

## Magnetic Resonance Imaging in Assessment of Perianal Fistulae

Dr. Nikita Vinod Nemade<sup>1\*</sup>, Dr. V. M. Kulkarni<sup>2</sup>, Dr. Neeraj Patil<sup>3</sup><sup>1</sup>Final year Junior Resident, Dr. D. Y. Patil Medical College and Hospital, Research Centre, Pimpri, Pune- 411018<sup>2</sup>Professor, Dr. D. Y. Patil Medical College and Hospital, Research Centre, Pimpri, Pune- 411018<sup>3</sup>Senior Resident, Dr. D. Y. Patil Medical College and Hospital, Research Centre, Pimpri, Pune- 411018DOI: [10.36347/sjams.2020.v08i12.011](https://doi.org/10.36347/sjams.2020.v08i12.011)

| Received: 01.12.2020 | Accepted: 09.12.2020 | Published: 13.12.2020

\*Corresponding author: Dr. Nikita Vinod Nemade

### Abstract

### Original Research Article

**Background:** This study analyses the perianal fistulae in detail with various MRI sequences to get the best possible surgical outcome. **Materials and Methods:** Prospective Study with the sample size of 50 cases, studies over 2 years from August 2018 to September 2020, studies at Padmashree Dr. D. Y. Patil Medical College and Hospital and Research Centre, Pimpri, Pune. **Result:** From our study involving 50 patients, 21 patients underwent surgery. The sensitivity and specificity of MRI in detection of thick fistulous tracts is 100%. The sensitivity of MRI in detecting thin primary fistulous tract and thin side branch are 50% and 71.4% respectively. **Conclusion:** MRI fistulography is an excellent guide for diagnosis, surgical intervention and has emerged as an imaging modality of choice.

**Keywords:** Magnetic resonance Imaging, Perianal Fistula, Endoanal Coil, Preoperative assessment, Saint Jame's Classification, Park's classification.

Copyright © 2020 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

## INTRODUCTION

One of the most commonly originated infections from the anal glands is Perianal fistulae. The relapse due to medical treatment is very common and thus surgical treatments have more roles in the management. This depends on the preoperative evaluation such as the course of fistula, presence of associated findings before surgery, as it decides the surgical approach [1-3]. Various imaging modalities to assess the extent of disease help to eliminate all the sources of infections and decrease the incidence of recurrent disease [4]. This study analyses the perianal fistulae in detail with various MRI sequences to get the best possible surgical outcome [5].

Crohn's diseases, Tuberculosis, Pelvic malignant tumors with radiotherapy are various common causes of perianal fistulae. Other rare causes are Idiopathic which are generally due to chronic intramuscular anal infection called as "Cryptoglandular hypothesis".

The tract usually opens on the skin. It is predominantly seen in males in comparison to the females with the ratio of 2:1[6]. Surgeons evaluate a fistulous tract by inspection, palpation, probing and injection by colored dyes. An anal fistula with internal opening above the levator muscle has high recurrence and / or fecal incontinence. Ineffective surgery can lead

to the recurrence and over ambitious surgery can lead to the incontinence. The clinical examination sometimes may not be conclusive [7].

Therefore, various imaging methods help in completing the evaluation of a fistula [8-10]. Various imaging methods are fistulography (conventional), 3 dimensional endoanal ultrasound (3D EAUS) (instillation of hydrogen peroxide within the track-optional), computed tomography (CT), and the magnetic resonance imaging (MRI) with pelvic/ endoanal coils/ both [7, 11]. The critical parameters needed for complete evaluation and radiological reports are classification and description of primary track, internal opening location, presence of extension (especially horse shoe extension) and presence or absence of the local abscess[12].

Magnetic resonance imaging (MRI) can identify infected tracts, abscesses, detailed anatomical descriptions in relation with fistula and anal sphincter complex [13-15]. Various sequences and multiplanar image acquisition helps in proper surgical planning and can achieve best possible treatment outcome. This study analyses the perianal fistulae in detail with various MRI sequences to get the best possible surgical outcome.

### Anatomy of anal region

Interpretation of perianal fistula requires adequate knowledge of the pelvic anatomy and the

sphincter complex [13]. Anal canal is a cylindrical tube measuring about 3cm [13]. The anal complex, the inner layer is the internal/inner anal sphincter which is involuntary composed of smooth muscle and the external/outer anal sphincter is composed of voluntary striated muscle [6,13] (Image. 1). Internal sphincter is responsible for 85% and an external sphincter is responsible for 15% of their resting tones and thus,

disruption of the external anal sphincter lead to loss of continence<sup>1</sup>. Inter-sphincteric space/plane separates internal and external anal sphincters. The junction between the columnar epithelium and the squamous epithelium where anal glands open is the important landmark called as dentate line. It may become the source of infection to start the fistula formation [16].

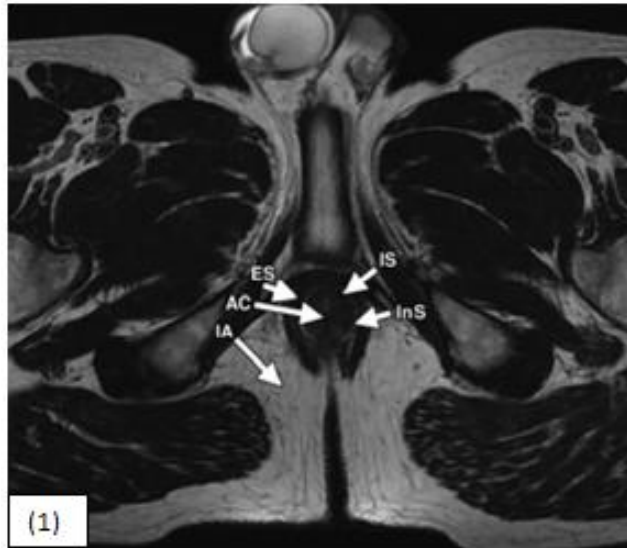


Image 1-Normal anatomy of anal sphincter Complex-T2W Axial image shows muscular anal canal. IA- Internal Anal sphincter, ES- External Anal sphincter, IA- Ischioanal Fossa

lithotomy position. It corresponds to the radiological view as well [17]. The 12 o'clock position lies in the anterior perineum, 6 o'clock- at the natal cleft, 3o'clock-at the left lateral aspect and 9 o'clock- at the right lateral aspect (Image 2).

Anal clock is a transversal view of this region. It is used for fistula surgery with patient in the

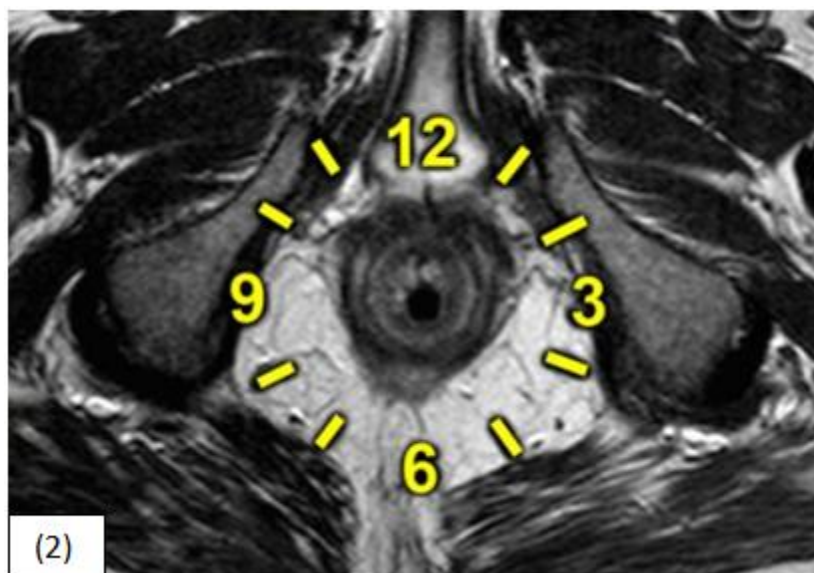


Image 2- Above Axial MRI image of the anal canal. 12- Anterior perineum, 3- Left lateral aspect, 6- Natal cleft and 9- Right lateral aspect.

**Pathogenesis of perianal fistula:** [18]

Anal glands lie at the dentate line (junction of columnar epithelium and squamous epithelium). Occlusion of these glands lead to infection, and

formation of small abscess which grows passes towards the anal verge, it can connect between the anal canal and perineum.

1. Ulcerating diseases of the anorectal region- Crohn’s disease [19]. Patients with Crohn’s disease have 20%-40% of risk go get a fistula in their lifetime.
2. Other like tuberculosis, adenocarcinoma and squamous cell carcinoma of anorectum, infections (actinomycosis and Human immunodeficiency virus).

90% of perianal fistula is arising secondary to impaired surgical excision and drainage of the anal glands, according to the “crypto- glandular hypothesis [20]”.

**Classification of perianal fistula**

Multiple classification systems have been established to describe to, and subsequently categorize

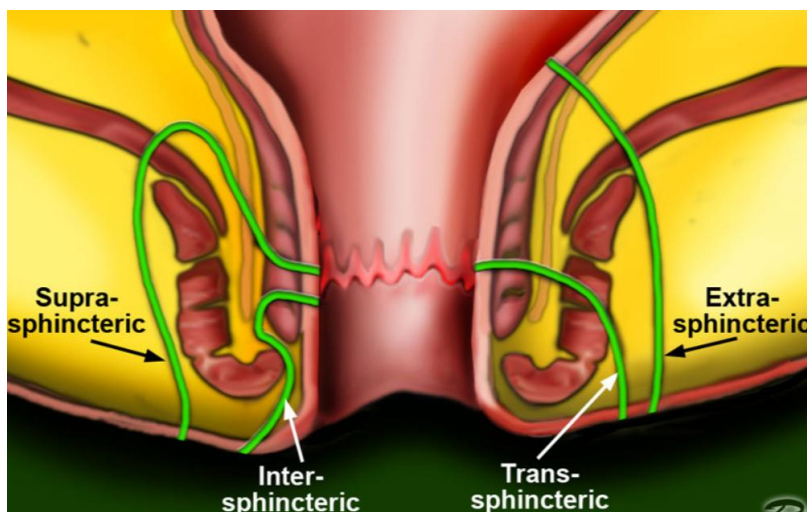
the risk of recurrence and possible surgical outcome in anal fistulae. Classification of perianal fistulae was based on surgical anatomy initially [6, 21]. Subsequently, on the basis of imaging anatomy on MRI, the modified classification system was developed which is called as the St. James’ University Hospital classification system.

