based on this classification, and use shape and signal intensities.

The rationale for using MRI is to find a non-invasive procedure to classify fistulae, thus directing proper management techniques, and helping in applying correct surgical procedures, thus decreasing hospital load in terms of patient follow-up. MRI is becoming the study of choice when evaluating complex fistulae and recurrent fistulaeand has been shown to improve recurrence rates by providing information on otherwise unknown fistulous extensions.[13]

Objectives

To determine the diagnostic accuracy of MRI in classifying fistula-in-ano in comparison to surgical findings.

Methods

Study Design:
Our study design is a cross-sectional study involving a comparison between surgical findings and MRI details. The sampling technique employed was consecutive non-probability sampling, with every patient meeting the inclusion criteria being part of the sample population.

Study Site:
The study was conducted in the Department of Radiology, Jinnah Postgraduate Medical Center, Karachi.

Inclusion Criteria:
- All patients clinically suspected of having fistula-in-ano due to presence of external opening around the anal region, with the duration of the presenting complaint of external opening being 1 year or less.

Exclusion Criteria:
- Patients having undergone surgery for fistula-in-ano within 6 weeks.
- Patients diagnosed with active pulmonary or gastrointestinal tuberculosis for which surgery was not planned for fistula-in-ano.

Sample Size:
The sample size was calculated keeping an expected sensitivity of 84% and specificity of 68% and prevalence of 0.351, d = 0.10. The prevalence was calculated from a previous study on 1023 patients with fistula-in-ano.[1] The sensitivity and specificity were

calculated using the results of another study comparing endosonography and MRI.[14] The sample size thus obtained was 149 participants. This value was used for our study.

Data Collection:

Patients meeting the inclusion criteria underwent MRI fistula-in-ano after taking written consent from the patients, whilst keeping their confidentiality.
All examinations were performed on a Philips 1.5 T MRI installed at JPMC, Karachi,with a body coil and post processing done on the workstation.The MRI images were evaluated by Dr. Z.N. with the consensus of a senior radiologist i.e. more than 5 year's experience in reading pelvic MR images. The images were evaluated for the presence and site of the fistulous tract according to the Parks and colleagues'criteria.[12] The surgical findings, as mentioned in the surgical notes of the surgeon who performed the fistula in anorectal surgery were recorded on a fistula-in-ano questionnaire, along with the radiological findings.

The detection and classification of fistula-in-ano was compared with surgical findings, which are currently taken as the gold standard. A "yes" or "no" score was given respectively on the basis of whether the MRI and surgical classification of fistula-in-anowere both in agreement or not. To be considered true positive, classification of fistula in anoneeded to be in agreement between MRI and surgery. If the MRI imaging did show a fistulous tract but its classification was not in agreement with the surgical findings, it was not considered a true positive.

Data Analysis:

The diagnostic accuracy of MRI in terms of accuracy, sensitivity, specificity, positive and negative predictive values was calculated for MR imaging in predicting the presence and exact location of fistulous tracts. Statistical analysis was performed by using SPSS Version 20.0. Mean and standard deviation were estimated for age. Frequency and percentages were computed for gender. Stratified analysis was for modifiers like age, gender and type of fistulous tracts, with the intention to avoid an effect upon reporting accuracy.

Results

A total of 173 patients were enrolled in this study. The mean age of enrolled participant was 43.5 ±8 years. Of our participants, males accounted for 82.6% of the study sample, and female as 17.4%. A male-to-female ratio of 4.7:1 was obtained. A total of 201 fistulous tracts were identified among these patients. The most common symptoms that patients presented with were pain (45%), discharge (50.2%), soiling (41.6%), pruritus (24.2%) and bleeding (13.2%). Most patients had a combination of two or more symptoms.

The frequency of fistulous tracts as diagnosed on MRI is shown and a comparison with fistulous tracts as diagnosed on surgery is shown in (Tab. 1). Number of secondary extensions is shown in (Graph 1).

