Diagnostic Accuracy of MR Fistulography using Saline in the Evaluation of Perianal Fistula

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ABSTRACT

BACKGROUND

Magnetic resonance imaging is known to demonstrate the perianal anatomy accurately. MR Fistulography with saline as contrast agent has been described to facilitate the detection of fistula tracks. We wanted to study the diagnostic accuracy, sensitivity, specificity, positive and negative predictive values of magnetic resonance fistulography using saline as a contrast agent using surgical findings as a reference standard.

METHODS

Fifty-nine clinically diagnosed cases of perianal fistulae who were sent for preoperative MR imaging of the perianal fistulae were included in the study. MR imaging after instillation of saline was obtained in these patients through a cannula inserted into the external opening. T2 and STIR images in axial and coronal planes were studied. Diagnostic indices were calculated using surgical findings as reference standard.

RESULTS

MR imaging with saline instillation demonstrated a sensitivity of 97.92 % in the detection of primary tracks. The sensitivity in determination of internal opening, secondary tracks, abscesses and horseshoe tracks were 98.04 %, 95.24 %, 100 % and 100 % respectively. MRI had 100 % specificity in detection of primary tracks, internal opening, secondary tracks, abscesses and horseshoe tracks before and after instillation of saline. The sensitivity was found to be more in participants who did not have active perianal discharge at the time of MR examination.

CONCLUSIONS

MRI with instillation of saline into the fistulous track is highly accurate for the presurgical evaluation of perianal fistula with respect to accurate depiction of primary track, secondary track, abscess and horseshoe extensions. It can serve as a cheaper alternative to MR examination using I.V. Gadolinium based contrast agents or MR Fistulography using Gadolinium agents.

KEYWORDS

Magnetic Resonance Imaging (MRI), Perianal Fistula, Saline, Pre-Operative Assessment, Fistulography, Horseshoe, Internal Opening, Secondary Tracks

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BACKGROUND

A perianal fistula is an anomalous connection between the perineal skin and the anal canal. It causes considerable morbidity and has a prevalence of 0.01 %, with young males more affected than females by a factor of 2 : 1. Perianal fistula most commonly present as discharge (65 % of cases) from the perianal openings. Local pain is the next common presenting complaint.[1] It can be a complication of chronic perineal inflammation, inflammatory disease, infiltrating malignancy, radiation therapy, perineal surgeries or traumatic delivery.[2] The crypto glandular hypothesis is the widely accepted theory about the etiopathogenesis of perianal fistula,[3] according to which intersphincteric gland infection is the primary event. With a persisting obstruction of the draining duct, this leads to formation of an intersphincteric track or abscess. A focal chronic infection in the intersphincteric plane may result in a recurrent abscess or persistently active fistula.

Perineal pain, secondary to inflammation is often the first symptom, followed by perineal discharge (65 % of cases), which is most common complaint with which patient presents.[4]

The management of perianal fistulas includes correctly identifying the anatomy of the fistula, after which aim is to clear any associated sepsis, to excise the fistulous track. The delineation of anatomy of fistula is crucial to prevent recurrence and to preserve sphincter integrity and continence. The best treatment to achieve cure is by laying open the fistula. Generally, in males, a fistulous track can be laid open if it involves half of the external sphincter bulk posteriorly or one third of the sphincter bulk anteriorly. In females only the posterior fistulas can be laid open and that too only if it involves one third of the sphincter bulk. In females an anterior fistula can never be laid open.[4] Other options include seton placement, advancement flaps, fibrin glue, etc.

Imaging Modalities in Evaluation of Perianal Fistula

MR imaging is the primary modality of choice for preoperative diagnosis and evaluation of perianal fistula and helps in improving patient outcome. Other imaging techniques include fistulography, CT fistulography and endoanal sonography.[1]

Fistulography with injection of contrast through the external perineal opening was earliest modality used in the evaluation of fistula, but the findings were difficult to interpret and often unreliable. Computed tomography (CT) depicts fistula in ano, but present role of CT is limited by its poor soft tissue contrast and is confined to the diagnosis of fistula associated with pelvic abscesses or when MR imaging is unavailable or is not tolerated.

Anal endosonography demonstrates the presence and length of anal sphincter disruption, but has limited accuracy in differentiating ischioanal and supralevator infections from fistulous extensions.

