Patient Safety & Quality Improvement Journal
http://psj.mums.ac.ir
PSQI

The Role of Magnetic Resonance Imaging in Preoperative Evaluation of Perianal Fistulas: A Cross-Sectional Study on Diagnostic Accuracy, Classification, and Surgical Implications

Salah Mohammed Abdulrahman

Department of Surgery, College of Medicine, Hawler Medical University, Erbil, Kurdistan Region-Iraq.
E-mail: salah.mohammed@hmu.edu.krd

ARTICLEINFO

Article type:
Original Article

***Article History*:**
Received: 29 May 2025
Accepted: 29 Jun 2025

Keywords:
Perianal abscess, Perianal Fistula, Preoperative evaluation, Secondary tracts, Secondary tracts/ramifications, Sphincter muscles

ABSTRACT

Introduction:
Perianal fistulas (PF) present significant clinical challenges due to their complexity and risk of recurrence. This study aimed to evaluate the role of MRI in the preoperative detection and characterization of perianal fistulae.

Materials and Methods:
A prospective cross-sectional study was conducted at Teaching Hospital-Erbil city-Kurdistan region-Iraq (March 2022–February 2023) involving 59 patients with symptomatic PFs. All underwent preoperative MRI using a 1.5T scanner with T1-weighted, T2-weighted, STIR, and diffusion-weighted sequences. Two radiologists independently analyzed images for fistula type (Parks' classification), secondary extensions, and sphincter involvement. Findings were compared to intraoperative results.

Results:
The most common locations of the internal fistula opening were left anterolateral 16 (24.6%) and left posterolateral 14 (21.5%). The abscess was separated in 10 (15.4%) and connected in 4 (6.2%) of the fistulae. The most common type among males was the inter-sphincteric 40 (87.0%) compared with 10 (52.6%) among females (P = 0.004). The most common type of fistulae among those with no secondary branch was the inter-sphincteric 41 (85.4%) compared with 9 (52.9%) among those with secondary branch (P = 0.011). The incidence rates of separated and connected abscesses were 6 (12%) and 1 (2%), respectively, among the inter-sphincteric fistulae (P = 0.007).

Conclusion:
The current study illustrates the significant role of MRI in the comprehensive preoperative evaluation of PFs. Given MRI's high accuracy in identifying fistula tracts, detecting secondary branches, associated abscesses, and determining the relationship of the fistula with the sphincter complex, improved surgical planning becomes possible.

► ***Please cite this paper as:***
Abdulrahman SM. The Role of Magnetic Resonance Imaging in Preoperative Evaluation of Perianal Fistulas: A Cross-Sectional Study on Diagnostic Accuracy, Classification, and Surgical Implications. Journal of Patient Safety and Quality Improvement. 2025; 13(1):113-120. Doi: 10.22038/psj.2025.88609.1473

Introduction

Perianal fistulas (PFs) are abnormal epithelialized tracts that form between the anal canal and the perineal skin, often resulting from chronic infection and inflammation of the anal glands. (1). These fistulas typically develop following obstruction and subsequent infection of the anal glands, leading to abscess formation and fistulous tract development that may extend through or around the anal sphincter complex (2). The pathophysiology involves persistent inflammation, tissue necrosis, and the formation of a communication channel that can cause significant morbidity, including pain, discharge, and recurrent infections (3).

Perianal fistulas are relatively common, affecting approximately 10 individuals per 10,000 people (4). It often manifests in adult males, with peak incidence occurring between the third and fifth decades of life (5). Fistula-in-ano is mostly seen in younger individuals, exhibiting a male-to-female ratio of 2:1 (6). These fistulas are not only painful and irritating, but can also serve as a source of systemic infection dissemination. The most common presenting symptom is discharge, observed in 65% of patients (7).

Surgical management remains the mainstay of treatment (8). Traditional diagnostic methods, such as physical examination and fistulography, are limited by poor soft-tissue resolution and operator dependency, often failing to delineate complex anatomical relationships with the anal sphincter complex (9).

