

MR fistulography with percutaneous instillation of aqueous jelly: A cost effective technique innovation

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Abstract

Background: Perianal fistula is a commonly encountered condition in routine surgical practice. Accurate presurgical mapping of these tracts is vital to prevent recurrence. We have assessed the effectiveness of percutaneous instillation of aqueous jelly prior to magnetic resonance (MR) fistulography. **Aims and Objectives:** To study the role of percutaneous instillation of aqueous jelly in fistulous tracts prior to MR fistulography. **Materials and Methods:** All patients with active discharge, referred for MR fistulography between January 2014 and April 2016, were included in this study. Approximately 3–5 ml of sterile aqueous jelly was percutaneously instilled into the external openings prior to MR fistulography. Post MR fistulography, patients were monitored till surgery for pain, fever, or bleeding. The type of fistulae, location of internal openings, lateral ramifications, and presence of abscess were compared with per operative findings for diagnostic accuracy. **Results:** Sixty-four patients enrolled in our study had undergone preoperative MR fistulography with aqueous jelly instillation. MR fistulography revealed a total of 77 tracts and showed a sensitivity and specificity of 100% in delineation of type of tract. Forty-nine internal openings were identified with 94.2% sensitivity, 100% specificity, and 95.3% accuracy. 90.5% sensitivity, 100% specificity, and accuracy of 97% were observed in delineation of lateral ramifications. None of the patients reported pain, fever, or bleeding post procedure till surgery. **Conclusion:** Percutaneous instillation of aqueous jelly prior to MR fistulography is a safe, cost effective, and accurate technique to provide a comprehensive delineation of the complex anatomy of perianal fistulae.

Key words: Aqueous jelly; magnetic resonance imaging; perianal fistula

Introduction

Perianal fistula refers to an abnormal tract connecting the anal canal and perianal skin. It is one of the commonly encountered conditions in routine surgical practice.^[1] Fistula-in-ano is a chronic, potentially debilitating problem for the patient due to repeated pus discharge from external openings in addition to pain, itching, and perianal swelling.

Rarely, there can be systemic spread of these infections, incapacitating the individual. In 10% of the cases, fistulae are a manifestation of Crohn's disease, tuberculosis, fungal infection, tumor, or trauma, which are usually complex in nature and more complicated in treatment.^[2] Surgery is the mainstay for treatment of fistula-in-ano. However, inadequate excision leads to frequent recurrences and over-excision may lead to sphincter incontinence.^[3-5] Therefore, accurate

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and detailed preoperative imaging plays a vital role in the surgical planning and outcome. The preferred modality for imaging currently is magnetic resonance imaging (MRI) with intravenous gadolinium, based primarily on the enhancement of tract wall inflammation.^[3,6-8] However, addition of intravenous gadolinium may give false negatives and positives in addition to increase in the overall costs.^[8] We have innovated a modified technique using percutaneous instillation of aqueous jelly into the sinus tract, which has successfully augmented the diagnostic potential of MR fistulography. The modified technique increases the conspicuity of the tracts by dual physical principles, first by distending the tracts, and second, by providing inherent contrast, comprehensively eliminating the need for gadolinium administration. This article studies the role of percutaneous instillation of aqueous jelly into the fistulous tracts prior to MR fistulography.

Materials and Methods

A prospective study was carried out in a tertiary care hospital, which included all patients with fistula-in-ano having active perianal discharge and referred for MR fistulography between January 2014 and April 2016. Patients who did not undergo surgery were excluded. Institutional ethical committee clearance and informed consent were obtained prior to the procedure. Patients were placed in prone position and external openings were identified. Under aseptic precautions, sterile aqueous ultrasound jelly was filled in a 10 ml syringe. Using the outer sheath of a 20 G venous cannula attached to the syringe containing jelly, external openings were gently cannulated. A slow hand injection depending on patient tolerance was given. Approximately 3–5 ml of aqueous jelly was instilled per external opening in patient preparation room just prior to the patient being taken into the gantry room. The injection was stopped once jelly started expelling out. Immediately following the instillation of jelly, MR fistulography of the patients was done using a 1.5 Tesla MRI scanner (Magnetom Avanto, Siemens Erlangen, Germany). The imaging was carried out in two orthogonal planes along the anal canal. The details of imaging protocol followed is shown in Table 1. In addition, diffusion weighted imaging at b values of 0, 400, and 800 were used in patients where abscess was suspected on initial sequences. The various imaging parameters studied for describing the fistulae were as follows:

Table 1: MRI imaging parameters for MR fistulography

Parameters	T2W Axial	T1W Axial	T2W Coronal	T2W Axial FS	T2W Coronal FS
TR (ms)	7070	725	5930	4400	6810
TE (ms)	85	21	90	85	90
Slice Thickness	2 mm	2 mm	2 mm	2 mm	2 mm
Resolution	320/75	320/70	256/70	320/70	256/70
No. of Averages	2	2	2	3	2

- Type of fistulous tract defined based on Park’s classification.^[9] Any tract arising from the external opening was defined as primary tract and any secondary tracts seen arising from these primary tracts were defined as lateral ramifications
- Location of internal openings in terms of ‘O’clock position
- Number and course of lateral ramifications
- Abscesses – number and location.

