RESEARCH ARTICLE

A retrospective study on the diagnostic values of magnetic resonance examination of the anal canal in the classification of anal fistula

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Abstract

Objective: To explore the diagnostic value of magnetic resonance imaging of the anal canal in classifying anal fistula.

Method: The retrospective study was conducted at Yongli Wu, Danyang Hospital of Traditional Chinese Medicine, Danyang, Jiangsu, China, and comprised clinical data of patients with anal fistula treated from April 2021 to March 2022. All the patients had undergone magnetic resonance imaging scanning and surgical treatment, with surgical resection specimens sent to pathology. Pathological results served as the gold standard for the diagnosis. The consistency between preoperative magnetic resonance imaging and surgical results in diagnosing anal fistula classification was analysed. Data was analysed using SPSS 21.

Results: Of the 79 patients, 58(73.4%) were males and 21(26.6%) were females. The overall mean age was 43.12±12.12 years, and mean disease duration was 7.11±1.76 months. Surgery found 75(94.9%) low, 4(5.1%) high, 42(53.2%) simple, 37(46.8%) difficult, 1(1.3%) internal, and 78(98.7%) external anal fistulae. Preoperative magnetic resonance imaging showed 74(93.7%) low, 5(6.3%) high, 43(54.4%) simple, 35(44.3%) difficult, 1(1.3%) internal and 78(98.7%) external anal fistulae. Surgery and magnetic resonance imaging detected anal fistulas similarly ($p>0.05$). Surgery found 36(45.6%) inter-sphincteric, 26(32.9%) trans-sphincteric, 11(13.9%) supra-sphincteric and 6(7.6%) extra-sphincteric anal fistulae. Pre-operative magnetic resonance imaging indicated 34(43%) inter-sphincteric anal fistulas, 25(31.6%) trans-sphincteric, 11(13.9%) supra-sphincteric and 6(7.6%) extra-sphincteric. Further, surgery detected 87(110.1%) internal orifices, 25(31.6%) abscesses, 79(100%) major fistulas, 67(84.8%) external orifices, and 22(27.8%) branch pipes. The corresponding values for magnetic resonance imaging were 84(106.3%), 25(31.6%), 76(96.2%), 66(83.5%) and 20(25.3%) respectively ($p>0.05$).

Conclusion: Magnetic resonance imaging of the anal canal was found to have a high accuracy in diagnosing and classifying anal fistula.

Keywords: Anal fistula, Magnetic resonance, Surgical pathology, Diagnostic value. (JPMA 75: S-85 [Suppl. 02]; 2025)

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Introduction

Anal fistula is a common clinical inflammatory disease, which is mainly caused by anal sinus infection, abscess rupture around the anorectum, or subcutaneous infection after incision and drainage.[1] Patients experience pain and anal itching, etc., and there are purulent or bloody secretions that have a severe impact on the patient's daily life.[2,3] Anal fistula is composed of three parts: internal aperture, orifice fistulae, and external aperture.[4] The internal opening is the origin of the anal fistula.[5-7] Due to the existence of original infection lesions and excretion, the wound may be polluted, so a "cycle" of pollution and repair has to occur.[8-10] Surgery is currently the primary means of treating patients with anal fistula, which can significantly improve the discomforting symptoms of patients.[11] However, preoperative diagnosis, especially judging the relationship and classification of surrounding tissues, such as the fistula and sphincter complex, plays a vital role in the surgical treatment process. In the past, the diagnosis of anal fistula was mainly based on perianal digital examination and personal experience.[12-14] However, it often occurred that insufficient preoperative assessment led to errors during operation, missing fistulas and branch fistulas or hidden abscesses that were not discovered in time, which affected the recovery of patients and even caused recurrence.[15-17] With the continuous advancement of medical technology, preoperative imaging examinations have begun to be used in the diagnosis of the classification of anal fistula pathology, which can clarify the relationship between the course of the fistula and the position of the anal sphincter, which has a great value in guiding clinical treatment.[18,19] High-resolution magnetic resonance imaging (MRI) technology has the advantages of high image quality and high resolution that can accurately display the delicate anatomy of the anal canal, and avoid the impact of tissues, bone and muscle on the image quality, which has important guiding significance for determining reasonable surgical course.[20-22]

Several studies have delved into the effectiveness of MRI in diagnosing and classifying anal fistulas. One study compared three-dimensional (3D) pelvic ultrasound with