Magnetic resonance imaging (MRI) has become the benchmark for the preoperative assessment of PFs because of its exceptional soft tissue contrast resolution and multiplanar imaging capability. MRI enables detailed visualization of fistula anatomy, including the primary tract, secondary extensions, abscesses, and the relationship of the fistula to the anal sphincter muscles (10). This detailed mapping is critical for classifying fistulas according to established systems such as Parks' classification, which categorizes fistulas based on their course relative to the sphincter complex, and St. James' classification, which grades fistulas by complexity and associated complications. (10). Studies demonstrate MRI's diagnostic accuracy, with sensitivities of 93–100% and specificities of 83–97% in detecting secondary tracts, abscesses, and levator ani involvement (11).

Despite the recognized utility of MRI, several gaps remain in the literature. Many studies have focused on the diagnostic accuracy of MRI in detecting fistula tracts and internal openings, yet discrepancies between MRI findings and intraoperative observations persist, especially regarding complex fistulas and internal openings. The novelty of the present study lies in its comprehensive evaluation of MRI's diagnostic accuracy in preoperative detection and classification of PFs using Parks' criteria, coupled with an assessment of how MRI findings influence surgical decision-making. Therefore, the present study aimed to evaluate the role of MRI in preoperative detection and characterization of perianal fistulas.

Methods and Materials

Study design and setting

This prospective observational cross-sectional study was conducted at the Teaching Hospital-Erbil city-Kurdistan region-Iraq, a tertiary care center, from March 2022 to February 2023. The study aimed to evaluate the diagnostic accuracy and clinical utility of MRI in the preoperative assessment of PFs.

Participants

Participants were recruited consecutively from the Department of Colorectal Surgery at the Teaching Hospital-Erbil city. Inclusion criteria comprised: (1) patients of any age or gender presenting with symptomatic PFs (e.g., discharge, pain, or recurrent abscesses); (2) those with a history of prior surgical intervention for fistula recurrence; and (3) individuals scheduled for elective surgical management. Exclusion criteria included: (1) contraindications to MRI (e.g., metallic implants, pacemakers, cochlear implants); (2) severe claustrophobia; and (3) refusal to provide consent. A convenience sampling method was employed, enrolling all eligible patients presenting during the study period. The sample size of 59 was determined based on patient availability and the annual caseload of PF referrals to the hospital.

Data Collection and MRI Protocol

Data were collected through structured clinical evaluations, MRI imaging, and surgical records.

MRI Imaging protocol

All patients had no bowel preparation, anal canal intervention, or fistula catheterization. An MRI was conducted with a 1.5 T body MRI equipment (Avanto) and a pelvic phased-array coil. The patients were positioned supinely throughout picture capture. The imaging volume was designed to include the distal rectum and subcutaneous tissue, including the anal canal, sphincter muscles, ischiorectal fossa, levator muscle, and supralevator space.