MR imaging is the preferred investigation of choice for preoperative assessment and characterisation of perianal fistula. MR imaging can accurately classify the tracts and thus offers additional information for the surgical treatment and contributes to better patient outcome.[5]

Latest additions in MR Imaging of Perianal Fistulas include three - dimensional (3D) turbo spin - echo (TSE) T2 - weighted sequences, that can be reformatted in any desired plane from the primary source data.[1] Diffusion - weighted sequences, is a new emerging sequence for imaging of anal fistulas which when used in combination with T2 - weighted imaging depicts the high signal intensity of inflammatory tissues. It is of particular value when the intravenous contrast agent are contraindicated.[6] Dynamic contrast - enhanced MR imaging is another recent development in the imaging of perianal fistulas. The active inflammation of fistula corresponds well to the quantity of enhancing pixels. It was found to be beneficial in patients with peri - anal Crohn's disease.[6] Finally, high strength magnetic fields like 3.0 - T imaging in the evaluation of perianal fistulas offers better signal – to - noise ratio, increased temporal resolution and increased spatial resolution, with decreased imaging time. Improved lesion visibility helps better sensitivity and characterization of perianal fistula.[6]

Fistulas are classified based on the route of the main track as it courses from the anal mucosa to the perineal skin. The two main widely accepted classification systems for perianal fistulas are Parks classification and St. James's University Hospital Classification.

Parks Classification

Parks et al classified perianal fistulas based on the course of the fistulous track and relationship of the track to the internal and external sphincters in the coronal plane and remains the most commonly used system for fistula classification. Four classes of fistulas were identified: intersphincteric being the simplest form, followed by trans sphincteric, supra sphincteric, and extra sphincteric.[7]

St. James's University Hospital Classification

is considered the radiological equivalent of the Parks' classification system is primarily based upon the appearance of perianal fistulae in the coronal and axial planes on MRI imaging and the use of the axial planes in identifying anatomic landmarks, which the radiologists are more familiar with.[8] The fistulae are classified into five grades. Grade 1 and Grade 2 fistulae are intersphincteric fistulae without and with abscess or secondary tracks respectively. Grade 3 and Grade 4 fistulae include trans sphincteric fistulae without and with abscess or secondary track in ischiorectal or ischioanal fossa respectively. Grade 5 fistulae include high fistulas being supralevator and translevator.

Imaging Appearance of Perianal Fistulas

Non-contrast T1 - weighted images depict excellently the anatomic details of the anal sphincter complex, the levator ani, and the ischiorectal fossa. Active pus - filled fistulae and granulation tissue appear hyperintense on T2 - weighted and STIR images. Active granulation tissue enhances on post

contrast T1 - weighted images, while fluid in the tract remains hypointense. Fistulae with fibrous walls are often seen around active tracts, in patients with history of recurrent chronic disease and prior surgery.

Chronic fistulous tracks are depicted as hypointense areas on both T1 - and T2 - weighted images and do not enhance with intravenous gadolinium contrast. Scars also show similar imaging appearance. The pus in the abscess cavity are seen appear hyperintense on T2 - weighted images and show central low signal intensity areas surrounded by intense ring enhancement on post contrast T1 - weighted fat - suppressed images.

The external anal sphincter can be clearly seen as relatively hypointense, and it contrasts well against the hyperintense ischioanal fat, in both STIR and fast T2 - weighted MR images. A fistula which is contained by and does not disrupt the external sphincter throughout its course is intersphincteric. An intersphincteric fistula is accurately excluded if there is extension of the tract into the ischioanal fossa. Trans sphincteric, supra sphincteric, and extra sphincteric fistulas have tracts that lie beyond the external sphincter and are differentiated by depicting the internal opening in the rectum and by demonstrating the course of the primary track around these structures.

This study aims to assess the diagnostic accuracy of MR Fistulography using saline.

METHODS

Saline introduced into the external opening can serve as an alternative method before the use of intravenous contrast agent or MR Fistulography using gadolinium chelates. With a pre - determined value of sensitivity and prevalence of disease as 95 % and 10 % respectively and maximum marginal error of 10 %, the calculated sample size was 35 according to the methodological review article by Hajian - Tilaki et al.[9] A diagnostic test evaluation study was conducted in Sree Gokulam Medical College and Research Foundation, Venjaramoodu over a span of two years from January 2013 to January 2015. All clinically diagnosed cases of perianal fistula, scheduled for surgery coming for pre - operative magnetic resonance imaging were included in the study. The external openings were cannulated using 18G cannula after applying lignocaine gel in the external opening. The images were assessed for the type of fistula, secondary tracks, internal opening, abscess, horseshoeing and supralevator extension by two radiologists having more than five years' experience. The findings were recorded in a fistula classification chart and compared with post - operative findings. MR imaging (Siemens Magnetom Essenza) was performed at 1.5 T (I6 channel Tim 25 x 16). A16 channel body coil with surface coil was used. T2 - weighted (TR / TE 3700 / 71 msec) and STIR (TR / TE / TI 3000 / 32 / 160 msec) images were obtained in sagittal, coronal, and transverse planes. Slice thickness was 3 mm, F.O.V. was 250 × 250 mm. Imaging matrix was 256 × 256. Microsoft Excel software was used for data entry and SPSS Software. Version 2 was used for data analysis. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were calculated and compared using surgical findings as the reference standard. Written informed consent was collected from all the patients. Clearance from the Institutional Ethical Committee was obtained.