			MR findings				Surgery performed
			True positive	False positive	False negative	True negative	
Primary tract	Submucosal	15	15	0	1	18	16
	Intersphinteric	44	32	9	2	5	34
	Transphincteric	86	78	4	2	5	80
	Suprashincteric	0	0	0	0		0
	Extrasphincteric	7	7	0	0		7
	Sinus	21	20	0	3		23
	False tracts						
		173	152	13	8	28	160

Table 1: Number of Fistulous tracts diagnosed on MRI and Surgery
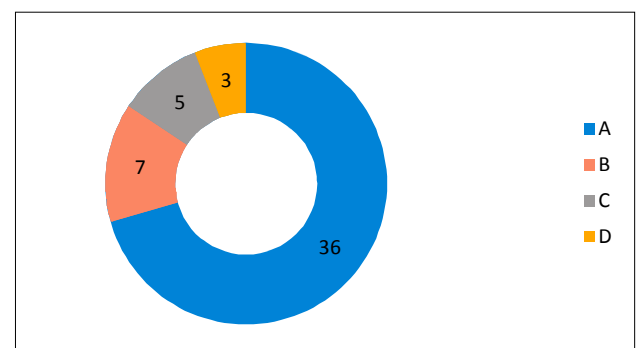
Where
A = Extension into roof of ischioanal fossa arising from apex of a transsphincteric fistula
B = Supralevatorpararectal extension arising from apex of a transsphincteric fistula
C = supralevator extension originating from intersphincteric plane
D = intersphincteric horseshoe

Graph 1: Number of secondary extensions

A 2x2 table was drawn (Tab. 2). The overall sensitivity of MRI in diagnosing fistula in ano was calculated as 95 %, with a specificity of 68.2% (Tab. 3). Positive predictive value for correctly diagnosing fistula in ano was 92.1% and a Negative predictive value of 77.7% was determined (Tab. 3).

		MRI Test		
		Positive	Negative	
Surgery	Positive	152	8	160
	Negative	13	28	41
		165	36	201

Table 2: Accuracy of MRI in diagnosing fistula-in-ano (2x2 table)

Parameters	Overall	Age Group		Sex		Type	
		<40 Years	>40 Years	Male	Female	Intersph-incteric	Trans-Sp hincteric
Sensitivity %	95	94	96.1	97.1	93.5	94.1	97.5
Specificity %	68.2	70.2	66.3	67.7	68.9	35.7	55.5
*PPV %	92.1	93.8	91.1	92.8	91.9	78.0	95.1
†NPV %	77.7	73.1	81.2	74.1	79.5	71.4	71.4
Accuracy %	89.5	91.3	87.9	92.2	86.4	77.0	93.2

Table 3: Sensitivity, Specificity, Positive and Negative Predictive Value and Accuracy for Overall and Stratified Data

Some images from MRI data obtained from our study participants is shown to illustrate our results. (Fig. 1) is a T2W axial view of the anorectal region in a patient who presented with a diagnosis of anal fistula for radiographic evaluation. On MRI, a trans-sphincteric fistula with an internal opening at the 6 'o' clock

Figure 1: T2W axial view of a trans-sphincteric fistula with an internal opening at the 6 'o' clock position

position was found. (Fig. 2) is of another patient, showing an extra-sphincteric fistula on a T2 coronal view. This later corroborated with the surgical findings on exploration in the operating room. (Fig. 3) shows an intersphincteric fistula as seen on MR images taken at an axial view in another of our patients.
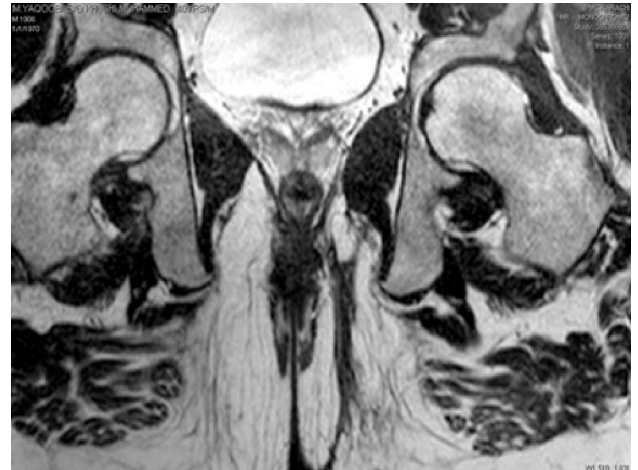

Figure 2: T2W coronal view showing an extra-sphincteric fistula

Figure 3: T2W axial view showing an intersphincteric fistula.

Stratified analysis based on age showed that those patients who were of ≤ 40 years of age had the sensitivity of MRI for correctly classification of 94%, specificity of 70.2%, and diagnostic accuracy of 91.3%. Those who were ≥ 40 years of age had a sensitivity of 96.1%, specificity of 66.3% and diagnostic accuracy of 87.9% (Tab. 3).
Stratified analysis on sex showed that those patients who were male had sensitivity forcorrect classification on MRI of 97.1%, specificity of 67.7% and diagnostic accuracy of 92.2%. Females had a sensitivity of 93.5%,

specificity of 68.9% and diagnostic accuracy of 86.4% (Tab. 3).