**Most commonly used classification systems for perianal fistula**

1. Parks classification: Parks and colleagues (1976) [21] it is based on the external sphincter as a reference point. It was developed primarily for surgical of 400 patients of the department of surgery in St. Mark’s Hospital in London. This classification system was useful for operated patients. Four categories of perianal fistulas were described.

**Table-1: Parks classification of perianal fistula [21]**

Parks Classification of Perianal Fistula	
Fistula type	Description
Intersphincteric	Confined to intersphincteric plane, does not cross external sphincter or levator muscles
Transsphincteric	Track passes radially through external sphincter
Suprasphincteric	Track passes upward within intersphincteric plane over puborectalis muscles and descends through levator muscles, ischiorectal fosse
Extrasphincteric	Fistula’s course is completely outside external sphincter



**Diagram-1: Schematic representation of type’s fistula**

1. Intersphincteric Fistula [21]: Is the commonest category. These are seen in the intersphincteric plane, runs along the longitudinal muscle. They do not cross the external anal sphincter (Diagram-1).
2. Transsphincteric perianal fistula [21]: Tracks the intersphincteric space crossing the external anal sphincter with internal opening in the anal canal. The most important difference between the transsphincteric fistula and extrasphincteric fistula is site of internal opening. Transsphincteric fistulous track enters the anal canal. Extrasphincteric fistulous track enters rectum directly coursing along the ischioanal fossa (Diagram.1).
3. Suprasphincteric perianal fistula [21]: Tracks upwards over the top puborectalis muscle in the intersphincteric plane then descends in the ischioanal fossa (Diagram. 1).
4. Extrasphincteric perianal fistula [21]: track travels in the ischioanal fossa, levator muscle and enters into a rectum, no anal canal sepsis (Diagram.1).

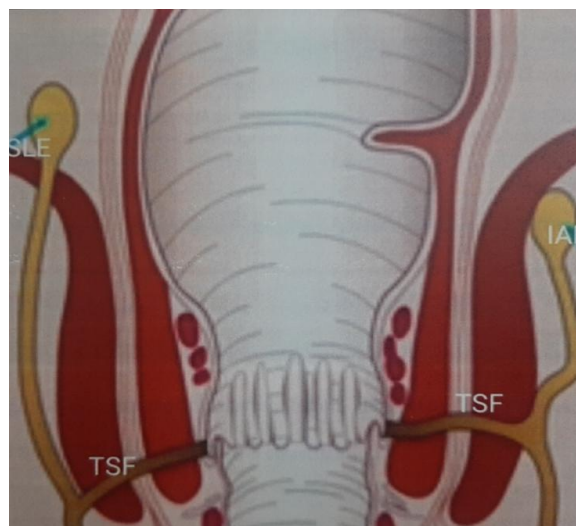


Diagram-2: Schematic representation of two transsphincteric fistula with supralelevator extension (SLE) and ischioanal extension (IAE) (TSF-Transsphincteric fistula).

**Causes of extrasphincteric fistula**

1. Diverticular disease
2. Crohn’s disease
3. Colonic carcinoma

**Fistulous Extensions**

Extensions are regions of sepsis which are connected to the primary tract. (Diagram 2)

Saint James’s University hospital classification: John Morris and colleagues [6] presented the MRI based classification system. This classification system describes the primary fistula, its secondary extensions, and associated abscesses (Diagram.3). Five grades perianal fistula described based on the anatomy seen on MR imaging.

Table2- St. James’s University Hospital MRI classification system<sup>6</sup>:

ST. JAMES’S UNIVERSITY HOSPITAL MRI CLASSIFICATION SYSTEM.	
Grade	Description
0	Normal appearance
1	Simple linear intersphincteric fistula
2	Intersphincteric fistula with a secondary fistulous track/ an abscess
3	Transsphincteric fistula
4	Transsphincteric fistula with abscess or secondary track within the ischioanal or ischioanal fossa
5	Supralelevator and translevator disease

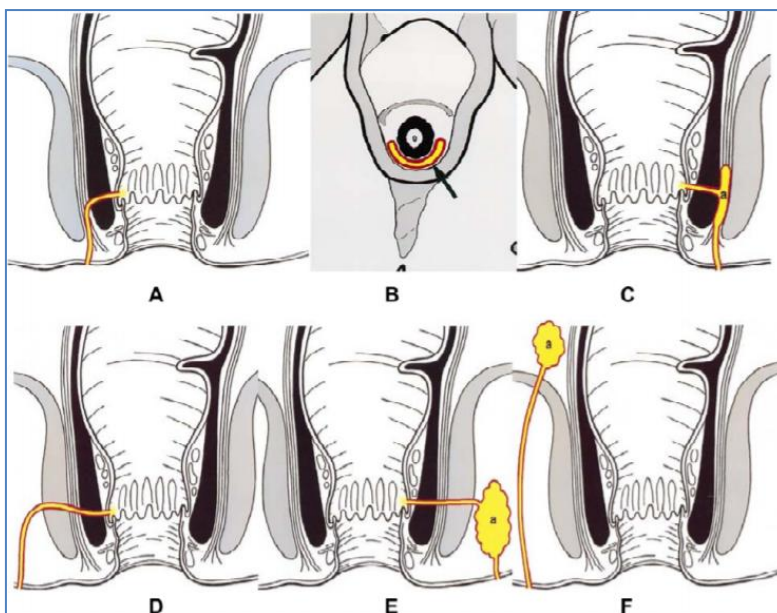


Diagram 3- showing perianal fistulous tract according to St James University hospital classification [6].

Perianal fistula evaluation done using several imaging techniques

1. Conventional Fistulogram.
2. Computed Tomographic Fistulography.
3. Endoanal Ultrasonography (EAUS).
4. Anorectal Manometry.
5. Magnetic Resonance imaging (MRI).

Endoanal ultrasound allows imaging anal sphincters and adjacent structures [7]. EAU cannot identify the fistula tracking over muscle. Advantages of endoanal ultrasound are low cost, and easily performed in outpatient setting.

Problems with endoanal ultrasound

1. Limited field of view (FOV)
2. Less availability
3. Difficult to differentiate between pus and fibrosis
4. Air shadows may mimic the transsphincteric tract
5. Interpretation of perianal fistula is difficult

Adequate knowledge of perianal fistula extension, all hidden tracts, the fistula to the anal sphincter relationship and its complex features are important before surgery reduce recurrence rate. For this purpose MR imaging considered to be the appropriate imaging modality [17, 22, 23]. MRI provides excellent anatomical detail relations of the fistulous tract with the sphincter complex, levator ani, ischioanal fossa, associated abscesses, horse shoe and secondary tracts[12]. MRI is painless, non-invasive and has non-ionizing radiation property, thus making it as the modality of choice in perianal fistula [12]. 3D MRI has superior contrast resolution, multiplanar reconstruction and processing reformation of image into

any desired plane (Axial plane, coronal plane and sagittal plane), and can potentially replace conventional sequences [12, 24, 25]. The results obtained from magnetic resonance Imaging should be regarded as the “Gold standard” for preoperative assessment [17, 26, 27, 28] patients. In most cases, surgical intervention is the mainstay for anal fistula management. The main aim of treatment is to eradicate the recurrence of fistula, preserve anal continence and decrease the risk of recurrence [29-31]. MRI is reported to be the most sensitive imaging method [32]. The main purpose of this study is to compare 3dimensional MRI with conventional MRI sequences.

### TREATMENT

The main aim of treatment is to heal the fistula tract. Most of the patient with Crohn’s disease associated perianal fistula is treated medically, using antibiotics (Metronidazole, Ciprofloxacin), tumor necrosis factor (TNF), and immunosuppressant (Azathioprine and 6-mercaptopurine).

Perianal fistula not related with Crohn’s in which Surgery is the most common treatment of choice. Surgery is dependent on the type of fistula [33]. Surgical options commonly used to treat perianal fistulae as follows, setons, fistulotomy, fistula plugs, ligation of intersphincteric track, fibrin glue and video assisted fistula treatment.

### AIMS OF SURGERY

1. To maintain continence
2. Eradicate all areas of sepsis

Role of fibrin glue injection in treating perianal fistula by interventional radiologist: interventional glue closing has become alternative option for treating fistula because of its simplicity, safety, minimal invasiveness. Interventional fibrin glue sealing has less morbidity as

compared to surgery. Fibrin glue application promotes the fistula healing and closure. The advantage of fibrin glue injection is minimizing the injury to the anal sphincter complex and avoids risk of incontinence. Platelet rich fibrin glue (PRFG) promotes the closure of fistula, lessens closure time [34, 35].

Failure to detect and treat secondary extensions is the most common cause of recurrence.

## MATERIALS AND METHODS

Place of study: Padmashree Dr. D. Y. Patil Medical College and Hospital and Research Centre, Pimpri, Pune

Type of study: Prospective Study.

Period of study: August 2018 to September 2020

Period required for data collection: 2 years.

