

Multifactorial Analysis of Postoperative Recurrence of Anal Fistula: A Retrospective Study

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Background: The aim of this study is to investigate the main factors that influence the recurrence of anal fistulas in patients with perianal abscesses following incision and drainage treatment.

Methods: A retrospective case-control study was performed according to the STROBE guidelines for patients with perianal abscesses who underwent surgical treatment at Guangdong Provincial Hospital of Chinese Medicine in Zhuhai and at the Affiliated Hospital of Xuzhou Medical University in Lasso between June 2021 and June 2023. Lasso and multivariate logistic regression analyses were performed to further determine the recurrence of perianal abscesses.

Results: A total of 435 patients were included in the study, with a median follow-up period of 25 months (range 18–40 months) after receiving treatment for perianal abscesses. Of these patients, 27 were in the anal fistula group and 408 were in the cured group. The results of the multivariate logistic regression analysis showed that a history of abscesses, enteritis, intraoperative pus cavity residue, standardized dressing changes after discharge, the surgeon's specialty, preoperative ultrasound or MRI examination, Parks classification and Wexner score were independently influential factors in the formation of anal fistulas after perianal abscess surgery ($P < 0.05$).

Conclusion: A history of abscesses and enteritis, Parks classification, and intraoperative pus cavity residue are high-risk factors for anal fistula recurrence. Standardized dressing changes after discharge, a preoperative ultrasound or MRI scan, and a postoperative assessment of anal function (Wexner score) are important for protecting anal sphincter function and improving the prognosis of perianal abscesses.

Keywords: perianal abscess, recurrence, anal fistula, risk factor

Introduction

A perianal abscess is a common acute suppurative infection encountered in clinical practice, with 90% of cases being caused by a blockage and subsequent infection of the anal glands within the anal sphincter interspace.^{1–3} The standard treatment for all perianal abscesses is incision and drainage.³ This surgical procedure involves making an incision in the centre of the abscess to drain the pus. While this is effective in controlling the further development of perianal abscesses, the rate of recurrence and sequelae, such as anal fistula, is high.⁴ A systematic review of six studies involving 817 patients revealed that antibiotic treatment following incision and drainage of simple perianal abscesses reduced the risk of postoperative anal fistula formation by 36%.⁵ However, many other factors influence the formation of an anal fistula following treatment for a perianal abscess, including age, smoking, diabetes mellitus, abscess interstitial extent, surgical methods, blood tests and perineal magnetic resonance imaging (MRI) extent. A retrospective study showed that abscess size and surgical method were independent factors affecting postoperative perianal abscess healing.⁶

However, the progression from perianal abscess to anal fistula remains unclear,⁷ and the development and persistence of anal fistula may involve multifactorial interactions between histological, microbiological and molecular factors.⁸ In this study, we conducted a median follow-up of 25 months for patients after perianal abscess surgery and analyzed the influence of multiple clinical data on the development of anal fistulae. These factors included history of abscesses and enteritis, intraoperative pus cavity residue, standardized dressing changes



after discharge, surgeon specialisation, and preoperative ultrasound or MRI examinations. We also considered Parks classification and Wexner score, as well as intraoperative protection of anal sphincter function and post-operative assessment of anal function. Our aim was to determine the risk and protective factors for anal fistula formation after incision and drainage treatment and to provide a basis for anal fistula prevention.

Materials and Methods

General Information

The study was conducted in accordance with the STROBE guidelines, the Declaration of Helsinki, and Good Clinical Practice standards. It was approved by the Ethics Committees of both the Guangdong Provincial Hospital of Chinese Medicine and the Affiliated Hospital of Xuzhou Medical University. All patients gave their consent prior to the start of the project. Patients were informed of all treatment options prior to surgery.

Clinical data from 435 patients with perianal abscesses who received treatment at the Guangdong Provincial Hospital of Chinese Medicine in Zhuhai and the Affiliated Hospital of Xuzhou Medical University between June 2021 and June 2023 were analyzed retrospectively. The cases were divided into two groups based on anal fistula recurrence,⁹ including 27 patients in the anal fistula group and 408 patients in the cured group, with a median follow-up of 25 months (range 18–40 months).

Inclusion and Exclusion Criteria

Inclusion criteria: (1) Aged between 18 and 65 years, regardless of gender; (2) Confirmed diagnosis of cryptoglandular perianal abscess with simple incision and drainage performed; (3) Patients willing and able to undergo follow-up. Exclusion criteria: (1) Lack of clinical research data; (2) Patients with spinal cord or pelvic floor nerve disease, or a mental disorder, who are unable to cooperate; (3) Patients with Crohn's disease or perianal skin disease; (4) Pregnant or breastfeeding women; (5) Patients with poor compliance who are unable to cooperate with follow-up; (6) Patients with a colorectal tumour.