The MRI protocol included a fat-suppressed non-contrast-enhanced T1-weighted sequence (T1/FS) acquired in axial, coronal, and sagittal planes, with a repetition time/echo time (TR/TE) of 650/13 ms, a section thickness of 3 mm, an interslice gap of 0.75 mm, a matrix size of 384 × 216, a field of view (FOV) of 320 × 320 mm, a received bandwidth of 15.5 kHz, and a scan duration of 4 minutes and 20 seconds. A T2-weighted sequence was acquired in the axial, coronal, and sagittal planes with a TR/TE of 5600/95 ms, a section thickness of 3 mm, an interslice gap of 0.75 mm, a matrix size of 448 × 336, a FOV of 320 × 320 mm, a received bandwidth of 19 kHz, and a scan duration of 3 minutes and 49 seconds. A STIR-weighted sequence was acquired in three planes with a TR/TE of 4410/33 ms, a section thickness of 3 mm, an interslice gap of 0.75 mm, a matrix size of 320 × 332046, a FOV of 320 × 270 mm, a received bandwidth of 16 kHz, and a scan duration of 4 minutes and 30 seconds. The diffusion-weighted MRI was acquired in the axial plane with a repetition time (TR) of 6000 ms and an echo time (TE) of 84.2 ms, featuring a slice thickness of 4 mm, an interslice gap of 1 mm, a total of 24 slices, a matrix size of 192 × 126, a field of view (FOV) of 380 × 309 mm, a bandwidth of 124 kHz, four signal averages, b-values of 50, 400, and 800 s/mm^2, and a scan duration of 2 minutes and 50 seconds. The apparent diffusion coefficient (ADC) values of the fistulas were quantified using axial diffusion-weighted magnetic resonance imaging (DW-MRI) with a b-value of 50 s/m^2. A circular region of interest (ROI) was positioned across the greatest suspicious area, and the mean ADC value together with its standard deviation (SD) were calculated (12).

Image analysis

The images were autonomously analyzed by proficient radiologists in pelvic MRI. The location of the abnormality was categorized radially, like a clock face, with the patient positioned in lithotomy (supine orientation of the body). Fistulas were categorized according to Park's criteria (13, 14), which delineate Grade 1 as Intersphincteric Fistula, restricted to the intersphincteric space, and Grade 2 as Transphincteric Fistula, characterized by the extension of the tract past the external sphincter. Grade 3: Suprasphincteric Fistula resembles trans-sphincteric but encircles the puborectalis and levator ani. Grade 4, identified as Extrasphincteric Fistula, indicates a suprasphincteric condition that opens high in the rectum, above the pelvic diaphragm (14,15).

Ethical Considerations

The study protocol received ethical clearance from college of medicine Ethics Committee. Written informed consent was obtained from all participants prior to enrollment. Patient confidentiality was ensured through anonymized data collection and secure storage.

Statistical Analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS, version 26). Descriptive statistics (mean, standard deviation, frequencies) include demographic and clinical characteristics. Fisher's exact test was used (rather than the Chi-square test) when the anticipated frequency was below 5 in more than 20% of the table's cells. A p-value of < 0.05 was deemed statistically significant.

Results

Fifty-nine patients (with 65 anal fistulae) were included in the study. Their mean age ± (SD) was 39.34 ± (10.96) years, the median was 40 years, and the age range was 6-67 years. The majority of the patients were in

the age range of 30-49 years, 7 (11.9%) were aged less than 30 years, and 8 (13.6%) were aged ≥ 50 years. The majority 42 (71.2%) of the patients were males, and 55 (93.2%) of the patients had one fistula (Table 1).

Table 1. Basic characteristics of patients

	No.	**(%)**
Age (years)		
< 30	7	(11.9)
30-39	21	(35.6)
40-49	23	(39.0)
≥ 50	8	(13.6)
Sex		
Female	17	(28.8)
Male	42	(71.2)
Number of fistulae		
One	55	(93.2)
Two	2	(3.4)
Three	2	(3.4)
Total	59	(100.0)

The most common locations of the internal fistula opening were left anterolateral 16 (24.6%) and left posterolateral 14 (21.5%), in addition to the other sites. The majority of the fistulae were of inter-sphincteric type 50 (77.0%), and 13 (20%) were of the trans-sphincteric type. The secondary branch was present in 7 (26.2%) of the fistulae, and the exit of the fistulae was mostly gluteal 64 (98.5%). Regarding T2 hyper-intensity, it was marked in 42 (64.6%) of the fistulae, and mild in 18 (27.7%). The enhancement was present in 63 (96.9%) of the fistulae. No abscess was detected in the majority 51 (78.5%) of the fistulae, the abscess was separated in 10 (15.4%) and connected in 4 (6.2%) of the fistulae (Table 2).

