

Perianal Fistula: A Roadmap from Diagnostic Imaging to Treatment

Adityan R¹, Jerald Paul Immanuel²

¹1st Year Student, M.Sc., Radiology and Imaging Technology, The Tamilnadu Dr. MGR Medical University, Chennai, ²Lab Specialist RMI Department, Institute of Applied Technology, Abu Dhabi.

Corresponding author: Jerald Paul Immanuel, Lab Specialist RMI Department, Institute of Applied Technology, Abu Dhabi.

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A B S T R A C T

The perianal fistula is noted in routine surgical practice that has the tendency to reoccur even after surgery due to missed tract or tissue. An adequate pre-surgical mapping is a necessity for giving an excellent surgical outcome and choosing an appropriate surgical technique for treating various fistulas. So, modalities like X-ray fistulography, endoanal ultrasonography, computed tomography fistulography, and the magnetic resonance fistulography were used for assessing fistula. Among these, magnetic resonance fistulography is the commonly preferred diagnostic imaging technique for interpreting the fistula due to higher resolution on soft tissues, non-usage of ionizing radiation, which reduced the threat of radiation-induced cancer, and non-invasive imaging technique, which reduces patient discomfort and complications. The fistula classification is mainly of two types namely, Park's classification and St. James university hospital's classification. In this literature, we have reviewed the importance of medical imaging modality in interpreting perianal fistula, especially magnetic resonance fistulography, as an accurate pre-operative, post-operative, and follow-up medical imaging modality for the perianal fistula's imaging. The subtraction technique, dynamic contrast imaging, volume imaging, and percutaneous instillation of aqueous jelly into the perianal fistula tract are the latest advances in imaging perianal fistula. Also the surgical techniques for treating perianal fistula were discussed.

Keywords: Classification of Fistula, Fistula Surgery, Magnetic Resonance fistulography, Perianal Fistula.

INTRODUCTION

The perianal region fistula is a pathological tract extending between the perianal skin and anal canal, commonly encountered in routine surgical practice.¹ Generally, a fistulous tract is a tract connecting one or two surrounding anatomical structures to the external skin surface, and it is said to be a sinus fistula tract when it connects only one hollow organ or skin.² The perianal fistula occurs either as tuberculosis, or one of the components of the inflammatory bowel diseases, such as Crohn's disease, anal crypts and gland's infections, crypto glandular disease, trauma, and infection which are more complicated for treatment in 10% of the cases.^{1,3} Among the general population, Crohn's disease occurs in 3 to 7 cases in 100,000 peoples.⁴ Approximately 40% of the patients diagnosed with Crohn's disease will develop a perianal fistula, and 36% of patients having Crohn's disease present with a perianal fistula as their initial complaint in which 75% of the cases were complex.⁵ The fistula in ano occurs approximately in 10 of 100,000 persons, with male predominance.⁶ The male-to-female ratio of perianal fistula occurrence is 2:1 with a common symptom of discharge from the fistulous tract and pain due to the inflammatory tissues in 65% of the cases.⁷ The reason for male predominance may be due to the higher abundance of anal glands.² The perianal fistulous tracts are more complex

in 5 – 15% of cases with the presence of secondary tracts and extensions like an ischioanal abscess, horseshoe fistula, and supra levator abscess outside the anal sphincter complex.⁸ The perianal fistula's characteristics include the external and internal openings, primary tract, lateral ramifications from the main tract, and other diseases complicating the fistula.⁹ Surgical intervention is the commonly preferred treatment for fistula in ano. But during surgery, improper excision lead to recurrences and over-excision may cause anal sphincter incontinence.¹ Up to 25% of fistulas reoccur, especially if secondary fistulous extension from the primary tract is present as it may be missed during surgery.¹⁰ In a hospital in the United Kingdom, there were 12,000 patients affected by perianal fistula between the years 2008 to 2009 and 10,000 patients were treated surgically. An excellent surgical treatment is linked with the perianal fistula's accurate preoperative evaluation because of its higher tendency to reoccur.^{3,11,12} Society of American colon and rectal surgeons has formed a task force for the classification of perianal fistula as simple and complex in which complex type is a high risk factor of developing incontinence after surgery.⁹ The pre-operative investigation of the pathological extension with medical imaging methods paved the way to the surgical elimination of all pathological tissues, thereby decreasing the recurrence rate.³ The imaging method is used to outline all the minute and