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MRI, revealing that while both methods were highly accurate, MRI stood out due to its superior ability to detail the anatomy and classify fistulas accurately.[23] This makes MRI the preferred choice for preoperative assessment, as it provides comprehensive images that help surgeons plan their procedures more effectively.[24,25]

Another research focussed on the sensitivity and specificity of 3D MRI in detecting perianal fistulas. It demonstrated that 3D MRI is particularly adept at identifying thin primary fistulous tracts and side branches, which are often challenging to detect with other imaging techniques. This capability is crucial for preoperative planning, as it allows for a more precise surgical approach, thereby reducing the likelihood of recurrence.[26,27]

MRI was also highlighted as the best imaging modality for preoperative assessment of anal fistulas in another study. This study emphasised MRI's ability to accurately demonstrate the extent of the disease, predict prognosis, and assist in therapy decisions.[28] The detailed anatomical information provided by MRI is essential for surgical planning, ensuring that all aspects of the fistula are addressed during the procedure.[29,30]

Further studies evaluated the impact of preoperative MRI on surgical outcomes for patients with perianal fistulas. These studies found that MRI could predict the severity of the disease with high sensitivity and specificity, which significantly correlates with surgical findings. This correlation improves treatment strategies, as surgeons can tailor their approach based on the detailed information provided by MRI, leading to better patient outcomes.[31,32]

Lastly, a decision-making tool based on MRI findings was introduced in another research. This tool is designed to predict the complexity and recurrence of anal fistulas, enhancing the accuracy of preoperative assessments.[33-35] By using this tool, surgeons can plan more effective treatments, and reduce the risk of postoperative complications.[36] The tool's ability to provide detailed insights into the fistula's characteristics helps in making informed decisions about the best surgical approach.[37,38]

The current study was planned to investigate the potential benefits and applications of MRI in accurately classifying anal fistulas.

Materials and Methods

The retrospective study was conducted at Yongli Wu, Danyang Hospital of Traditional Chinese Medicine, Danyang, Jiangsu, China, and comprised clinical data of patients with anal fistula treated from April 2021 to March 2022. Data was collected after approval from the institutional ethics review committee.

Those included were anal fistula patients aged >18 years having purulent or bloody secretions and perianal swelling wh had been who had been diagnosed by surgical pathology.

Those excluded were patients with other perianal diseases, patients with mental illness or malignant tumours, pregnant or lactating women, patients with heart and cerebrovascular diseases, and patients with liver kidney and other vital organ dysfunction.

Several logical and academic reasons justified the sample size as it ensured sufficient statistical power to detect significant differences and relationships within the data compared to other studies,[17,32] thus enhancing the reliability and validity of the findings. Besides, the inclusion criterion was stringent, focussing on patients diagnosed with anal fistula by surgical pathology, aged over 18 years, and who underwent surgical treatment, ensuring a homogenous sample that accurately represented the target population. Also, the exclusion criterion left outpatients with other perianal diseases, mental illnesses, malignant tumours, and vital organ dysfunction, which further refined the sample to eliminate confounding variables.

The sample size also allowed for a comprehensive analysis of various subtypes of anal fistula, as well as the comparison of MRI and surgical diagnostic methods. Overall, the sample size balanced the need for robust statistical analysis with practical considerations of patient availability and ethical research practices.

All the patients had been examined by MRI scanning. They were placed in a supine position, with the pubic symphysis as the centre, the upper edge containing the middle rectum, and the lower edge containing the perianal skin. Firstly, plain MRI scanning was performed with slice thickness 4mm, including sagittal, coronal and transverse T1 and T2 fat proton intensity-weighted imaging. Coronal T2-weighted imaging (T2WI) scanning sequence, axial T1-weighted imaging (T1W1) sequence, and turbo spin echo (TSE) were used, and coronal, axial, and sagittal enhanced scanning of the anal canal area was routinely performed. Contrast agent 15mL gadopentetate meglumine was intravenously injected into the upper extremity of patients at an injection speed of 1mL per second with an interval of 35s. In the process of axial scanning of the patients, it was ensured that the anal canal was perpendicular to the layer. In contrast, in coronal scanning, the anal canal was parallel to the layer.