Table 2. Characteristics of the fistulae

	No.	**(%)**
Location of internal opening		
Midline anterior	5	(7.7)
Midline posterior	9	(13.8)
Left anterolateral	16	(24.6)
Left posterolateral	14	(21.5)
Right anterolateral	9	(13.8)
Right posterolateral	12	(18.5)
Type of fistula		
Inter-sphincteric	50	(77.0)
Trans-sphincter	13	(20.0)
Supra-sphincter	1	(1.5)
Superficial fistula	1	(1.5)
Secondary branch		
Absent	48	(73.8)
Present	17	(26.2)
Exit location		
Gluteal	64	(98.5)
Labial	1	(1.5)
T2 hyper-intensity		
Absent	5	(7.7)
Mild	18	(27.7)
Marked	42	(64.6)
Enhancement		
Absent	2	(3.1)
Present	63	(96.9)
Abscess		
Absent	51	(78.5)
Separated	10	(15.4)
Connected	4	(6.2)
Total	65	(100.0)

No significant association was detected between age and the type of fistula (P = 0.341). The most common type among males was the inter-sphincteric 40 (87.0%) compared with 10 (52.6%) among females (P = 0.004). The most common type of fistulae among those with no secondary branch was the inter-sphincteric 41 (85.4%) compared with 9 (52.9%) among those with secondary branch (P = 0.011). No notable association (P = 0.231) was detected between the exit location and the type of fistula (Table 3).

Table 3. Type of fistula by age, gender, secondary branch, and exit location

		Type of fistula				
		Inter-sphincteric	**Trans-sphincteric**	**Supra-sphincteric**	**Superficial**	
	N	**No. (%)**	**No. (%)**	**No. (%)**	**No. (%)**	**p***
Age						
< 30	9	6 (66.7)	2 (22.2)	0 (0.0)	1 (11.1)	
30-39	22	17 (77.3)	5 (22.7)	0 (0.0)	0 (0.0)	
40-49	25	21 (84.0)	4 (16.0)	0 (0.0)	0 (0.0)	
≥ 50	9	6 (66.7)	2 (22.2)	1 (11.1)	0 (0.0)	0.341
Gender						
Female	19	10 (52.6)	8 (42.1)	1 (5.3)	0 (0.0)	
Male	46	40 (87.0)	5 (10.9)	0 (0.0)	1 (2.2)	0.004
Secondary branch						
Absent	48	41 (85.4)	6 (12.5)	0 (0.0)	1 (2.1)	
Present	17	9 (52.9)	7 (41.2)	1 (5.9)	0 (0.0)	0.011
Exit location						
Gluteal	64	50 (78.1)	12 (18.8)	1 (1.6)	1 (1.6)	
Labial	1	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0.231
Total	65	50 (76.9)	13 (20.0)	1 (1.5)	1 (1.5)	
*By Fisher's exact test.						

No significant (P = 0.122) association was detected between T2 hyper-intensity and enhancement (Table 4).

Table 4. Enhancement by T2 hyper-intensity

		Enhancement		
		Absent	Present	
T2 hyper-intensity	N	No. (%)	No. (%)	p
Absent	5	0 (0.0)	5 (100.0)	
Mild	18	2 (11.1)	16 (88.9)	
Marked	42	0 (0.0)	42 (100.0)	0.122*
Total	65	2 (3.1)	63 (96.9)	
*By Fisher's exact test				

It is evident in Table 5 that the trans-sphincteric type of fistula is more liable for abscess formation, whether separated 4 (30.8%) or connected 2 (15.4%). The incidence rates of separated and connected abscess were 6 (12%) and 1 (2%) respectively among the inter-sphincteric fistulae (P = 0.007) (Table 5).