Period required for data analysis and reporting: 6 months

Sample size: 50 Cases

Study design: Diagnostic study

METHOD OF DIAGNOSIS: 1.5 Tesla Whole Body MRI, Siemens Magnetom Avanto and 3 Tesla Siemens Magnetom Vida (64 channel).

Institutional Ethical Committee (IEC) clearance has been obtained before the start of the

study. Informed consent and written consent will be obtained from all the patients.

### Inclusion Criteria

1. Patients clinically diagnosed as having perianal fistulae referred for Magnetic Resonance Imaging by the surgical and gastroenterology Department (correlation with surgical finding whenever possible).
2. Both male and female patients are included in the study.
3. All age groups included.

### Exclusion Criteria

1. Patients with, intracranial aneurysm clips or intra-orbital metal fragments and any electrically, magnetically or mechanically activated implants (including cardiac pacemakers, bio stimulators, neurostimulators, cochlear implants, and hearing aids).
2. Patients with claustrophobia
3. Postoperative patients
4. Pregnant patients

### MRI Technique

The patients will be further evaluated using MRI 1.5 Tesla and 3 Tesla machines with body surface coil. The St. James University Hospital classification will be used to grade the disease. Discharge from a fistula will act as an inherent contrast.

Saline will only be injected into the cutaneous opening if at all required. Patient will be positioned in supine position (with vitamin E tablet kept as marker at external opening), Centering by a laser beam will be done over symphysis pubis, 4 inches below iliac crest and MRI scan will be performed using the following protocol:

Sequence	TR	TE	FOV	ST	GAP	MATRIX
STIR COR SAG TRA	4000	23	220	3.0	1.0	512X265 512X256 320X256
T2 COR SAG TRA	4500	80	220	3.0	1.0	512X512 512X512 512X320
T1 COR TRA	400	15	220	3.0	1.0	512X512
3D T2 FS SPACE TRA All optional	2000	126	220	1.0	1.0	512X320
T1FS TRA	650	12	220	3.0	1.0	512X256
DIFFUSION TRA	5000	85	220	3.5	1.0	512X256

[TR-Repetition Time; TE-Echo Time; FOV-Field-of-view; ST-Slice thickness]

## IMAGE ANALYSIS

The following imaging findings will be assessed on each of the acquired sequences:

(1) Type of fistula:

### Simple

- If only a single infralevator tract is identified with no complications.

### Complex

- If tract is piercing the levator ani (suprasphincteric/extrasphincteric)
- If tract has more than one ramification or the ramification involves/extends superior to levator ani
- If the fistula has horseshoe communication or abscess

In this study thick and thin side branches assigned based on visual assessment. Simple tract is a linear tract with no side branches. Complex Tract is a branching tract having communication with abscess cavity.

Park's classification will be used to classify the fistula into various subtypes. (2) Internal opening: Either the continuation of the primary tract itself into the anal mucosa or the radial site closest to the maximal inflammation found in the intrasphincteric space or discontinuation of mucosa will be accepted as the internal opening. The internal openings will be assessed with respect to quadrants of clock face.

(3) Presence of abscess

(4) Presence of secondary tracts/ramifications

(5) Presence of horseshoe extension- when the extension occurs in horizontal plane

The St. James University Hospital MRI classification system will be used for studying the images.

## STATISTICAL ANALYSIS

Agreement between MRI sequences and surgical findings of the fistula variables will be assessed using Cramer's V for fistula type and Kappa statistics for rest of the four variables using SPSS software version.

Cross tabulation statistics will be used and sensitivity, specificity and accuracy will be calculated on basis of 2x2 tables.

## RESULT AND DISCUSSION

Total 50 patients with suspected perianal fistula by clinical examination were evaluated in our study, out of which 41 (81 %) were males and 9 (18 %) were females. Characteristics used to assess perianal fistula,

- 1) Internal opening
- 2) Course of the tract
- 3) Grade (St James University)
- 4) Side branches
- 5) Complex/ single tract
- 6) Complications (Abscess/collections/secondzry tracts)

Internal opening: Among the enrolled 50 patients the internal opening distribution is as follows (Fig. 1).

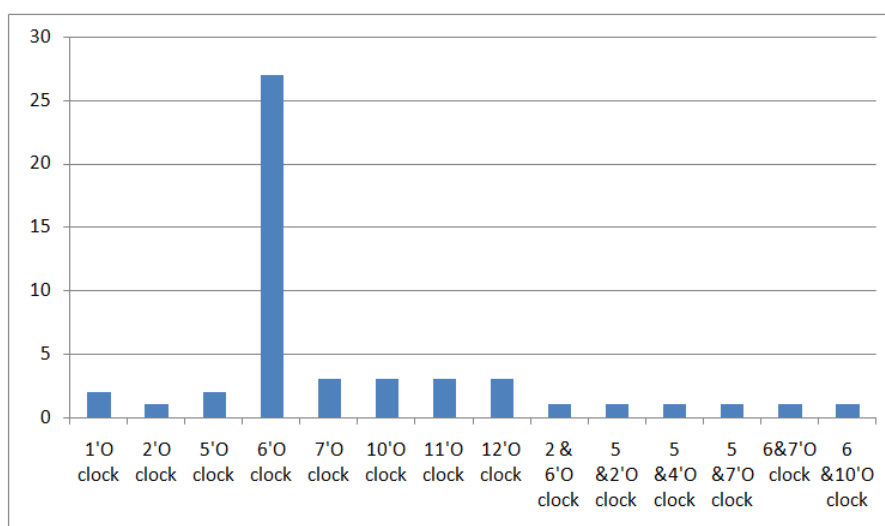


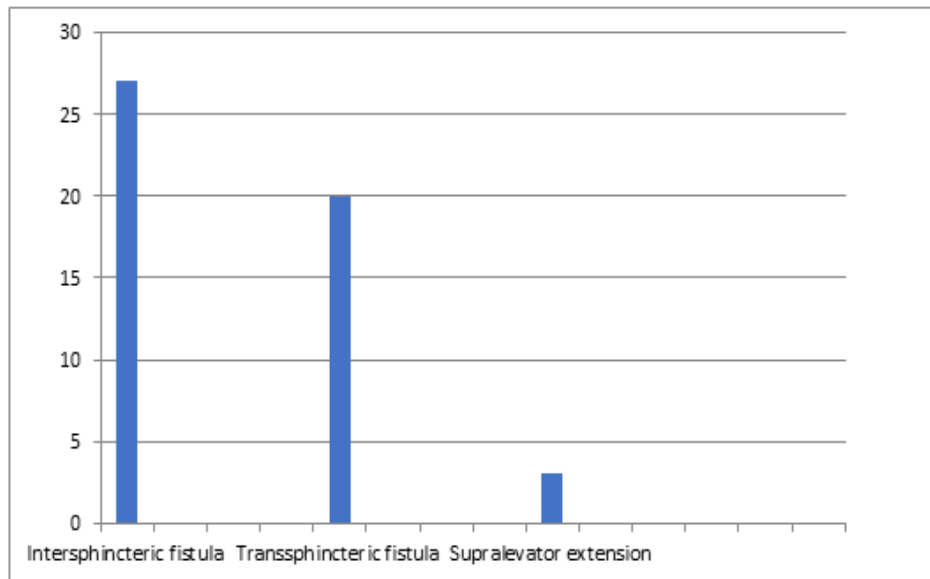
Fig-1: The chart below shows the internal opening distribution of 50 patients: Presence of internal opening in MRI

The most common internal opening was at 6 o' clock position 27(54%) followed by 5 o' clock position 6 (11%) at the canal.

1) Course of the tract: In this study, all 50 primary fistulous tracts and internal openings were detected on MRI. 44 thick fistulous tracts were identified on

MRI and 6 thin fistulous tracts were detected on 3D sequence of MRI which is important in management point of view.

The plane of fistula in our study as follows (on MRI),  
 Intersphincteric fistula 27 (54%) (image.9)  
 Transsphincteric fistula 20 (41%)  
 Supralelevator extension 3 (5%)



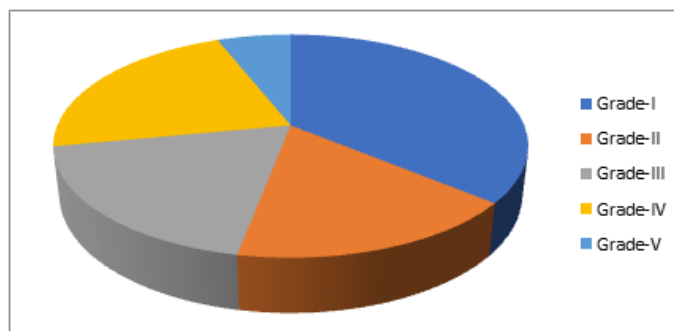
**Fig-2: The below bar chart shows assessment of course of perianal fistula: Assessment of type of perianal fistula**

2) Grade: According to the Saint James University hospital classification of perianal fistula, our study revealed the following results (Table.6 and Fig.3)

**Table-6: The following table shows frequency of distribution of cases**

Grade	No of Cases
I	18
II	8
III	10
IV	11
V	3

Grade I or simple inter-sphincteric - in 18 (36%) patients (Image.10, 12, 15)  
 Grade II or inter-sphincteric - with an abscess or secondary tract in 8 (17%) patients (Image. 19)  
 Grade III or trans-sphincteric - in 10 (19%) patients (image. 13 and 17)  
 Grade IV or trans- sphincteric -with a secondary tract or an abscess or 11 (22%) (Image.6)  
 Grade V or supralevator extension in 3 (6%) patients  
 Grade I or simple inter-shincteric fistula (Image.16) is the most common type of fistula followed by grade IV or trans-sphincteric (Image. 11) with a secondary tract or an abscess.