RESULTS

Of the total of 71 patients who came for the pre-operative MR imaging of perianal fistula, 9 patients were excluded from the study as they did not have an external opening which could be cannulated.

The mean age of the study participants was 40.2 years. Of the 59 participants, 53 (89.8 %) were males and the rest 6 (10.2 %) were females. 42 participants (71.2 %) had active perianal discharge at the time of examination. 17 (28.8 %) did not have active perianal discharge at the time of examination.

The distribution of perianal fistula according to Parks Classification in MRI after the instillation of saline is as follows: 12 sinuses, 31 intersphincteric fistula, 15 trans sphincteric fistula and 1 extra sphincteric fistula.

Fistula Parameters		Surgical Findings +	Surgical Findings -	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Diagnostic Accuracy
Primary Track	+	47	0	97.92	100	100	91.67	98.31
	-	1	11					
Internal Opening	+	50	0	98.04	100			
	-	1	11					
Secondary Tracks	+	20	0	95.24	100	100	97.44	98.31
	-	1	38					
Abscess	+	8	0	100	100	100	100	100
	-	0	51					
Horse Shoe Tracks	+	8	0	100	100	100	100	100
	-	0	51					
Supralevator Extension	+	3	0	100	100	100	100	100
	-	0	56					

Table 1. Diagnostic Indices of MRI Fistulography Using Saline in the Evaluation of Fistula in Ano

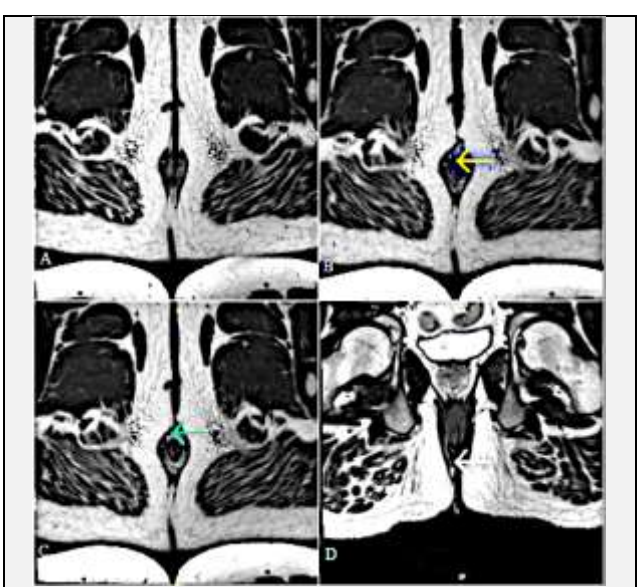

Figure 1. Intersphincteric Fistula (Grade 1 Fistula)

(A, B, C) Axial T2 weighted images and (D) Coronal T2 weighted shows an intersphincteric fistula between internal sphincter (yellow arrow) and external sphincter (green arrow).

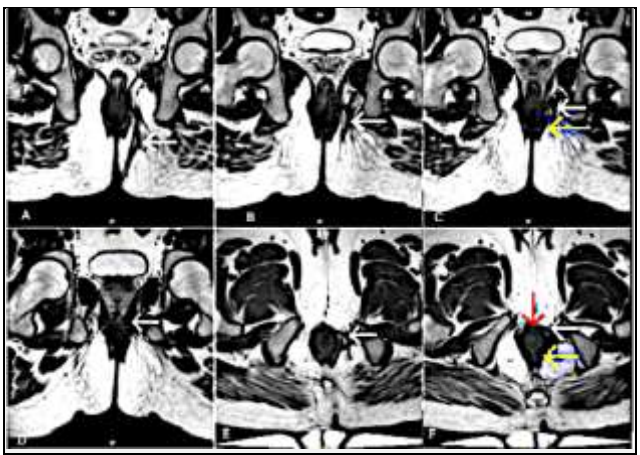

Figure 2. Trans Sphincteric Fistula (Grade 3 Fistula)

(Grade 3 fistula). (A, B, C, D) Coronal T2 weighted images and (E, F) Axial T2 weighted images shows hyperintense fistulous track. Coronal images (B, C, D) depicts the penetration of external sphincter (yellow arrow) by the fistula. Internal opening (red arrow) is seen at 12 O'clock position (F).

	MRI using Saline as Contrast	Surgical Findings
	Primary Track	
SINUS		
Inter - Sphincteric		
Trans - Sphincteric		
Supra - Sphincteric		
Extra - Sphincteric		
Inter - Sphincteric		
Ischiorectal		
	Internal Opening	
Site (High, Mid, Low)		
O'clock Position		
Secondary Tracks		
Abscess		
External Opening		
Horse - Shoeing		
Supralevator Extension		

Table 2. Fistula Classification Sheet (Data Collection Sheet)

DISCUSSION

Distribution of Primary Track (According to Park's Classification)

On surgery, one sinus was found to be an intersphincteric fistula. There was no disparity in the type of fistula described in MRI and in surgery. The distribution of type of tracks in the present study is comparable to other studies in the literature.