Table 5. Incidence of abscess by type of fistula

		Abscess			
		Absent	**Separated**	**Connected**	
Type of fistula	N	No. (%)	No. (%)	No. (%)	P*
Inter-sphincteric	50	43 (86.0)	6 (12.0)	1 (2.0)	
Trans-sphincteric	13	7 (53.8)	4 (30.8)	2 (15.4)	
Supra-sphincteric	1	0 (0.0)	0 (0.0)	1 (100.0)	
Superficial	1	1 (100.0)	0 (0.0)	0 (0.0)	0.007
Total	65	51 (78.5)	10 (15.4)	4 (6.2)	
*By Fisher's exact test					

Discussion

Perianal fistulas present a considerable clinical challenge for surgeons due to their complex nature and high recurrence rates (16). Accurate preoperative assessment to determine the fistula tract, its relationship with the sphincter complex, and the presence of secondary branches and potential abscesses is crucial for selecting the appropriate surgical approach and for reducing recurrence and postoperative complications (17,18). This cross-sectional study examines the diagnostic accuracy, classification, and surgical implications of MRI in the preoperative evaluation of PFs. The present study demonstrated that MRI, employing various sequences such as T1, T2, STIR, and DWI, has possesses a high capability to identify and classify fistulas, as well as to detect sphincter involvement and secondary extensions. The findings of this study align with a multitude of previous research, which also highlighted the superiority of MRI in evaluating PFs compared to other imaging methods like fistulography and clinical examination. Numerous studies have reported the high sensitivity and specificity of MRI in identifying primary and secondary fistula tracts, abscesses, and their relationship with surrounding structures. Irshad et al. (19), conducted a research evaluating the diagnostic accuracy of magnetic resonance imaging in identifying and characterizing PFs, using surgical findings as the gold standard. The results indicated that MRI exhibited a sensitivity of 94.9%, specificity of 83.3%, and a diagnostic accuracy of 93%. Additionally, in the study by Ahmad et al. (20), aimed at evaluating the role of MRI in identifying and classifying PFs to compared its outcomes with surgical results, MRI demonstrated good sensitivity and specificity in detecting and classifying PFs. The results indicated that MRI has excellent diagnostic performance in evaluating PFs, and accurate preoperative assessment is essential to prevent complications and recurrences, thereby reducing the need for additional surgeries. The findings of the current study revealed that most fistulas were of the intersphincteric type, a finding consistent with other studies showing a high prevalence of this type of fistula. In the study by Issa et al. (21), which examined the clinical and radiological characteristics of PFs, most fistulas were intersphincteric. In this study, most fistulas were observed in males, which aligns with the higher male-to-female ratio found in other research, including studies conducted in Spain (22), and Egypt (4), where a higher prevalence of fistulas in males compared to females was identified. In this study, the standard MRI protocol included T1-weighted, T2-weighted, STIR, and diffusion-weighted sequences, which allowed for a comprehensive visualization of secondary extensions and abscesses. Consequently, several secondary branch fistulas were reported, a feature often missed by conventional imaging methods such as fistulography. These findings agree with the study by Zhao et al. (14), which demonstrated the superior diagnostic accuracy of MRI in detecting complex anatomical relationships, particularly in suprasphincteric and extrasphincteric cases. However, a study by Akhoundi et al. (23), indicated that endoanal ultrasound might be a relatively more accurate method than MRI

for diagnosing PFs. The differences in results could be attributed to variations in study populations, MRI protocols used, and radiologists' experience. The findings of this study highlight that transsphincteric fistulas are more prone to abscess formation. This emphasizes the clinical utility of MRI in identifying high-risk cases that require aggressive surgical intervention. This observation aligns with the findings of Hagelberg et al. (24), who demonstrated the predictive value of MRI for abscess complications. By directly correlating abscess incidence with fistula type, the present study emphasizes the importance of this association. The correlation between MRI findings and intraoperative results was a notable aspect of the present study. The precise imaging of sphincter involvement provided by MRI facilitates tailored approaches, such as fistulotomy for intersphincteric fistulas versus seton placement for transsphincteric types, thereby minimizing recurrence risks. This result is consistent with the studies by Sudoł-Szopińska et al. (25), and Algazzar et al. (12), which indicated that MRI-guided surgical planning leads to superior outcomes.