The above mentioned imaging parameters were compared with per-operative findings and sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were assessed for each parameter. Patients underwent fistulectomy within 7 to 18 days from the day of MRI, with a mean interval of 10.3 days. All patients were followed up till surgery for the potential postprocedure complications of pain, fever, or bleeding from external openings/per rectum.

Results

Out of 98 patients, 64 patients who underwent surgery included 53 males (82.8%) and 11 females (17.2%) in the age ranging 25–64 years with mean age being 38.4 years. None of the patients developed post MRI complaints of pain, fever, or bleeding. A total of 77 tracts were seen in these 64 patients, with 10 patients having multiple tracts from multiple external openings. The most common type of tract observed was inter-sphincteric, as per Park’s classification [Figure 1-3]. Trans sphincteric [Figure 4] and those with supra-levator extension [Figure 5] were among



Figure 1: T2 weighted image with fat saturation in coronal plane shows an intersphincteric perianal tract (white arrow)

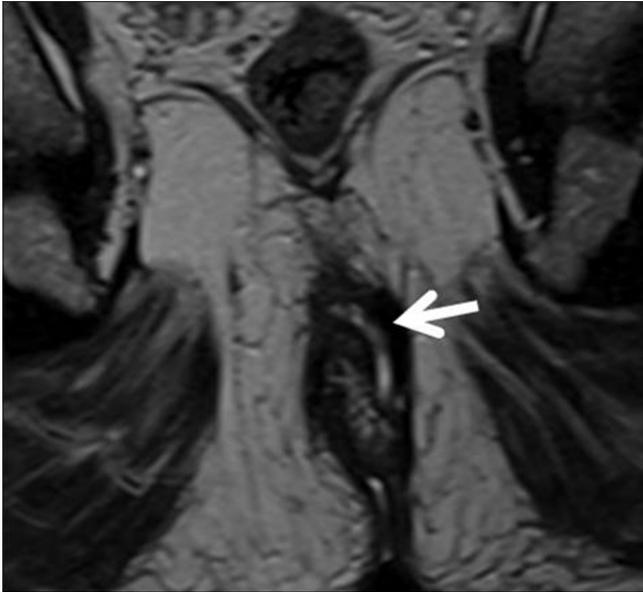


Figure 2: T2 weighted image in coronal plane shows a well distended intersphincteric perianal tract (white arrow)



Figure 3: T2 weighted image in coronal plane shows an intersphincteric fistulous tract (white arrow)



Figure 4: T2 weighted image with fat saturation in coronal plane shows a fistulous tract with a superolateral ramification (white arrow) from the transsphincteric main tract (black asterisk)

the least common. Distribution of tract types is shown in Figure 6. Our technique achieved a sensitivity and specificity of 100% in the delineation of the type of tracts, on correlation with per-operative findings.

Internal openings could be identified in 49 of 64 patients (76.6%), the most common location being at 5 to 7 'O'clock position [Figure 7]; remaining patients (23.4%)



Figure 5: T2 weighted image in coronal plane shows a well delineated extrasphincteric tract (white arrows) extending across levator ani (asterisk) and opening into rectum

demonstrated only blind-ending sinuses. The distribution of location of internal openings detected in our study, in terms of 'O' clock position, is shown in Figure 8. On surgery, 52 of 64 patients had internal openings. MR fistulography could not detect the location of three internal openings which were found to be 8 'O' clock (two cases) and 4 'O' clock (one case) positions. To detect the location of internal openings, our study achieved a sensitivity of 94.2%, specificity of 100%, PPV of 100%, NPV of 80% and an accuracy of 95.3%. Twenty-one lateral ramification tracts [Figure 4] were found per-operatively in 64 patients. Nineteen of these lateral ramifications were identified on MR fistulography implying a sensitivity of 90.5% specificity of 100%, PPV of 100%, NPV of 95.6%, and accuracy of 97%. Seven patients had ischio-anal abscesses, all of which were identified on MR fistulography. A total of 152 positive findings were correctly identified on MR imaging, out of the 157 found per-operatively. Comparative distribution of findings on MRI and per-operatively is depicted in Figure 9. Overall, MR fistulography with percutaneous instillation of aqueous

jelly into the tracts showed a sensitivity of 97% and PPV of 100% in comparison with per-operative findings.