hidden tracts along with its extension and relation to the anal sphincter complex.² The diagnostic evaluation of perianal fistula is challenging even for specialists in colorectal surgery and also for radiologists.⁴ The initial role of radiologists is to be accurate and detail in making their final reports in estimating the perianal fistulous tract, as diagnostic information will be vital in making decisions about choosing whether medication or surgical intervention.¹² So, it is initial to see the perianal fistula's course along with its relevant findings before performing the surgical intervention.³ The recommendation from the American Association of Gastroenterology states that for diagnosing the simple and complex types of perianal fistula, physical examination with rectosigmoid endoscopy is sufficient but in case of pain or planning for surgery as the initial treatment, examination under anesthesia (EUA) or Magnetic Resonance Imaging (MRI) fistulography are preferred. Also, the recommendations acknowledge that performing EUA alone is not 100% accurate.¹³ MRI is predominantly preferred for diagnosing the anal region fistula, anovaginal, and rectovaginal fistula's anatomy.³ The major objective of this review is to provide a clear information about the selection of appropriate diagnostic imaging modality for the evaluation of perianal fistula along with the treatment and management.

GRADING OF PERIANAL FISTULA

Park's Classification

The Parks type of classification for perianal region fistula

Type	Name
I	Intersphincteric Fistula
II	Transsphincteric Fistula
III	Suprasphincteric Fistula
IV	Extrasphincteric Fistula

Table-1: Park's type of perianal fistula classification⁹

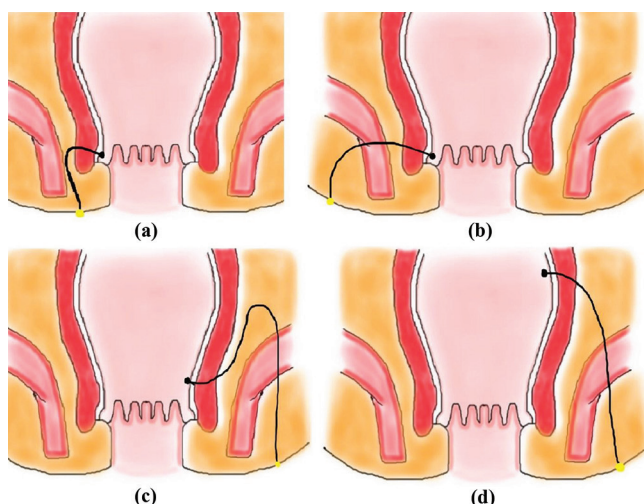


Figure-1: Coronal plane illustration of Park's classification of perianal fistula. (a) Represents intersphincteric fistula, (b) Represents transsphincteric fistula, (c) Represents suprasphincteric fistula, and (d) Represents extrasphincteric fistula. (Yellow dot indicates external opening, Black dot indicates internal opening).

was formed by Parks et al. from the results of 400 perianal fistula cases treated in St. Mark's hospital, London. There were four major types based on its extent and anal sphincter relationship, which is mainly developed for surgical usage.^{7,12,14} The Park's classification of the perianal fistula is given in table 1 and diagram illustrated in figure 1.

St. James university hospital's classification

The radiologists formed the St. James university hospital's classification for being accurate and descriptive in their final reports to help surgeons in their treatment.⁷ Morris et al. reported that St James's University Hospital classification's grade 1 and grade 2 fistula types have satisfactory outcomes whereas grade 3 to grade 5 have unsatisfactory results as it needs a surgical intervention.¹⁵ The St. James university hospital's classification is given in table 2 and diagram illustrated in figure 2.

Grade	Name
I	Simple Linear Intersphincteric Fistula
II	Intersphincteric Fistula with an abscess and / or secondary tract
III	Transsphincteric Fistula
IV	Transsphincteric Fistula with an abscess and / or secondary tract
V	Supralelevator extension.