Moreover, the detailed information from MRI assists surgeons in avoiding unnecessary sphincter damage, thereby reducing the risk of complications (26). This prospective study, which employed standardized imaging protocols and direct comparison with intraoperative findings, improves the image quality and reliability of results. Additionally, observer bias was minimized by having images analyzed by two radiologists. However, the study's generalizability is somewhat limited due to being conducted in a single center and having a small sample size, which was determined based on patient availability. The direct impact of MRI on surgical adjustments or long-term patient outcomes, such as recurrence rates, is not reported in the results, despite its importance being mentioned in the introduction.

Conclusion

This study demonstrates the significant and pivotal role of MRI in the comprehensive preoperative evaluation of PFs. Given its high accuracy in identifying fistula tracts, detecting secondary branches, associated abscesses, and their relationship with the sphincter complex, MRI provides surgeons with the necessary information to make informed treatment decisions. This enables the selection of the optimal therapeutic strategies, prevents potential sphincter muscle damage, improves surgical success rates, and reduces the risk of disease recurrence and unwanted postoperative complications.

Acknowledgments

We extend our heartfelt appreciation to everybody who dedicated their time, effort, and skill to ensure the success of this research.

Conflict of interest:

All authors assert the absence of any conflict of interest.

Data availability:

Upon reasonable request, the data from the research may be obtained from the

References

1. Włodarczyk M, Włodarczyk J, Sobolewska-Włodarczyk A, Trzciński R, Dziki Ł, et al. Current concepts in the pathogenesis of cryptoglandular perianal fistula. Journal of International Medical Research. 2021;49(2):0300060520986669.
2. Sohrabi M, Bahrami S, Mosalli M, Khaleghian M, Obaidinia M. Perianal Fistula; from etiology to treatment - a review. Middle East journal of digestive diseases. 2024;16(2):76-85.
3. Kawecki MP, Kruk AM, Drążyk M, Domagała Z, Woźniak S. Exploring perianal fistulas: insights into biochemical, genetic, and epigenetic influences—a comprehensive review. Gastroenterology Insights. 2025;16(1):10.
4. Emile SH, Elgendy H, Sakr A, Youssef M, Thabet W, Omar W, et al. Gender-based analysis of the characteristics and outcomes of surgery for anal fistula: analysis of more than 560 cases. Journal of Coloproctology (Rio de Janeiro). 2018;38(3):199-206.
5. Fugita FR, dos Santos CHM, da Silva Ribeiro CO. Epidemiological profile of patients with fistula in ano. Journal of Coloproctology. 2020;40(01):001-7.
6. Chang CC, Qiao LH, Zhang ZQ, Tian X, Zhang Y, Cheng WW, et al. High-resolution direct magnetic resonance imaging fistulography with hydrogen peroxide for diagnosing anorectal fistula: A preliminary retrospective study. World journal of radiology. 2025;17(1):101221.