Discussion

MR fistulography is an important preoperative tool to provide a roadmap to surgeons to prevent recurrences or sphincter incontinence.^[3-5] Various protocols of MR fistulography including noncontrast MRI, percutaneous gadolinium instillation, and contrast-enhanced MRI have been used to achieve better results imaging.

Lunniss *et al.* compared results of noncontrast MR fistulography with surgical findings using spin-echo T1-weighted images and STIR images acquired on a 0.5 Tesla MR system. They found concordance between MRI and surgery in 85.7% of cases for presence and course of tract, 91.4% for presence of lateral ramifications (secondary tracts) and abscesses, and 80% for position of internal opening. The

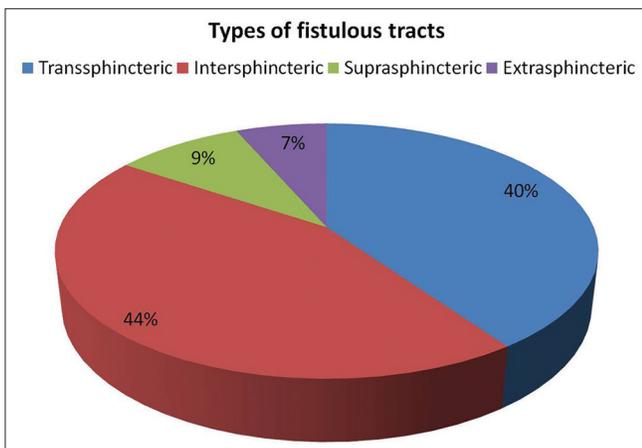


Figure 6: A Pie diagram depicting distribution of types of fistulous tracts

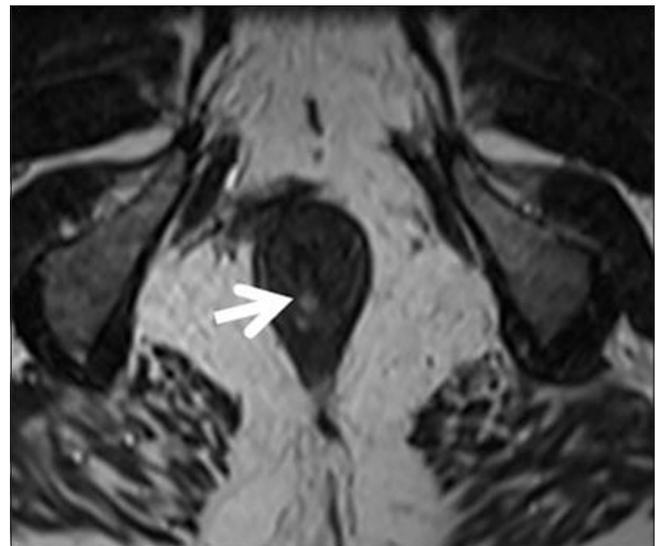


Figure 7: T2 weighted image in Axial plane show internal opening (white arrow) of a transsphincteric fistula at 6' O clock position

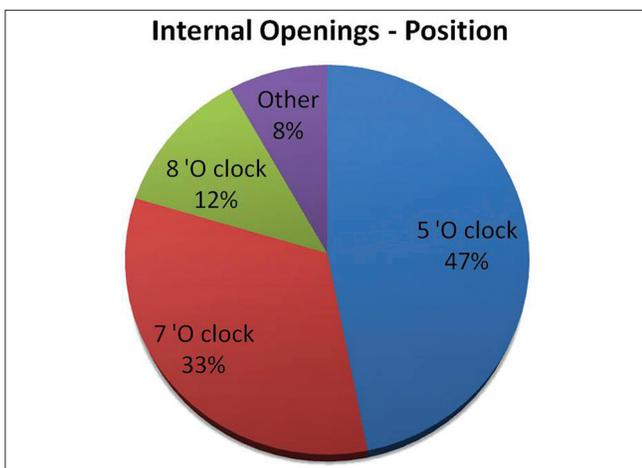


Figure 8: A pie diagram depicting location of internal openings of fistulous tracts

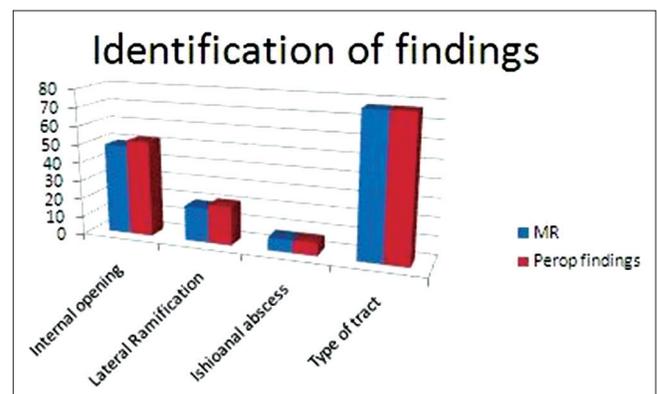


Figure 9: A bar diagram showing comparison of MRI and per-operative findings

study did not use intravenous contrast and used an enema tip to demarcate the walls of the anal canal.^[4] However, inactive small tracts and complex fistulae could not be clearly distinguished in the study. Beets-Tan *et al.* used a noncontrast T1 and T2weighted imaging protocol, and found 100% sensitivity and 86% specificity in identifying the primary tract, and 96% sensitivity and 90% specificity in identifying internal opening.^[10] In the present study, using percutaneous instillation of jelly, a higher proportion of findings such as internal openings (94.2%), presence and course of tracts (100%), and lateral ramifications (97%) were identified accurately on MR fistulography compared to surgery.