Two physicians with senior diagnostic experience in the imaging department read the images independently. If

there were differences of opinion, the image results were discussed and analysed by the two together. The observation contents included image quality to observe the rendering effects of the musculus levator ani, sphincter space, external sphincter, and internal sphincter, and whether the display was clear. It also included classification of anal fistula, including low and high anal fistula, simple and complex anal fistula, internal and external fistula. Finally, the type of anal fistula was determined, including inter-sphincteric, trans-sphincteric, supra-sphincteric, and extra-sphincteric.

Surgical results were used as the gold standard for diagnosis. All the patients underwent anal fistula resection after MRI scanning, and the specimens were taken and sent to the Pathology Department.

The consistency between preoperative anal canal MRI in the diagnosis of anal fistula classification and surgical results was analysed by comparing surgical pathological results and preoperative anal canal MRI results.

Data was analysed using SPSS 21. Count data was expressed as frequencies and percentages, and the chi-square test was used to do a pairwise comparison, Measurement data was expressed as mean ± standard deviation, and an independent sample t-test was used to do a pairwise comparison. P<0.05 was considered statistically significant.

Results

Of the 79 patients, 58(73.4%) were males and 21(26.6%) were females. The overall mean age was 43.12±12.12 years, and mean disease duration was 7.11±1.76 months. Surgery found 75(94.9%) low, 4(5.1%) high, 42(53.2%) simple, 37(46.8%) complex, 1(1.3%) internal, and 78(98.7%) external anal fistulae. Preoperative MRI showed 74(93.7%) low, 5(6.3%) high, 43(54.4%) simple, 35(44.3%) difficult, 1(1.3%) internal and 78(98.7%) external anal fistulae. There was no significant difference between MRI and surgery in diagnosing and classifying the types of anal fistulas (Table 1).

Surgery found 36(45.6%) inter-sphincteric, 26(32.9%) trans-sphincteric, 11(13.9%) supra-sphincteric and 6(7.6%) extra-sphincteric anal fistulae (Table 2). Pre-operative MRI indicated 34(43%) inter-sphincteric anal fistulas, 25(31.6%) trans-sphincteric, 11(13.9%) supra-sphincteric and 6(7.6%) extra-sphincteric (Table 3).

The accuracy of MRI in identifying fistula types did not significantly differ from the results obtained through surgical diagnosis (p>0.05) (Table 4, Figure 1).

Table-1: Comparison of Consistency between surgical findings and preoperative anal canal magnetic resonance imagiing (MRI) in the diagnosis of anal fistula classification.

Diagnostic methods	Low anal fistula	High anal fistula	Simple anal fistula	Complex anal fistula	Internal fistula	External fistula
Surgical results	75	4	42	37	1	78
MRI results	74	5	43	35	1	78
x^2	1.007	0.118	0.026	0.102	0.000	0.000
p-value	0.316	0.731	0.873	0.749	1.000	1.000

Table-2: Classification results of surgical diagnosis of anal fistula.

Surgery results	n (%)
Inter-sphincteric type	36 (45.57)
Trans-sphincteric type	26 (32.91)
Supra-sphincter type	11 (13.92)
Extra-sphincteric type	6 (7.59)

Table-3: Classification results of preoperative anal canal magnetic resonance imaging (MRI) in the diagnosis of anal fistula.

Diagnostic results	Preoperative MRI diagnosis		
	False negative	False positive	True positive
Inter-sphincteric type	1	1	34
Trans-sphincteric type	1	0	25
Supra-sphincteric type	0	0	11
Extra-sphincteric type	0	0	6

Table-4: Comparison of the classification results of the two methods in diagnosing anal fistula.

Diagnostic method	n	Inter-sphincteric type	Trans-sphincteric type	Supra-sphincteric type	Extra-sphincteric type
Surgical results	79	36	26	11	6
MRI results	79	34	25	11	6
x^2		0.123	0.029	0.000	0.000
p-value		0.749	0.865	1.000	1.000

MRI: Magnetic Resonance Imaging.

Table-5: Comparison of consistency between surgical findings and preoperative anal canal magnetic resonance imaging (MRI) in the diagnosis of anal fistula. structure.