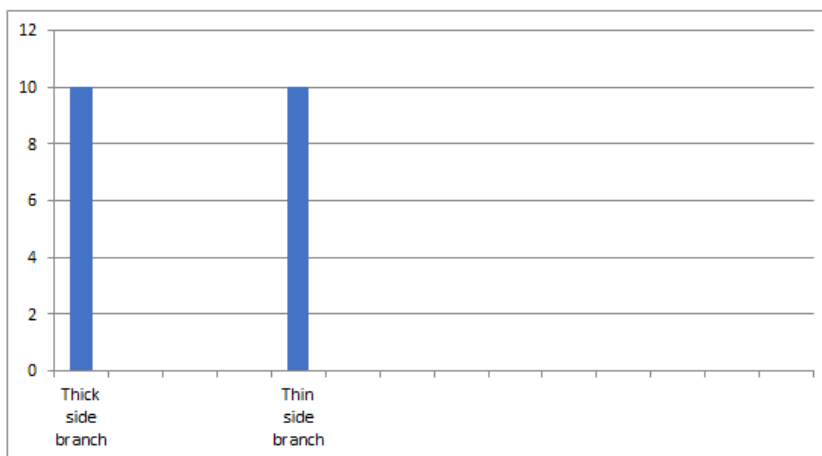


**Fig-3: The pie chart shows frequency distribution of cases based on St James University classification of perianal fistula**

It was observed that Grade I is the most common type of fistula (Image. 18).

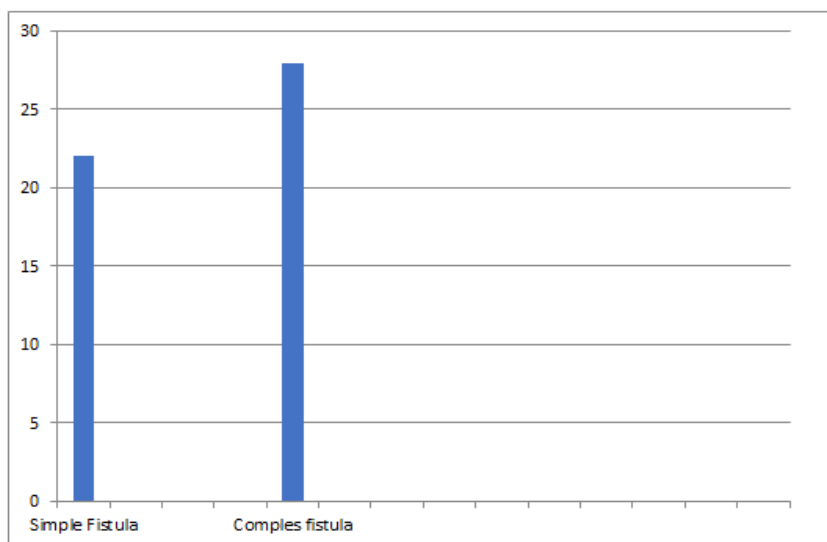
3) Side branches: Out of 50 patients, 20 patients had branches in which 10 were thick and 10 were thin.





**Fig-4: Assessment of side branches of primary perianal fistula**

4) **Complex/simple tract**



**Fig-5: The histogram show below illustrates simple and complex perianal fistulae**

We observed that 22 (44%) were simple tracts and 28 (56%) were complex tracts (Image. 8)

5) **Complications (abscess/collections/communication with viscera)**

In our study there were 6 perianal abscesses. There was no case with internal communication with urinary bladder or bowel loops.

6) **SURGERY**

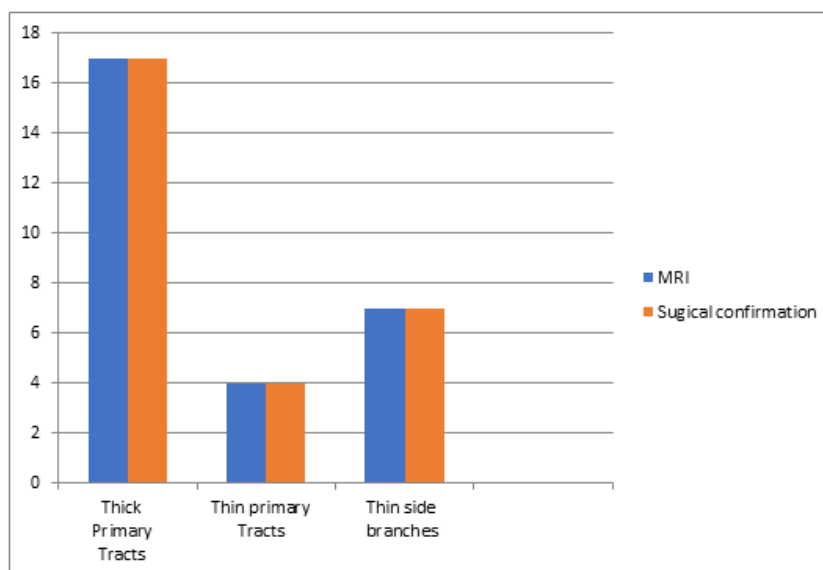
21 patients out of the total 50 were operated. On evaluation of per-operative findings, it was found out that findings were more or less consistent with the MRI imaging findings and the comparisons are as follows (Table.7 and Fig.6).

**Table-7: The following table shows MRI findings and surgical correlation**

3D MRI finding	True Positive	False Positives	False Negatives	True Negatives
Thick Primary Tracts	17	0	0	0
Thin primary Tracts	4	0	0	0
Thin side branches	7	0	0	0

According to our study (Table.7) the sensitivity and specificity of MRI (in operated 21 cases)

in detection of thick primary fistulous tract, thin primary fistulous tracts and thin side branch is 100%.



**Fig-6: Correlation of MRI and per-operative findings**

Thick fistulous tracts that were detected on MRI, and also confirmed by per-operative findings are 17. Thin fistulous tracts with internal openings detected on 3D MRI, and confirmed by per-operative findings are 4. Thin side branches detected on 3D MRI, and further confirmed by per-operative findings are 7.

In this prospective study of 50 patients with clinically diagnosed perianal fistulae, radiological evaluation was by employing MRI in all the cases. For diagnostic accuracy surgical correlation was done where ever possible.

As N. Daabis and his colleagues mentioned in 2013 [34] that MRI is the most useful modality for accurate perianal fistula evaluation by correctly assessing the extent of the tract, relationship with the sphincter complex, secondary tracts and abscess resulting in complete assessment and higher possible diagnostic accuracy, thus aiding increased success rate in management. Therefore, by this analysis the best use of MRI can make a distinguishable difference in diagnostic accuracy and ultimately in the management of perianal fistula.

A study done by Manar T Alaat El essayy in 2013 [35], total of 56 patients studied, 46 (82.1%) patients were males and 10 (17.9%) patients were females. Another study conducted by kulvinder singh *et al.* in 2014 [36], total of 50 patients. In our study we observed that perianal fistula more commonly affects males 41 (81%) than females 9(19%), this corresponds to the previous studies.

In our evaluation of 50 cases (100%), the main fistulae and internal openings were detected on MRI. MRI could identify 44(88%) thick fistulous tracts and 6(12%) thin fistulous tracts.

As is study done, John Morris, *et al.* in 2000, [6] intersphincteric fistula is the most common type of fistula. Another study by Hoda salah Darwish, *et al.* [37] involved a sample size of 35 patients with 38 fistulous tracts. Out of those 38 fistulous tracts, 24(63%) were intersphincteric fistulae, 11(29%) were transsphincteric fistulae and 2(5%) were suprasphincteric fistulae. Our study showed 27(52.8%) were intersphincteric fistulae followed by 20(41.6%) were transsphincteric fistulae, suggesting intersphincteric fistula being the commonest fistula type.

In our study we found that the commonest internal opening location was at 6 o' clock position. A study by Rania E.Mohamed, *et al.* in 2013 [38] revealed that the commonest internal opening location was at 6 o' clock position, which is similar to our study. Amongst 50 patients, 20 patients had side branches in which 10 were thick and 10 were thin.

In our study of 50 patients, they were assessed for Grade wise distribution. We observed that 18(36%) patients had Grade I which is the most common type of fistula followed by 11(22%) had Grade IV, 10(19%) had Grade III, 8(17%) had Grade II and 3(6%) had Grade V. This did not corroborate to the study by Jaime de Miguel Criado, *et al.* in 2011 [25] on 178 patients. As per the St. James university hospital Classification of perianal fistula, the commonest type diagnosed were those of Grade-IV (25.3%), followed by Grade-I (24.7%), Grade-III (24.2%), Grade-III (24.2%), Grade-II (18.5%) and Grade-V (7.3%).

From our study involving 50 patients, 21 patients underwent surgery. The sensitivity and specificity of MRI in detection of thick fistulous tracts is 100%. The sensitivity of MRI in detecting thin primary fistulous tract and thin side branch are 50% and 71.4% respectively. The specificity of MRI in detection

of thin primary fistulous tract and thin side branch is poor.

According to our study the sensitivity and specificity of 3D Magnetic Resonance Imaging (in operated 21 patients) in detecting thick primary fistulous tract, thin primary fistulous tract and thin side branch is 100%.