Table-2: St. James university hospital's classification of perianal fistula.²⁷

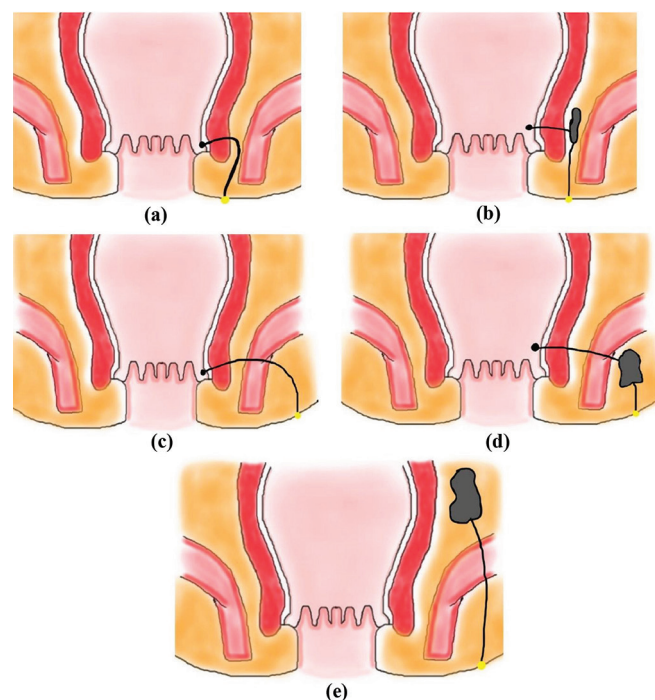


Figure-2: Coronal plane illustration of St. James University's classification of perianal fistula. (a) Represents grade 1 intersphincteric fistula, (b) Represents grade 2 intersphincteric fistula with abscess, (c) Represents transsphincteric fistula, (d) Represents transsphincteric fistula with abscess, and (e) Represents supralelevator fistula extension. (Yellow dot indicates external opening, Black dot indicates internal opening).

MEDICAL IMAGING TECHNIQUES

Conventional Fistulography

The conventional fistulography was the imaging technique used for perianal region fistula evaluation with radio - opaque contrast media instillation. This procedure is done by catheterizing the fistula's external opening with a cannula and injecting water - soluble contrast media into it, and obtaining a radiograph.¹⁶ But the drawbacks listed below,

- The difficulty in interpreting the secondary tract extension is due to the lack in filling of contrast media.^{7,16}
- The inability to visualizing the levator muscle to estimate the supra levator or infra levator extension¹⁶ and the perianal fistula's relationship with anal sphincters.⁷
- The conventional fistulography has sensitivity, and specificity ranges from 16% - 87%.¹⁷

Computed Tomography

Computed Tomography (CT) is performed both with instillation of rectal and intravenous contrast media into the fistulous tract for perianal region fistula evaluation.⁷ Ergen et al. has shown the rectal contrast media's effectiveness following the act of forced defecation to visualize the openings of the anovaginal fistula or rectovaginal fistula interior of the rectum.³ CT usually fails to visualize inflammatory disease and also perianal abscess as it lacks soft - tissue resolution^{7,8} and also fails in correct perianal fistula's classification as it fails to show the tract near the sphincter ani externus muscle and levator muscle, which results from the similar attenuation values.^{18,19} On MRI, the abscess that contains air may be difficult to interpret from bowel air, but CT is free from this limitation.²⁰

There are concerns raised regarding the CT usage as it may steer the chance of developing radiation - induced malignancies; however the advancements in CT's software and hardware configurations enable lesser radiation dose scans without compromising the image quality.

Endo Anal Ultrasonography

Endo Anal Ultrasonography (EAUS) was the first medical imaging technique used for interpreting the anal sphincter complex's anatomy³, rectal wall, and fistula with its relation to the sphincter complex.^{7,8} The high - frequency transducers were used to accurately identify of intersphincteric fistula and the internal opening of the fistula.¹⁷ For assessing the fistula's internal opening, EAUS shows 91% accuracy, and MRI shows 97% accuracy.⁷ Nevertheless, EAUS has a major drawback of limited field of view (FOV), which disables its use in evaluating the superficial fistula, suprasphincteric fistula with secondary branches, extrasphincteric fistula, and fistula extending to some distance far away from the EAUS probe favoring the use of MRI in such cases.^{7,17} Even though MRI is higher in every aspects, EAUS is preferred in most cases, especially in claustrophobia patients.^{2,7,17}