Stratified analysis on types of fistulous tract showed that sensitivity of MRI for correctly classifying fistula-in-anoin patients with intersphincteric fistula was 94.1%, specificity of 35.7 % and diagnostic accuracy of 77%. In those who had trans-sphincteric fistula, the sensitivity of MRI was 97.5 %, specificity 55.5% and diagnostic accuracy 93.2 (Tab. 3).

Discussion

While diagnosing an anal fistula is usually simple through clinical examination, correct classification and determination of the surrounding anatomy requires more skill and multiple diagnostic tools. Examination under anaesthesia (EUA) has long been considered the golden standard for correct assess-ment of an anal fistula. This is now questioned,with MRI regarded by many as equal to, or superior to examination under anaesthesia.

The use of Body coil MRI in our study has the advantage of giving additional information on structures away from the rectum and anus. However, there can be difficulties in differentiating between fistulous tracts and vessels. Similarly, it can be hard to distinguish between active and healed or fibrosed tracts, and scar tissue.[15] In our study, difficulties in discriminating between vessels or oedema and fistulous tracts with MRI were noted in four patients. In our study, the surgical findings have been used as the golden standard. This could be questioned, especially for fistulae that did not heal primarily after surgery. A previous study found body-coil MRI as more accurate for predicting outcome of treatment than surgical exploration.[16] The same authors also studied the effect of MRI on the treatment of primary anal fistula, and determined that MRI usage increased favorable outcomes by 10% than with Examination under anaesthesia alone.[17]

In our study patient outcome was not discussed due to the study design and loss of follow-up.

In general, the sensitivity and specificity figures for the detection of fistula tracks are in agreement with those in other studies. The sensitivity for the detection of a primary track (95%) was high but the specificity was relatively low (68.2%). A comparison with previously published literature local and international literature in (Tab. 4), and our results seem to be consistent with the international studies.

Study, year published	Sample Size (n)	Sensitivity	Specificity
Maier et al, 2001[14]	77	84%	68%
Gustafsson et al, 2001[18]	23	90%	33%
Buchanan et al, 2004[19]	108	97%	80%
Rehman et al, 2014[20]	30	90%	100%

Table 4: A comparison of sensitivity and specificity of MRI in diagnosing anal fistuale

In our study one submucosal fistulous tract in a patient was misclassified as a sinus due to the limited section thickness of MRI and lack of usage of gadolinium contrast agent. This can be improved by enhancing contrast resolution and increasing spatial resolution. MRI diagnosis of sinus formation in two of the patients proved to be transphincteric fistulous tract on surgery. The reason for this might be lack of visualization of the internal opening into the anal canal. In such an instance, clinical examination and proximity of the sinus may be correlated for the probable internal opening of fistulous tract on MRI. Two patients in our study in whom surgery showed intersphincteric tract showed transphincteric fistulous tracts on MRI. A possible reason was very close proximity of the sinus tract with the external sphincter. Similarly two patients had intersphincteric tracts misclassified as transphincteric fistulae.

A combination of simple MRI with fistulographymay reduce the false positive diagnosis of fistulous tracks by distinguishing true fistulae from fibrotic, T2 hyper-intense tracks. A combination of these two methods may better allow visualization of the anatomy of the internal opening for surgical planning.

Among the limitations of our study are the possibilities of selection bias. There is a possibility that people more concerned about their health were more likely to respond to the questionnaire.

The sensitivity and specificity figures must be interpreted with caution. Nearly all of the patients in our study had a fistula because they were selected for surgery only after a proved or strongly suspected fistula. Awareness of the fact that patients will undergo

surgery anyway may lead to over-reading of the MR images. In the clinical setting of our study, it was more important to indicate all possible tracks and extensions than to avoid a false-positive reading. This can produce a high sensitivity at the expense of a lower specificity.

With the MR imaging technique used in the present study, we aimed to improve the spatial resolution by using a phased-array coil, which resulted in a completely noninvasive high-spatial-resolution MR imaging technique. The multiple-coil arrangement in a phased-array coil increases the signal-to-noise ratio and allows us to obtain images with smaller voxel sizes and higher spatial resolution than those obtained with a body coil. The specific coil used in our study was a quadrature phased-array spine coil.

Conclusions

It is concluded from this study that MRI is a sensitive and specific test for diagnosis and classification of fistula-in-ano. We recommend that MRI should serve as a pre-surgery workup in every suspected fistula-in-ano for a better surgical outcome.

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