### Case Gallery

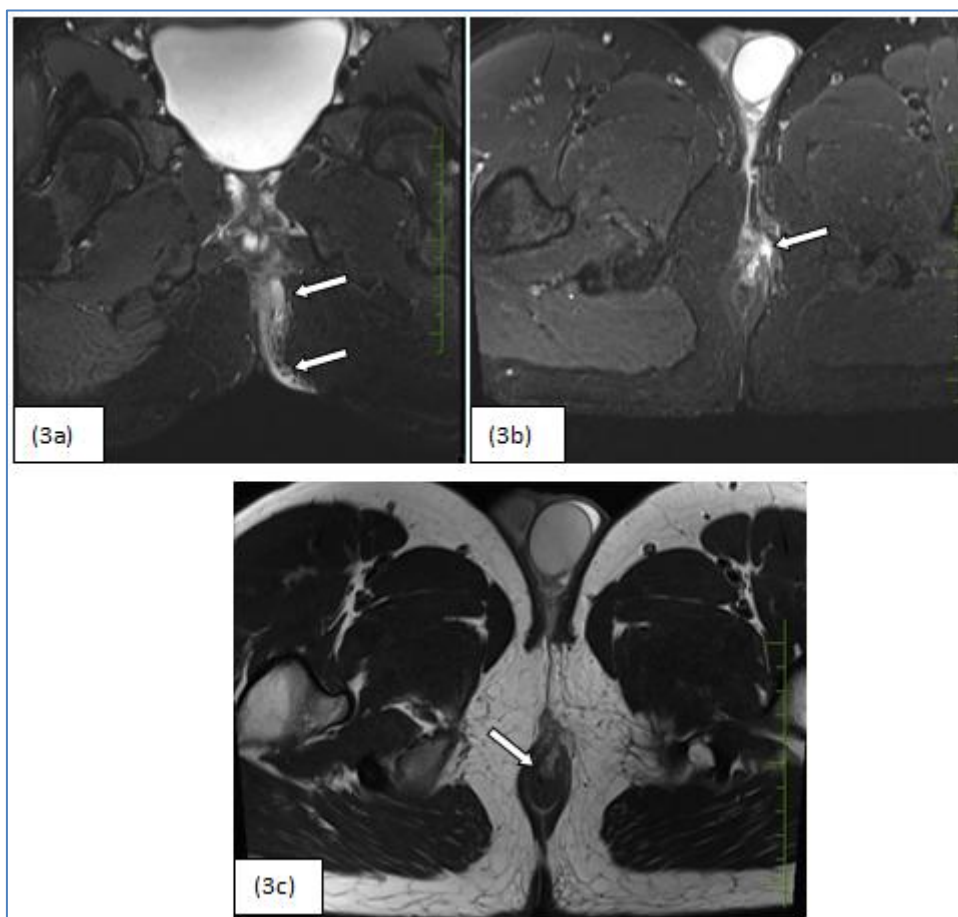


Image 3-(a) T2 STIR Coronal, (b) T2 STIR Transverse, (c) Axial T2WI showing trans-sphincteric sinus tract (arrow) in perianal region on left side forming a collection (arrow) of along its course in left ischiorectal fossa adjacent to external sphincter (1-2 O'

### In our study we observed that

1. Thin fistulous tract and thin side branch are well seen on MRI.
2. Definition of internal opening is well seen on MRI.
3. Delineation of sphincter complex anatomy is well seen on MRI.

clock position) - abscess. Soft tissue edema (arrow) is seen adjacent to the course of sinus tract. (c) Axial T2WI- an internal opening (arrow) at 12 O'clock position noted.

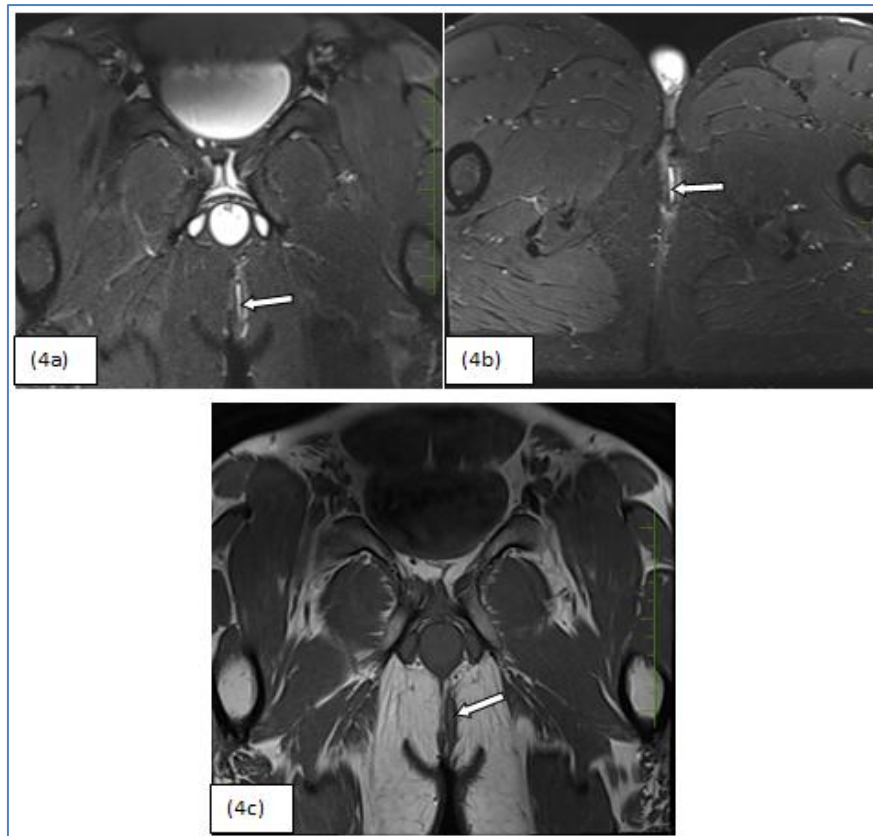
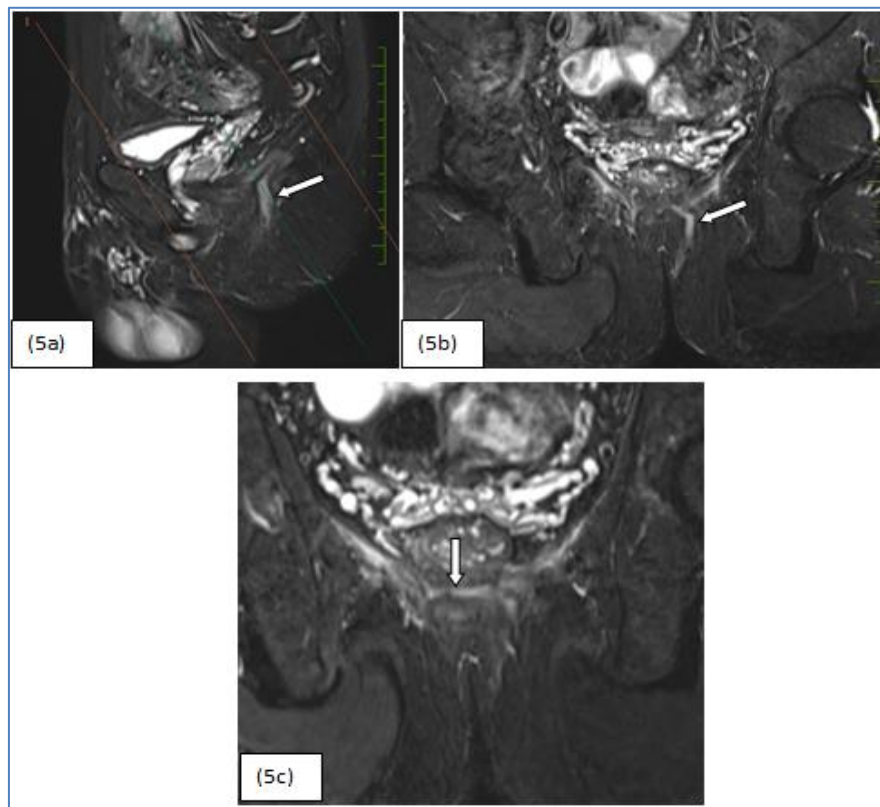


Image 4- (a) T2 STIR Coronal, (b) T2 STIR Transverse, (c) Axial T2WI- Linear non-branching intersphincteric fistulous track (arrow) in the left

perianal region (St. James university hospital classification Grade 1).



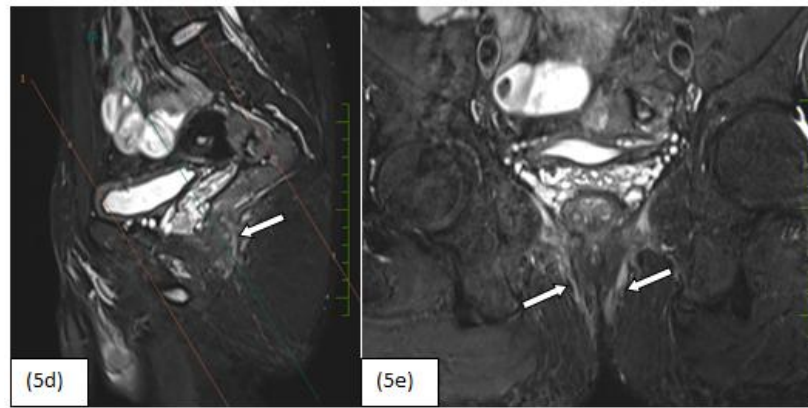


Image 5- Shows two curvilinear low level transphincteric fistulous tracks on either side communicating with each other posterior, (a,b) T2 STIR Sagittal and Coronal-showing transphincteric fistulous track (arrow) on left side and curving medially, (c) T2

STIR Coronal-shows communication (arrow) posterior to the anal canal and external spincter, (d) T2 STIR Sagittal- showing transphincteric fistulous track (arrow) on right side, (e) T2 STIR Coronal- showing transphincteric fistulous tracks (arrows) on both sides.