Diagnostic methods	Internal mouth	Abscess	Main fistula	External aperture	Branch pipe
Surgical results	87	25	79	67	22
MRI results	84	25	76	66	20
x^2	3.053	0.000	3.058	1.008	2.095
p-value	0.081	1.000	0.080	0.315	0.148

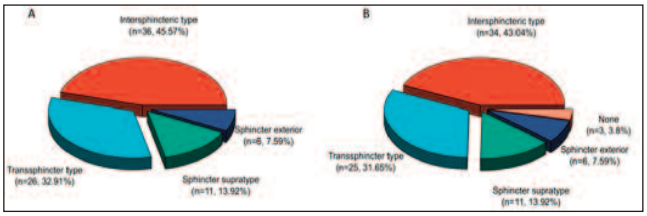

Figure-1: Distribution of surgical findings (A) and pre-surgery magnetic resonance imaging (MRI) of the anal canal in the diagnosis of anal fistula.

Further, surgery detected 87(110.1%) internal orifices, 25(31.6%) abscesses, 79(100%) major fistulas, 67(84.8%) external orifices, and 22(27.8%) branch pipes. The corresponding values for MRI were 84(106.3%), 25(31.6%), 76(96.2%), 66(83.5%) and 20(25.3%) respectively. (p>0.05) (Table 5).

Discussion

An anal fistula is a granulomatous pathway produced by the abnormal growth of infection foci in the anal canal and skin surface, and it mainly occurs in the male population, with a male-to-female ratio of about 2:1.[39] There are more muscle tissues and gaps in the perianal area, which leads to the diversity of infection focus spread, and further forms different types of anal fistula, resulting in perianal abscess, which brings difficulties to clinical treatment.[40] Blind treatment can lead to an increased risk of perianal recurrence, as well as sinus tract branching and abscess formation, which ultimately leads to increased pain for patients. Therefore, exploring the formation and progress of anal fistula and clarifying its classification and typing is of vital importance for clinical guidance of treatment.

Preoperative imaging examination can understand the range of infection infiltration and inflammatory infiltration to a certain extent, clarify the relationship between the anal canal and sphincter, and the internal aperture and location of the anal fistula, which is conducive to rational treatment of anal fistula in the clinic, improving the one-time cure rate of patients, and protecting the sphincter function of patients to the maximum extent.[41] At present, computed tomography (CT), intracavitary ultrasound, and MRI can be used to diagnose perianal patients in clinics. CT can only perform relevant examinations on the rectal area, but the anatomical structure of the area cannot be clearly described. In addition, CT, as a radiation imaging examination, has a limitation in clinical application. The resolution and display tissue contrast of intracavity ultrasound are poor. The external rectal sphincter cannot be displayed well, and the results of this examination are directly affected by the operator's experience level. The MRI examination of the anal canal can image the soft tissue in any plane and has a high-resolution ability (Figure 2). It can clearly display the anatomical relationship among the external anal sphincter, puborectalis, and levator ani through multi-sequence imaging technology. In addition, this method can also clearly display the course of the anal canal and associated diseases.[42] Anal canal MRI can clearly display the anal canal branch pipes, primary fistula, and criticism fistulae with high accuracy, and it can guide the clinic in selecting appropriate treatment methods.[43] Accurate positioning of the anal canal and the internal aperture of the anal fistula is of great significance to the prognosis of patients and is the key to successful surgery.

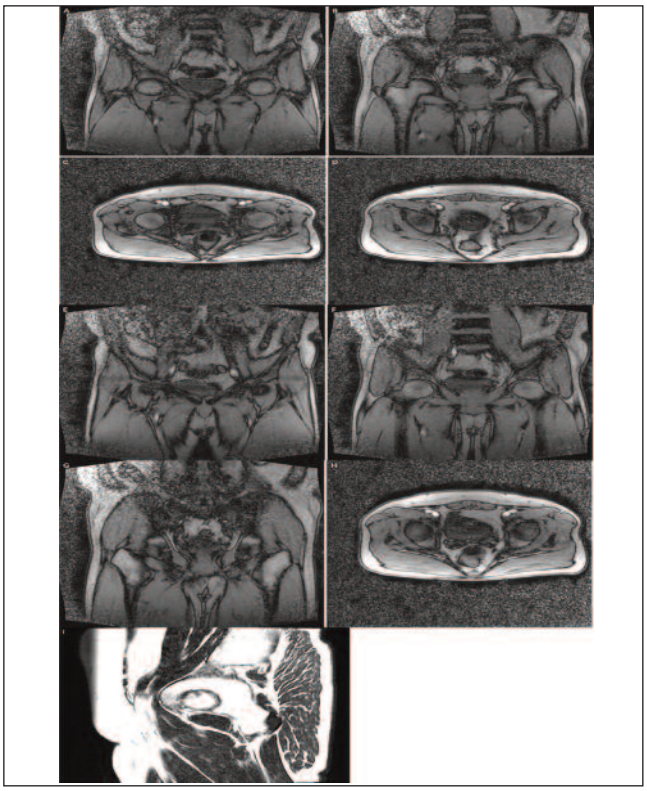

Figure-2: High-resolution magnetic resonance imaging (MRI) scans of patients with anal fistula (high complex anal fistula changes).