Magnetic Resonance Imaging

MRI has been applied for various clinical investigations, whereas its use on the evaluation of perianal fistulas was first reported in the 1990s with a higher rate of specificity and sensitivity.¹⁷ The diagnostic accuracy reports of MRI

in detecting perianal fistula were from 1992, and the fistula classification was from 1994.²¹ Surgical intervention is considered the preferable technique or reference standard for evaluating and treating fistula but, MRI is highly accurate than surgery for diagnostic evaluation for perianal fistula and Crohn's disease.¹ The MRI's advantage is its better visualization of anal sphincter complex and fistula relationship with multiplanar imaging technique and higher soft-tissue resolution.¹⁹ MRI is the accurate pre and post-operative imaging technique in evaluating the fistulous tract with secondary extensions, but it has drawbacks like higher time consumption, higher expense, and claustrophobia in some patients.^{20,22} 75% of the surgery with MRI as the pre-operative investigation reduces the recurrence of perianal fistula. Villa C et al. demonstrated the MRI's accuracy in ruling out the main fistulous tract with 100% sensitivity and 86% specificity, whereas for abscesses visualization, it gives 96% sensitivity and 97% specificity.¹⁴ Most of the perianal fistula cases were presented in the lower pelvic region, and in the case of supra levator fistula extension, bowel peristalsis may cause artifacts which can be overcome by anti-peristaltic agents.²

The radiofrequency coils utilized for fistula in ano imaging are body coil; in some studies, spine coil, and endoanal coil. Researchers have performed a comparative evaluation of body coil and endo anal coil MRI imaging, in which body coil MRI shows a surgical concordance rate of 96% and endo anal MRI shows 68%.²¹ Hence both coils can also be simultaneously used to get better diagnostic accuracy, but it is not easy to employ.²

Mostly the researchers prefer the T2 weighted turbo spin echo imaging method for appreciable differentiation between a hypo intense fibrous wall and hyper intense fluid of the fistula, which collaterally enables nice visualization in the anal sphincter's layers.⁵ In order to attain an exemplary sequence of planning, a T2-weighted sagittal plane image is acquired first, which shows the entire pelvic overview, anal canal's extent, and axis.⁷ The T1 weighted pulse sequence in fistulography is used for an anatomical overview of the pelvis, especially the ischiorectal fossae, levator ani plate, and sphincters. For the effective fistulous tract evaluation in abscess and sepsis, a combination of T2, short tau inversion recovery, and post-contrast T1 weighted imaging in axial as well as coronal planes were preferred.¹⁴ The diffusion-weighted imaging (DWI) increases the confidence level of radiologists in reporting.¹⁹ The inflammatory tissues tend to have hyper enhancement in DWI. The DWI is combined with T2 weighted imaging in improving the diagnostic efficiency of patients with contraindication of contrast media imaging, but it needs an extra 2 - 4 minutes of scan time.^{7,23} The Three dimensional (3D) imaging had paved the way for multiplanar reconstruction (MPR) into any plane, eventually decreasing the routine number of pulse sequences performed.⁷ The gradient echo 3D imaging enabled post-processing techniques like MPR, maximum intensity projection (MIP), and T2 weighted 3D turbo spin echo imaging provides raw data for any desired plane reconstruction.^{4,20} The 3D pulse sequence's advantages were,⁷

- No operator dependence as any plane can be

reconstructed.

- Higher signal to noise ratio.

Thinner slice acquisition

However, the T2 weighted 3D imaging is not preferred in some of the cases as it prolongs scan time for a single sequence and more sensitive to patient motion.²⁰

The MRI uses gadolinium-based media for contrast-enhanced T1 weighted imaging which shows a hypo intense signal from fluid or active inflammation and shows a hyper intense signal from granulation tissue.^{5,7} The post-contrast-acquired images were used to evaluate the degree of inflammation and differentiate the scar tissue from granulation tissues, increasing the diagnostic confidence prior to surgery.¹⁵ The chronic fistulous tracts show low enhancement in T1, T2 weighted imaging, and no enhancement in post-contrast T1 weighted images.⁷

Current Trends

The crucial drawback of MRI is that nerve and vasculatures can be mistaken as a fistulous tract.²⁴ To overcome this, digital subtraction MRI is done by acquiring T1 fat-saturated pre and post-contrast sequences. The acquired images were subtracted, which gives dark fat background and hyper enhanced fistulous tract with different degrees of low signal intensity of fluids, which enables reasonable interpretation of minute fistulous tracts.^{4,7}