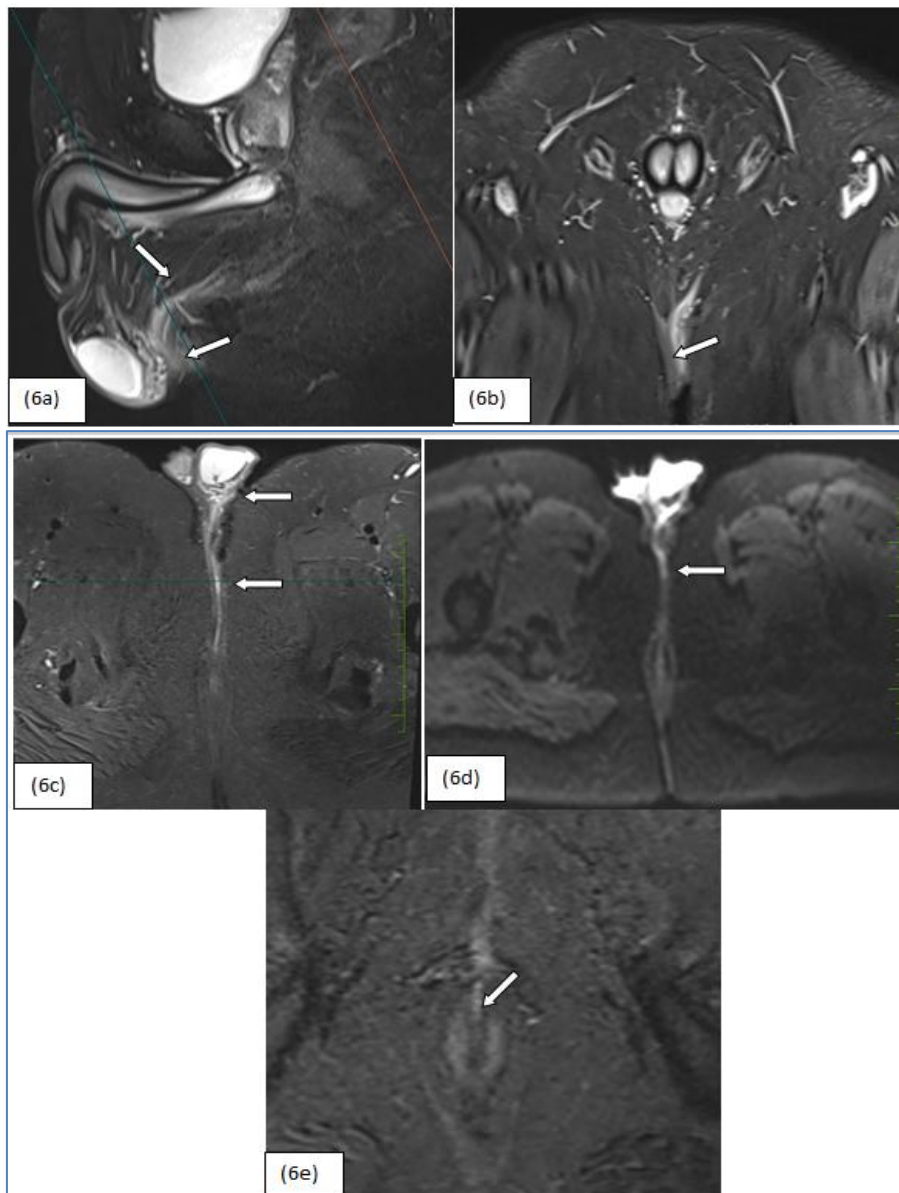


Image 6- (a,b) T2 STIR Sagittal and Coronal- showing a linear non branching fistulous tract (arrow) with its external opening in left scrotal wall (arrow) and traversing posterior just to the left of midline, (c) T2 STIR Transverse - a linear non branching fistulous tract (arrow) An extra-testicular collection is noted in left hemi-scrotum with edema, (d) DWI- showing diffusion restriction (arrow), (e) T2 STIR Transverse- Showing communication (arrow) of the tract with the anal canal at 12 O' clock position.

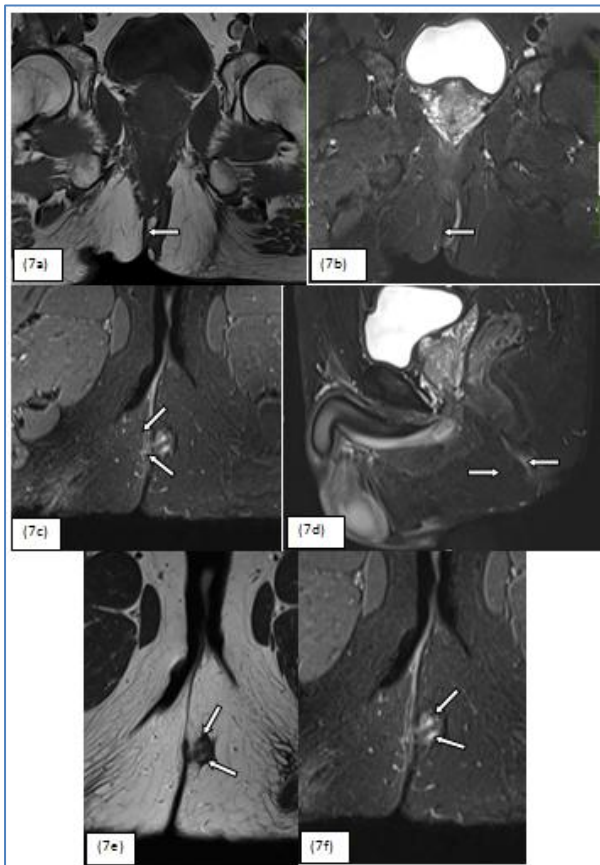


Image 7- (a) T2WI Coronal and (b) T2 STIR Coronal images- showing linear intersphincteric fistulous track (arrow) is noted in the left anterolateral perianal region. It appears and hyperintense on T2W and STIR images, (c, d) T2 STIR Transverse and Sagittal images- showing bifurcation into two linear

tracks (arrows), (e) T2WI Transverse and (f) T2 STIR Transverse images- showing external openings at 3 O' and 4O' clock positions in the natal cleft.

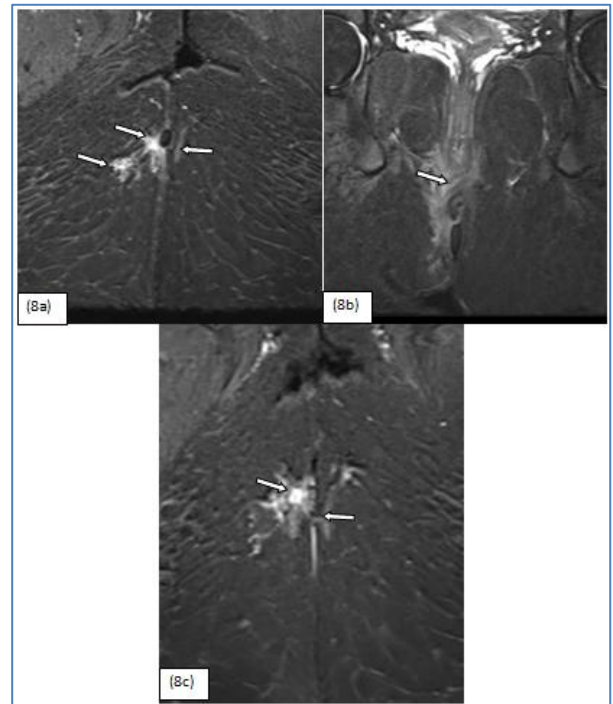


Image 8- (a) T2 STIR Transverse image- showing Vitamin E tablet (arrow) as a marker at the external opening (arrow) at 11 O' clock position on right side of natal cleft, Adjacent subcutaneous edema (arrow) is seen at the sinus tract opening- likely post-incision changes. Edema was also seen in the perisphincteric musculature (not shown in figure), (b) T2 STIR Coronal image- showing a blind ending ramification (arrow) in the form of a similar linear blind ending tract is seen in the extrasphincteric region traversing to the left side of perianal region, also shown in figure (c), (c) T2 STIR Transverse image- showing an ill-defined collection (arrow) appearing hypointense is seen in the subcutaneous plane of right superficial ischio-rectal fossa at the site of opening of the tract.