Moreover, anal canal MRI has been widely used in the diagnosis and classification of anal fistula.[44] Preoperative anal canal MRI results in the current study showed that there were 74 cases of low anal fistula, 5 cases of high anal fistula, 43 cases of simple anal fistula, 35 cases of complex anal fistula, 1 case of internal fistula, and 78 cases of external fistula. The surgical results showed that among 79 patients, there were 75 cases of anal fistula, 4 cases of high anal fistula, 42 cases of simple anal fistula, 37 cases of complicated anal fistula, 1 case of internal fistula, and 78 cases of external fistula. The number of cases of internal and external fistula in preoperative anal canal MRI results was consistent with the surgical result, giving it an excellent diagnostic value.

The current results showed that the accuracy of preoperative anal canal MRI in the diagnosis of inter-sphincteric, trans-sphincteric, supra-sphincteric and extra-sphincteric anal fistulas was not significantly different to the surgical results (p>0.05). It suggested that preoperative anal canal MRI had excellent value in diagnosing the types of anal fistulas, and could be used to identify the types of anal fistulas. However, in the current study, MRI failed to detect 3 cases of internal openings of

the anal fistula, indicating false-negatives, and 1 internal opening of the anal fistula, suggesting a false-positive. The reason may be that the internal opening of the anal fistula is closed, and the small internal opening can lead to false-negatives. The false-positive may have a specific relation with the hyperintense blood vessel confusion in the T2WI fat-suppressed sequence. In addition, the study also found that preoperative anal canal MRI had no significant difference in the diagnosis of internal orifice, abscess, primary fistula, external orifice, and the number of branch pipes compared to the surgical results ($p>0.05$). This showed that it was of great significance in judging abscesses and the number of abscesses, the course and quantity of fistulas, and the location of internal and external openings. However, the MRI examination failed to detect 3 internal orifices, 3 main fistulas, 1 external orifice, and 2 branch pipes. The reason for the main fistula not being detected may be that the primary main fistula is deep in the surrounding tissues, and the distance is relatively far away. In addition, with the further development of the disease, secondary branch pipes may appear and branch out into several new branches, which are near and far away from the primary fistula, making it difficult to detect all the branch pipes by MRI.[45] The reasons why the branch pipes could not be fully detected was perhaps due to the low content of pus in the branch pipes, the inactive fistula, and the unclear description of T2-weighted imaging with fat suppression (T2WIFS) sequence images. The bronchus is deep in the surrounding tissues, and the diameter of the tube is relatively small, which leads to a high risk of missed diagnosis.[46] In addition, the path of the fistula is more complicated, and there is a natural resistance between the fat space outside the sphincter and the sphincter.[47] In the abscess examination, preoperative anal canal MRI altogether detected the abscesses, which was consistent with the surgical results, and the diagnostic value was good. The study also found that preoperative anal canal MRI diagnosed 34 cases of inter-sphincteric anal fistula, 25 cases of trans-sphincteric anal fistula, 11 cases of supra-sphincteric anal fistula, and 6 cases of extra-sphincteric anal fistula. The surgical results showed that there were 36 cases of inter-sphincteric anal fistula, 26 cases of trans-sphincteric anal fistula, 11 cases of supra-sphincteric anal fistula, and 6 cases of extra-sphincteric anal fistula. The total accuracy rate of preoperative anal canal MRI diagnosis was 96.20, which was basically consistent with the surgical results, and the diagnostic value was higher.

Conclusion

Preoperative anal canal MRI in the diagnosis of anal fistula had high accuracy, could classify anal fistula well, and accurately identified anal fistula types. In addition, it could also evaluate the relationship between internal and external sphincters and fistula, and played a vital role in judging abscesses and the number of abscesses, the course and number of fistulas, and the location of internal and external openings. It was found to be a practical examination method that could provide reference basis for clinically accurate treatment and was worthy of clinical application.

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Conflict of Interest: None.

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