7. Bondurri A. Epidemiology of anal fistula and abscess. Anal Fistula and Abscess: Springer; 2022;3-11.
8. Lee JL, Yoon YS, Yu CS. Treatment strategy for perianal fistulas in crohn disease patients: The surgeon's point of view. Annals of coloproctology. 2021;37(1):5-15.
9. Kazemian H, Mehrad-Majd H. Recent advances in the prevention and treatment of chemotherapy–induced cardiotoxicity. Research in Biotechnology and Environmental Science. 2023;2(2):24-9.
10. Arkenbosch JHC, van Ruler O, de Vries AC, van der Woude CJ, Dwarkasing RS. The role of MRI in perianal fistulizing disease: diagnostic imaging and classification systems to monitor disease activity. Abdominal radiology (New York). 2025;50(2):589-97.
11. Vo D, Phan C, Nguyen L, Le H, Nguyen T, Pham H. The role of magnetic resonance imaging in the preoperative evaluation of anal fistulas. Scientific reports. 2019;9(1):17947.
12. Algazzar HY, Eldib DB, Bahram MA, Zaher NA. Preoperative MRI of perianal fistula evaluation and its impact on surgical outcome. Egyptian Journal of Radiology and Nuclear Medicine. 2019;50:1-10.
13. Konan A, Onur MR, Özmen MN. The contribution of preoperative MRI to the surgical management of anal fistulas. Diagnostic and Interventional Radiology (Ankara, Turkey). 2018;24(6):321-7.
14. Zhao WW, Yu J, Shu J, Sha JT, Li CY, Zeng J, et al. Precise and comprehensive evaluation of perianal fistulas, classification and related complications using magnetic resonance imaging. American Journal of Translational Research. 2023;15(5):3674-85.
15. 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;49(2):133-144.
16. van Oostendorp JY, Eddarazi A, Molenaar CBH, Zimmerman DDE, Bemelman WA, Han-Geurts IJM. Mid- and long-term functional outcomes of advancement flap for cryptoglandular perianal fistulas. Techniques in Coloproctology. 2025;29(1):112.
17. Aly RA, Badr MA, Korayem EM, Abdalsalam OH, Omar H. Role of MRI in classification and preoperative evaluation of perianal fistula. Egyptian Journal of Radiology and Nuclear Medicine. 2024;55(1):141.
18. Zakaria R, Amin MM, Orban YA, Elfwakhry RM, Alhussein Abo-Alella H. Diagnostic value of trans-recto-perineal ultrasound in perianal fistula—preoperative versus intraoperative findings: A comparative cross-section study. Formosan Journal of Surgery. 2025;58(2):60-6.
19. Irshad R, Majeed A. Diagnostic accuracy of magnetic resonance imaging(Mri) for Perianal fistula tract taking operative findings as gold standard. Pakistan Armed Forces Medical Journal. 2025;75(1):S16-S9.
20. Ahmad MW, Shehzadi HS, Dogar IH, Rashid N, Tayyab MA, Qureshi UA, et al. Magnetic resonance imaging (MRI) evaluation of perianal fistula with surgical correlation. Pakistan Journal of Medical & Health Sciences. 2023;17(03):230.
21. Issa SA, Legesse TK, Kebede AG, Worke AB, Buser AA. Clinical and Radiological Features of Perianal Fistula: An MRI-Based Study in Addis Ababa, Ethiopia. Ethiop J Health Sci. 2024;34(1):31-8.
22. Sanchez-Haro E, Vela E, Cleries M, Vela S, Tapiolas I, Troya J, et al. Clinical characterization of patients with anal fistula during follow-up of anorectal abscess: a large population-based study. Tech Coloproctol. 2023;27(10):897-907.
23. Akhoundi N, Bozchelouei JK, Abrishami A, Frootan M, Siami A, Alimadadi E, et al. Comparison of MRI and endoanal ultrasound in assessing intersphincteric, transsphincteric, and suprasphincteric perianal fistula. J Ultrasound Med. 2023;42(9):2057-64.
24. Hagelberg J, Pape B, Heikkinen J, Nurminen J, Mattila K, Hirvonen J. Diagnostic accuracy of contrast-enhanced CT for neck abscesses: A systematic review and meta-analysis of positive predictive value. PLoS One. 2022;17(10):e0276544.
25. Sudoł-Szopińska I, Santoro GA, Kołodziejczak M, Wiaczek A, Grossi U. Magnetic resonance imaging template to standardize reporting of anal fistulas. Techniques in Coloproctology. 2021;25(3):333-7.
26. Elnaim ALK, Wong MP, Sagap I. Obstetric anal sphincter injuries (OASIS) and secondary overlapping sphincteroplasty from a colorectal perspective: A systematic review. Academic Medicine & Surgery. 2025;1(1):1-11.