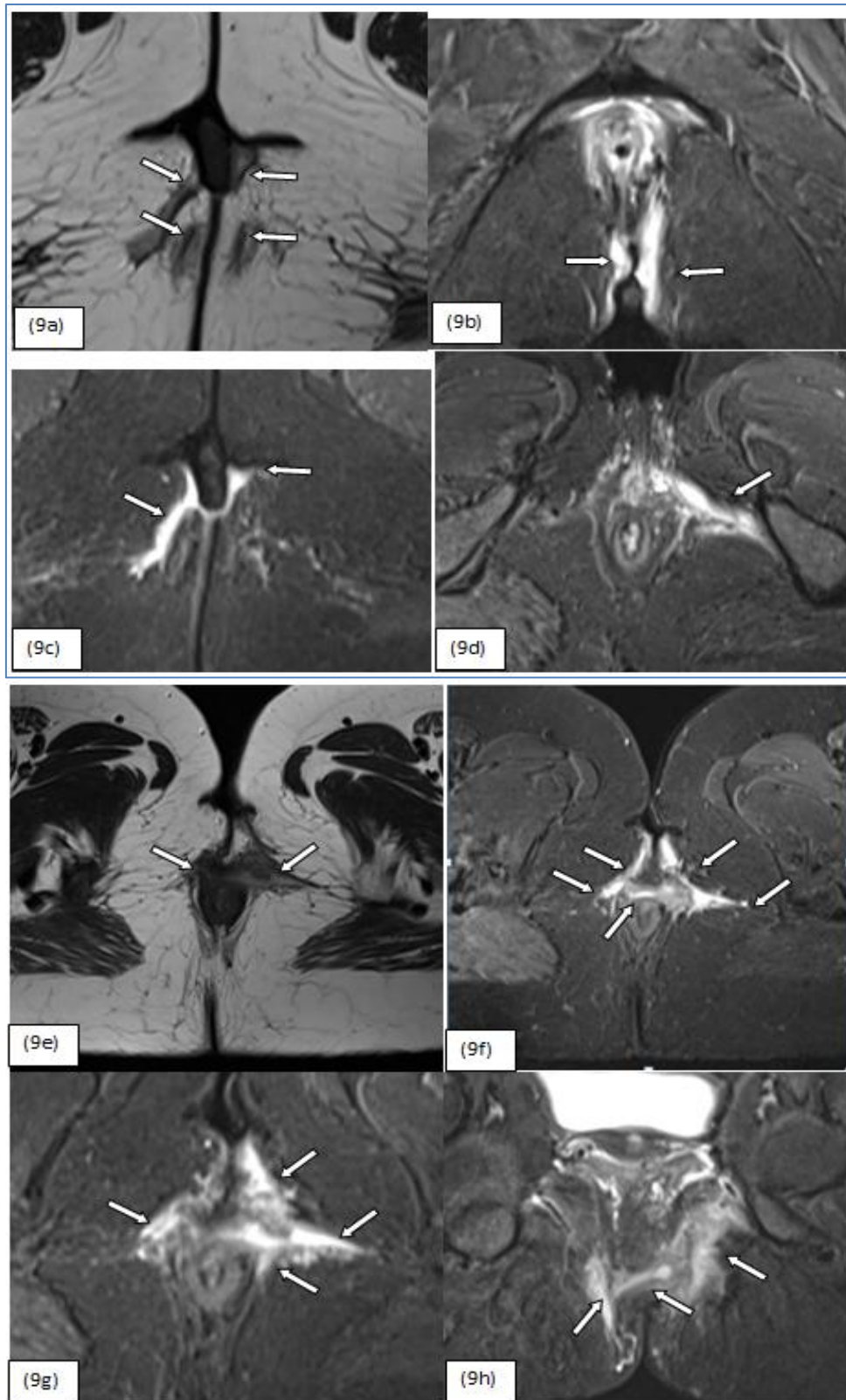


Image 9- Complex perianal sinus tracks- (a) T2WI Transverse image- showing external openings (arrows) of sinus tracts in the perineum on either side, (b) T2 STIR Coronal image- showing sinus tracts (arrows) on either side, (d) T2 STIR Transverse image- showing a collection (arrow) along the course of sinus

in left ischioanal fossa with adjacent fat stranding, (e, f, g, h) T2WI, T2 STIR Transverse and T2 STIR Coronal images- showing atleast three to four side branches (arrows) arising from the collection in left ischioanal fossa and communication (arrow in the midline) with the right side is also noted.

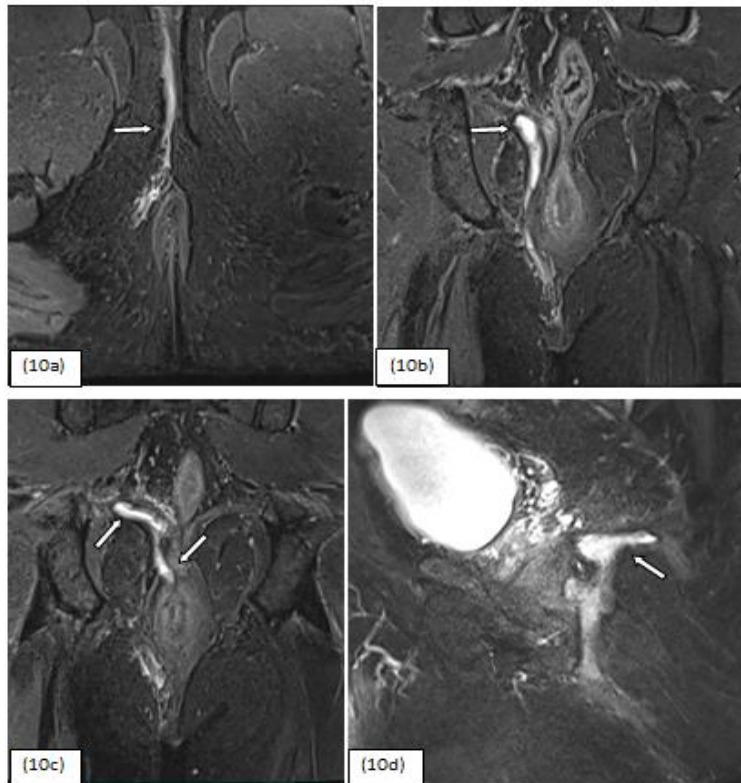


Image 10- (a) T2 STIR Transverse image- showing a linear fistulous tract (arrow) is noted in the anterior perineal region on right side, extending superiorly and posteriorly (not shown here), (b, c, d) T2 STIR Coronal and Sagittal images- showing that the tract is giving dichotomous branching, the lateral tract

shown in image (b) extends superiorly upto the right levator plate (arrow). The medial tract shown in image (c) is piercing the external anal sphincter, intersphincteric space and internal sphincter with inner opening at 6 o'clock position.

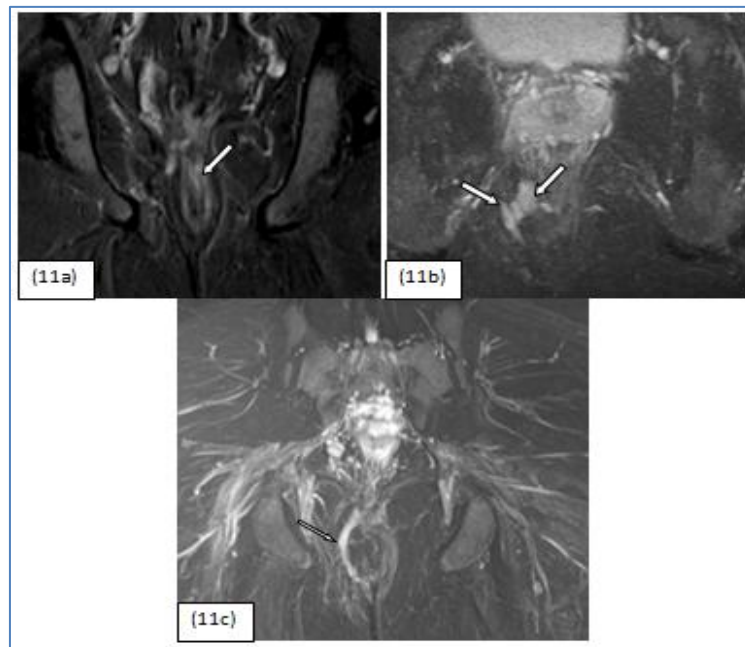


Image 11(a) T2 STIR Coronal image- showing internal opening (arrow) of the fistulous tract in the supralevator region, (b) T2 STIR MIP image in Transverse - showing ramification (arrow) and a

collection (arrow), b) T2 STIR MIP image in Coronal – showing a linear inter-sphincteric fistulous tract (arrow) on right side.



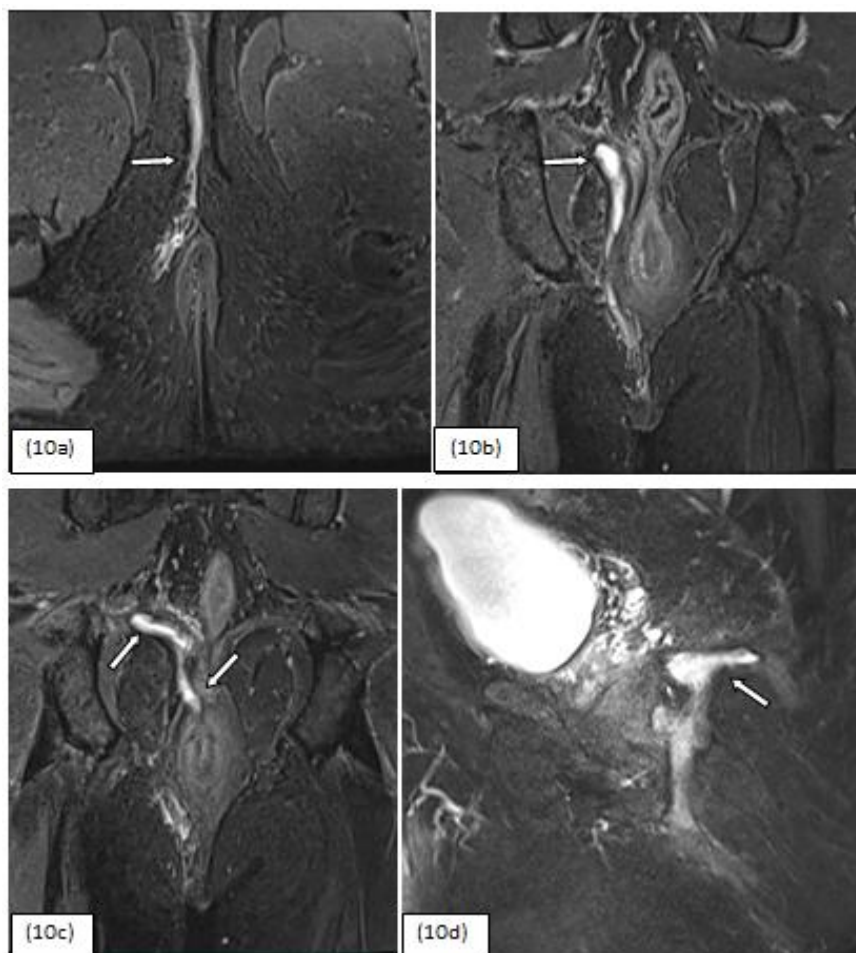


Image 12 (a,b) T2 STIR MIP images in Sagittal and Coronal- showing two linear sinus tracts (arrows) in the posterior perianal region just on right of midline, one medial and one on lateral aspect, (c) T2 STIR MIP image Transverse- showing that the lateral tract mentioned above is forming a collection in right gluteal region, (d) T2 STIR MIP image Transverse- showing that the medial tract mentioned above is reaching upto the wall of the anal canal on anterior aspect.