The distribution of primary tracks in our study compares well with previous studies by Khera et al,[10] Rehman et al,[11] Mahmoud et al[12] and E Esaway.[13] Most primary tracks were intersphincteric fistula, followed by trans sphincteric fistula. Our study had a substantial amount of sinus tracks, more than described in the previous mentioned studies. This could be attributed to the more confident diagnosis of sinuses with an absence of internal opening after instillation of saline.

Internal Opening

The position of internal opening in the anal canal was classified as high, mid and low. The position of internal opening in surgery was in concordance with the MR findings with instillation of saline in all patients. Two patients had 2 internal openings each. The position of internal opening in surgical findings was in concordance with the position of internal opening in MRI with instillation of saline in all patients.

Diagnostic Indices for the Detection of Primary Track in MRI

The specificity and positive predictive value of MRI with saline instillation in the detection of primary track was found to be 100 % and overall diagnostic accuracy was 91.67 %. Previous studies by Regina et al[14] and K Singh et al[15] showed less specificity and positive predictive values of MRI in the detection of primary track. A study by Rehman et al[11] showed an overall predictive accuracy of 90 % in the detection of primary track, which is less than the predictive accuracy found after the instillation of saline in our study.

Diagnostic Indices for the Detection of Internal Opening in MRI

The specificity and positive predictive value of MRI in the detection of internal openings was found to be 100 %, which is similar to the study by Mahmoud et al.[12] Previous studies by Regina et al,[14] E Essaway et al[13] and K Singh et al[15] showed slightly decreased indices. The specificity of MRI in the detection of internal opening was only 80 % in the study by K Singh et al.[15]

Diagnostic Indices for the Detection of Secondary Tracks in MRI

The specificity and positive predictive value of MRI in the detection of secondary were found to be 100 %. A study by K Singh et al[15] had showed a sensitivity of 93.75 % and specificity of 94.12 % in the detection of secondary tracks by MRI. This clearly demonstrates the value of saline in the detection of secondary tracks, which are often the cause of failed surgical outcome.

Diagnostic Indices for the Detection of Abscess in MRI

The diagnostic accuracy of MRI in the detection of abscess was found to be 100 % with the instillation of saline. This fares better in comparison to the studies by Regina et al[14] E Essaway et al[13] and K Singh et al[15] in terms of sensitivity, specificity, positive and negative predictive values. Specificity and sensitivity were found to be 100 % each in the study by Mahmoud et al.[12]

Diagnostic Indices for the Detection of Horse-Shoe Tracks in MRI

All the horse shoe extensions were detected in MRI with instillation of saline and thus had a diagnostic accuracy of 100 %. The results are comparable to the studies by Regina et al[14] and E Essaway et al,[13] while studies by K Singh et al[15] and Mahmoud et al[12] showed slightly less sensitivity and specificity in the detection of horseshoe tracks those given in literature.

Diagnostic Indices for the Detection of Supralevator Extension of Tracks in MRI

MRI has 100 % diagnostic accuracy in the detection of supralevator extension of fistulous track.

Comparison of Diagnostic Indices of MRI in the Detection of Primary Track in Participants with Active Discharge and in Participants without Active Discharge

The sensitivity and diagnostic accuracy of MRI in the detection of primary track is lower in patients without active discharge (96.97 % and 97.62 % respectively) before the instillation of saline. This could be attributed to the absence of fluid distending the track. Without fluid, the track appears hypointense in T2 weighted image and may be not detected. With the distension of track with saline, these fistulas can be easily detected. The sensitivity, negative predictive value and diagnostic accuracy in both groups are increased after the instillation of saline.

Limitations

All participants in our study were imaged for preoperative evaluation of fistula or when there was a strong suspicion of fistula. This selection bias may have led to methodologic difficulties. Since the participants were sent for preoperative evaluation and all possible tracks and extensions were described to avoid a false - positive reading. This fact could attribute to the high specificity in our study. The instillation of saline can be done only in patients with an active external opening. Patients with healed or fibrosed tracks cannot be evaluated with instillation of saline.

CONCLUSIONS

MRI using saline as a contrast agent has a specificity and sensitivity comparable to those obtained in studies using gadolinium contrast agents either intravenously or as a local agent. Saline can thus act as cheaper alternative to gadolinium - based contrast agents in the evaluation of perianal fistula. Patients with no active discharge through the fistula at the time of examination are more likely to benefit from using saline instillation into the tract.

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