The dynamic contrast enhanced magnetic resonance imaging (DCEMR) is used to evaluate Crohn's disease's activity rate by acquiring time signal intensity curves from a T1 weighted image for active tract estimation by measuring the volume of enhancing pixels.⁷

Another technique for diagnosing perianal fistula is using aqueous jelly instead of gadolinium-based contrast media and saline. Plain MRI cannot delineate the walls of the fistulous tract, particularly the smaller tract. So, instillation media is used for tract delineation. Initially, gadolinium contrast media and saline were used by Waniczek et al. for better visibility of the pathological tract.¹⁶ The gadolinium contrast media have a disadvantage of giving false positive and false negative results and increasing the total cost of the examination. As an alternate, the aqueous jelly is a cheap, viscous, inert, and readily available that can be routinely used to give sustained and adequate delineation of the tracts.¹ Hence a modified innovative technique is the percutaneous instillation of the aqueous jelly into the perianal fistulous tract to diagnose perianal fistula. This technique elevates the diagnostic evaluation by distending the fistulous tract and inherent contrast due to longer T2 relaxation time, which collaterally eliminates the need of MRI contrast media.¹

TREATMENT AND MANAGEMENT

Surgical Intervention

The estimation of a successful surgical intervention is the correct balance of disease eradication and maintaining the normal function, which is achieved by detailed knowledge about the fistula's relation with the anal sphincter and secondary extensions from it to avoid recurrences and incontinence.^{3,16,25} After surgical intervention, clinical examination is difficult as fibrosis takes place; in such cases,

MRI is referred instead of EAUS as it also distinguishes active sepsis from fibrosis.¹³ The types of surgical intervention are,

Fistulotomy¹⁵

Fistulotomy is done in treating low transphincteric and intersphincteric fistula as it maintains fecal continence.⁵ It is performed by an initial incision on the fistula's opening and blending it with the anal canal for healing process. But performing this type of surgery for treating complex fistula leads to incontinence in approximately 50% of the cases, which is overcome by marsupialization of fistulotomy wounds to accelerate the healing process.

Fistulectomy¹⁵

Fistulectomy is for treating low transphincteric and intersphincteric fistula. The surgery is performed by completely removing the pathological tract causing larger wound compared to fistulotomy that is overcome by marsupialization of the wounds to accelerate the process of healing.

Noncutting seton¹⁵

It is an alternative technique for fistulotomy and fistulectomy with non-healing wounds. Setons are threads made up of nylon, silk, rubber, polyester, plastic, silicone, self-locking cable ties, and wire. It prevents the closing of the fistula's external opening site, thereby allowing the drainage of fluids to prevent abscess formation, which is the primary or temporary treatment for reducing the fistula's severity.⁷ To rule out the position of the seton after surgery, T1 weighted gradient echo imaging sequence was used.¹⁵

Advances in surgical intervention¹⁵

Biomaterials, which is a biological glue with collagen materials, are used recently as an alternative treatment method for perianal fistula with an initial success rate in 60 – 85% of cases. The biological glue used is a fibrin glue that has both thrombin and fibrinogen components to make it a tissue adhesive. The procedure starts the instillation of both components into the tract to seal it by forming a fibrin clot, which has a higher healing rate with delayed recurrences.

Medication

Crohn's disease has higher healthcare and hospitalization costs²⁶, which is treated initially by antibiotics like ciprofloxacin and metronidazole.⁵ The antibodies with anti-tumor necrosis factor like infliximab are used for good results.⁷ The infliximab treatment for every eight weeks reduces 70% of surgeries and hospitalization for Crohn's disease patients and 50% reduction in surgical procedures compared to placebo maintenance treatment.²⁶

CONCLUSION

The perianal fistula imaging is most challenging as any missed diagnostic information may lead to recurrences and repeated surgical intervention. The most commonly preferred investigation for perianal region fistulas evaluation is MRI fistulography, which is considered as the accurate pre-operative, post-operative, and follow-up imaging technique. The most significant advantage of MRI is increased soft tissue anatomy, which is very important in evaluating fistulous tract extension and non-usage of ionizing radiation that reduces

the chance of radiation-induced cancer occurrence. Hence from this review it is clear that medical imaging plays a remarkable role in treatment planning for perianal fistula.

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