## CONCLUSION

It is important to correctly depict fistulous tract anatomy preoperatively to avoid recurrence.

MRI fistulography is an excellent guide for diagnosis, surgical intervention and has emerged as an imaging modality of choice.

All the MRI sequences showed findings significantly similar to the surgical findings, however most superior MRI sequences were T2W and T2 STIR images. St James university hospital classification employs simple anatomical discriminator.

MRI is better in detecting thin side branches and fistula morphology as acquisition is done in thin slice and multiplanar capability. Large FOV sequences

are also needed to look for abscesses and other complications.

## REFERENCES

1. Lunniss PJ, Barker PG, Sultan AH, Armstrong P, Reznick RH, Bartram CI, Cottam KS, Phillips RK. Magnetic resonance imaging of fistula-in-ano. *Diseases of the colon & rectum*. 1994 Jul 1;37(7):708-18.
2. Mazroa JA, Elmogy SA, Elgendy MM. Value of contrast enhanced spoiled gradient (SPGR) MR and MIP MR imaging in diagnosis of peri-anal fistula. *The Egyptian Journal of Radiology and Nuclear Medicine*. 2012 Jun 1;43(2):119-28.
3. Agha ME, Eid M, Mansy H, Matarawy K, Wally M. Preoperative MRI of perianal fistula: Is it really indispensable? Can it be deceptive?. *Alexandria Journal of Medicine*. 2013 Jun 1;49(2):133-44.
4. Buchanan G, Halligan S, Williams A, Cohen CR, Tarroni D, Phillips RK, Bartram CI. Effect of MRI on clinical outcome of recurrent fistula-in-ano. *The Lancet*. 2002 Nov 23;360(9346):1661-2.
5. Mohey N, Hassan TA. Effectiveness of magnetic resonance imaging in grading of primary perianal fistula and its associated findings in correlation with surgical outcome. *The Egyptian Journal of*

- Radiology and Nuclear Medicine. 2017 Mar 1;48(1):1-6.
6. Morris J, Spencer JA, Ambrose NS. MR imaging classification of perianal fistulas and its implications for patient management. *Radiographics*. 2000 Mar;20(3):623-35.
  7. Gordon N, Buchannan, Steve Halligan, Clive I. Bartram, Andrew B. Williams, Danlio Tarroni, C. Richard G. Cohen. Clinical Examination, Endosonography, and MR imaging in preoperative Assessment of fistula in Ano: Comparison with outcome-based reference standard. 2004;233(3).
  8. Sahni VA, Ahmad R, Burling D. Which method is best for imaging of perianal fistula?. *Abdominal imaging*. 2008 Jan 1;33(1):26-30.
  9. Ziech M, Felt-Bersma R, Stoker J. Imaging of perianal fistulas. *Clinical gastroenterology and hepatology*. 2009 Oct 1;7(10):1037-45.
  10. Nilesh H. Chaudhari, Ameya D. Sinkar, Samparna Swoyam. Role of magnetic resonance imaging in evaluation of perianal fistulas. *International journal of research on medical sciences*. Int J Res Med Sci. 2016 Feb;4(2):482-485.
  11. deSouza NM, Hall AS, Puni R, Gilderdale DJ, Young IR, Kmiot WA. High resolution magnetic resonance imaging of the anal sphincter using a dedicated endoanal coil. *Diseases of the colon & rectum*. 1996 Aug 1;39(8):926-34.
  12. George U, Sahota A, Rathore S. MRI in evaluation of perianal fistula. *Journal of medical imaging and radiation oncology*. 2011 Aug;55(4):391-400.
  13. O??? Malley RB, Al-Hawary MM, Kaza RK, Wasnik AP, Liu PS, Hussain HK. Rectal imaging: part 2, perianal fistula evaluation on pelvic MRI??? What the radiologist needs to know. *American Journal of Roentgenology*. 2012 Jul;199(1):W43-53.
  14. Sofic A, Beslic S, Sehovic N, Caluk J, Sofic D. MRI in evaluation of perianal fistulae. *Radiology and Oncology*. 2010 Dec 1;44(4):220-7.
  15. Baskan O, Koplay M, Sivri M, Erol C. Our experience with MR imaging of perianal fistulas. *Polish journal of radiology*. 2014; 79:490.
  16. Tolan DJ. Magnetic resonance imaging for perianal fistula. In *Seminars in Ultrasound, CT and MRI*. 37(4); 2016: 313-322.
  17. Michael R Torkzad, Urban karlbom. MRI for assessment of anal fistula. *Insights imaging*. 2010 May; 1(2): 62–71
  18. Sainio P. Fistula-in –a defined population. Incidence and Epidemiological Aspects.” *Annales Chirurgiae*. 1984, 73(4):219-224.
  19. Schwartz DA, Herdman CR. The medical treatment of Crohn's perianal fistulas. *Alimentary pharmacology & therapeutics*. 2004 May; 19(9):953-67.
  20. Pushpinder S Khera, Hesham A Badawi, Ahmed H Afifi. MRI in perianal fistula. *Abdominal and Gastrointestinal Radiology*. 2010; 20(1):53-57.
  21. Ag P, Gordon PH, Hardcastle JD. A classification of fistula-in-ano. *Br J Surg*. 1976;63(1):1-2.
  22. Torkzad MR, Ahlström H, Karlbom U. Comparison of different magnetic resonance imaging sequences for assessment of fistula-in-ano. *World journal of radiology*. 2014 May 28;6(5):203.
  23. Buchanan GN, Halligan S, Williams AB, Cohen CR, Tarroni D, Phillips RK, Bartram CI. Imaging of fistula in ano. *British journal of surgery*. 2003 Jul 1;90(7):877-81.
  24. Halligan S, Healy JC, Bartram CI. Magnetic resonance imaging of fistula-in-ano: STIR or SPIR?. *The British journal of radiology*. 1998 Feb;71(842):141-5.
  25. de Miguel Criado J, del Salto LG, Rivas PF, del Hoyo LF, Velasco LG, de las Vacas MI, Marco Sanz AG, Paradela MM, Moreno EF. MR imaging evaluation of perianal fistulas: spectrum of imaging features. *Radiographics*. 2012 Jan;32(1):175-94.
  26. Beets-Tan RG, Beets GL, van der Hoop AG, Kessels AG, Vliegen RF, Baeten CG, van Engelshoven JM. Preoperative MR imaging of anal fistulas: does it really help the surgeon?. *Radiology*. 2001 Jan;218(1):75-84.
  27. Gustafsson UM, Kahvecioglu B, Åström G, Ahlström H, Graf W. Endoanal ultrasound or magnetic resonance imaging for preoperative assessment of anal fistula: a comparative study. *Colorectal disease*. 2001 May 14;3(3):189-97.
  28. Abdrabou N Mashhour MD , Haitham S Omar, Ahmed S Marzouk, Mohamed M Raslan, Ahmed Farag. Evaluation of the role of endoanal ultrasonography in preoperative assessment of perianal fistula. 2015; 34(2):122-126.
  29. Chapple KS, Spencer JA, Windsor AC, Wilson D, Ward J, Ambrose NS. Prognostic value of magnetic resonance imaging in the management of fistula-in-ano. *Diseases of the colon & rectum*. 2000 Apr 1;43(4):511-6.
  30. Garcia-Aguilar J, Belmonte C, Wong WD, Goldberg SM, Madoff RD. Anal fistula surgery. *Diseases of the colon & rectum*. 1996 Jul 1;39(7):723-9.
  31. Gecse KB, Bemelman W, Kamm MA, Stoker J, Khanna R, Ng SC, Panés J, Van Assche G, Liu Z, Hart A, Levesque BG. A global consensus on the classification, diagnosis and multidisciplinary treatment of perianal fistulising Crohn's disease. *Gut*. 2014 Sep 1;63(9):1381-92.
  32. Yildirim N, Gökalp G, Öztürk E, Zorluoglu A, Yilmazlar T, Ercan İ, Savci G. Ideal combination of MRI sequences for perianal fistula classification and the evaluation of additional findings for readers with varying levels of experience. *Diagnostic and Interventional Radiology*. 2012;18(1):11.
  33. Spencer JA, Ward J, Beckingham IJ, Adams C, Ambrose NS. Dynamic contrast-enhanced MR imaging of perianal fistulas. *AJR. American journal of roentgenology*. 1996 Sep;167(3):735-41.

34. Daabis N, El Shafey R, Zakaria Y, Elkhadrawy O. Magnetic resonance imaging evaluation of perianal fistula. *The Egyptian Journal of Radiology and Nuclear Medicine*. 2013 Dec 1;44(4):705-11.
35. Alat El Essawy MT (2013). Magnetic Resonance Imaging in Assessment of Anorectal Fistulae and its Role in Management. *J Gastroint Dig Syst* 3:139.
36. Singh K, Singh N, Thukral CL, Singh KP, Bhalla V. Magnetic resonance imaging (MRI) evaluation of perianal fistulae with surgical correlation. *Journal of clinical and diagnostic research: JCDR*. 2014 Jun;8(6):RC01.
37. Hoda Salah Darwish, Hossam Abdelhafiz Zaytoun, Hanaa Ahmed Kamel, Sadia Raheez Qamar, Magnetic Resonance Imaging Evaluation of Perianal Fistulas, *The Egyptian Journal of Radiology and Nuclear Medicine*. 2013 Dec;44(4):747-754.
38. Mohamed RE, Abo-Sheisha DM. Role of magnetic resonance imaging in pre-operative assessment of ano-rectal fistula. *The Egyptian Journal of Radiology and Nuclear Medicine*. 2014 Mar 1;45(1):35-47.