MRI without intravenous gadolinium had drawbacks of inability to delineate the tract walls, especially the smaller ones, and chronic tracts because they may not show hyperintensity on T2 weighted imaging.^[5,8] Essawy *et al.* used intravenous gadolinium MR fistulography, in the same study, instillation of gadolinium contrast diluted in normal saline into the fistulous tracts was also done in some patients to obtain distension of tracts; however, no mention of its efficacy was made in that study.^[3] Spencer *et al.* used dynamic contrast enhanced MR fistulography and found a sensitivity of 97% and a low specificity of 60% for localizing internal opening, which is in contrast to the present study which showed both higher specificity and sensitivity.^[6]

Yildirim *et al.* concluded that addition of contrast-enhanced fat-suppressed T1 imaging sequence will help identify the course of primary tract, lateral ramifications, and internal openings accurately, as well as will enhance visualization of the smaller tracts.^[5] Khera *et al.* in a similar study, used intravenous contrast-enhanced MR fistulography; however, the study was limited by the lack of surgical correlation.^[7] The walls of the fistulae show shortening of T1 time with intravenous gadolinium, thus making the tracts more obvious. However, chronically inflamed tracts, scar tissue may not show any enhancement, thus making them less apparent. In addition, enhancing vessels such as hemorrhoidal veins may be confused for fistulous tracts.^[8] Moreover, there is no distension of the tracts, making this technique less sensitive in identifying thinner tracts. Utility of percutaneous instillation of gadolinium and normal saline into the tract to cause their distension without intravenous contrast was assessed by Waniczek *et al.* for better demonstration of the main tract.^[11] Gadolinium and normal saline, being watery in consistency, only cause temporary distension of the tracts, and smaller tracts may not have distended at all, and therefore smaller tracts, position of internal opening, and lateral ramifications would not be identified reliably using this technique.^[3]

Aqueous jelly is inert, cheap, and widely available. Being viscous in nature, it produces adequate and sustained distension of the tracts. Aqueous jelly has a long T2

relaxation time, giving it an inherent contrast on T2 weighted imaging. Instillation of aqueous jelly prior to MR imaging is a simple procedure and can be easily performed routinely in cases of perianal fistula for better results. The present study with percutaneous instillation of aqueous jelly showed a sensitivity and specificity of 100% in identifying the type of tract (100%), which is superior to the results derived by Essawy *et al.* (96%). Both the studies show comparable values of sensitivity (94.2% and 96%, respectively) and specificity in identifying internal openings (100% and 96%, respectively) and ischioanal collections (100% in both studies). Essawy *et al.* did not study the lateral ramifications, which was included in the present study. The most common type of the tract seen in the present study was of the intersphincteric type (44.1%) followed by the transsphincteric type, concurring with observations by Khera *et al.*

In the current study, the internal openings, types of fistulous tracts and lateral ramifications were best identified on T2weighted axial images. Multiplicity of tracts and supralelevator extension were best seen on T2weighted coronal images. Coronal images also gave a holistic overview of the fistulae. Hence, a combination of T2 weighted axial and coronal images are the most informative about the anatomy of the fistulous tracts. T2weighted imaging with fat saturation helps identify small and subtle tracts, which may not be obvious otherwise. These findings are also in agreement with other studies.^[4-5,8]

Limitations

Although surgery has been considered as reference standard for comparing the findings, MRI is stated to be more accurate in identifying all findings. Hence, comparison with surgical findings may underestimate the accuracy of MR fistulography.^[4-5] The efficacy of this innovation could have been better evaluated if comparative analysis of with and without percutaneous instillation of jelly in same individuals was done. Instead, findings were evaluated using surgery as the reference standard and diagnostic efficacy thus calculated was compared with the existing data on MR fistulography.

Conclusion

Prior instillation of aqueous jelly in MR fistulography provides accurate delineation of the complex anatomy of fistulae. This technique is reliable in identifying internal openings, lateral ramifications, and multiplicity of tracts. The accuracy of this information is vital to map the extent of disease and prevent complications such as recurrence and incontinence.

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Conflicts of interest

There are no conflicts of interest.

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