Surgical Procedure

Perianal abscess incision and drainage: both groups of patients were given lumbar or general anaesthesia and placed in the lithotomy or prone position. A radiating incision was made to open the abscess cavity and allow it to drain. Using anoscopy and a probe, the location and scope of the abscess were cleared and the radial incision was performed at the location where the abscess showed the most obvious fluctuation. The pus septum formed by necrotic tissues in the abscess cavity was then opened and removed, with necrotic tissues in the cavity scraped off as far as possible. If the opening of the internal fistula was found during surgery (without preoperative testing), the opening of the internal fistula will be performed to ensure the edge of the incision was trimmed flat and the bottom of the abscess cavity was shaped like a large V.

If necessary, a tube or adhesive tape will be placed to drain the abscess. The abscess should be rinsed repeatedly with a dilute solution of iodised povidone-iodine and saline during the operation. As the abscess was infected, antibiotics were routinely administered for 5–7 days after the operation.

Case Selection

Anal Fistula Group

Postoperative outpatient and telephone median follow-up were performed to assess the recovery after 25 months (range, 18–40 months). When the patients run into any of the below conditions, they would be assorted in the anal fistula group:¹⁰ repeated non-healing of the incision after surgery, symptoms such as perianal fever (in contrast to increased temperature in other parts of the perianal area), perianal pain, and pus flow; diagnosis of perianal abscess or anal fistula confirmed by examination (ultrasound or MRI).

Cured Group

If there was no recurrence of the above-mentioned conditions to the patients during the follow-up period, they would be assorted in the cured group.

Observation Indicators

Information on all patients was recorded, including (1) Basic information: group number, gender, age; (2) Other important clinical information: Parks classification,⁹ location, title of surgeon, preoperative examination, intraoperative pus cavity residue (abscess cavity was too large and deep to be opened completely for drainage), preoperative fever (temperature over 37.5°), number of incisions, operation time, time of dressing change, standardized dressing changes after discharge, urinary retention, postoperative Wexner score 25 months (range, 18–40 months),⁶ whether the patient was accompanied by anemia, diabetes mellitus, enteritis (recurrent diarrhoea, diagnosed by colonoscopy) and history of abscesses. The observation indicators were measured by deputy chief physician or above.

Standardized Dressing Changes After Discharge

After discharge, patients were required to return to the hospital for regular dressing changes two to three times per week until the anal wound had healed. If there was stool inside the wounds, they would first need to be cleaned with water and then irrigated with povidone. During the early and mid-postoperative period, when there was a high level of wound secretion, gauze should be applied in multiple layers. In the later stages, when secretion decreased, a single layer of gauze should be used. When changing the dressing on a pus cavity, the rubber strip should be rinsed. If the pus cavity extended to the posterior rectal or pelvic space, the pus cavity must be rinsed repeatedly with saline until the rinsing fluid was clear. Dressing changes were performed by nurses specialising in dressings.

Surgeon Titles

Attending: Clinical work in the Department of Anorectal Surgery for 5 years; Deputy Chief Physician: Attending Physician for five years, during which time the number of outpatients reached 300, with surgery performed on at least 200 occasions; Chief Physician: Deputy Chief Physician for five years, during which time the number of outpatients reached 400, performing surgery on at least 300 occasions.

Statistical Analysis

SPSS 22.0 statistical software was selected to process the data. The quantitative data ($\bar{x} \pm s$) that conformed to normal distribution was tested by *t*-test, and quantitative variables that did not conform to normal distribution were tested by nonparametric rank-sum test; qualitative data (%) were tested by χ^2 or Fisher's exact test. The R 4.1.3 "glmnet" package was used for Lasso regression, and cross-validations were used to screen covariates, then multifactorial logistic regression analysis was used to analyze the factors affecting the formation of anal fistula after receiving treatment with incision and drainage in patients with perianal abscess, and the difference $P < 0.05$ was considered as statistically significant.

Results

General Statistics

Among the 435 patients, including 27 patients in anal fistula group and 408 patients in cured group through median follow-up 25 months (range, 18–40 months) (Figure 1), 377 were male and 58 were female; 353 males and 55 females were in the cured group, with a mean age of (38.3±12.81) years; and 24 males and 3 females were in the anal fistula group, with a mean age of (34.7±7.44) years. The study found that there was no significant difference between the two groups in terms of age and gender, preoperative inflammatory indicators (WBC, NEUT%), the presence of anemia, diabetes mellitus, in terms of dressing change time, operation time (<15min or ≥15min), location of abscess, preoperative fever, number of incisions and postoperative urinary retention ($P > 0.05$). And there were significant differences in the two groups in terms of the history of abscess, enteritis, in terms of the title of surgeon, Parks classification, preoperative examination, intraoperative pus cavity residue, standardized dressing changes after discharge and wexner score ($P < 0.05$) Table 1. Wexner score of 1 showed the most rarely liquid incontinence. Postoperative healing and recurrence in the two groups are shown in Figure 2.

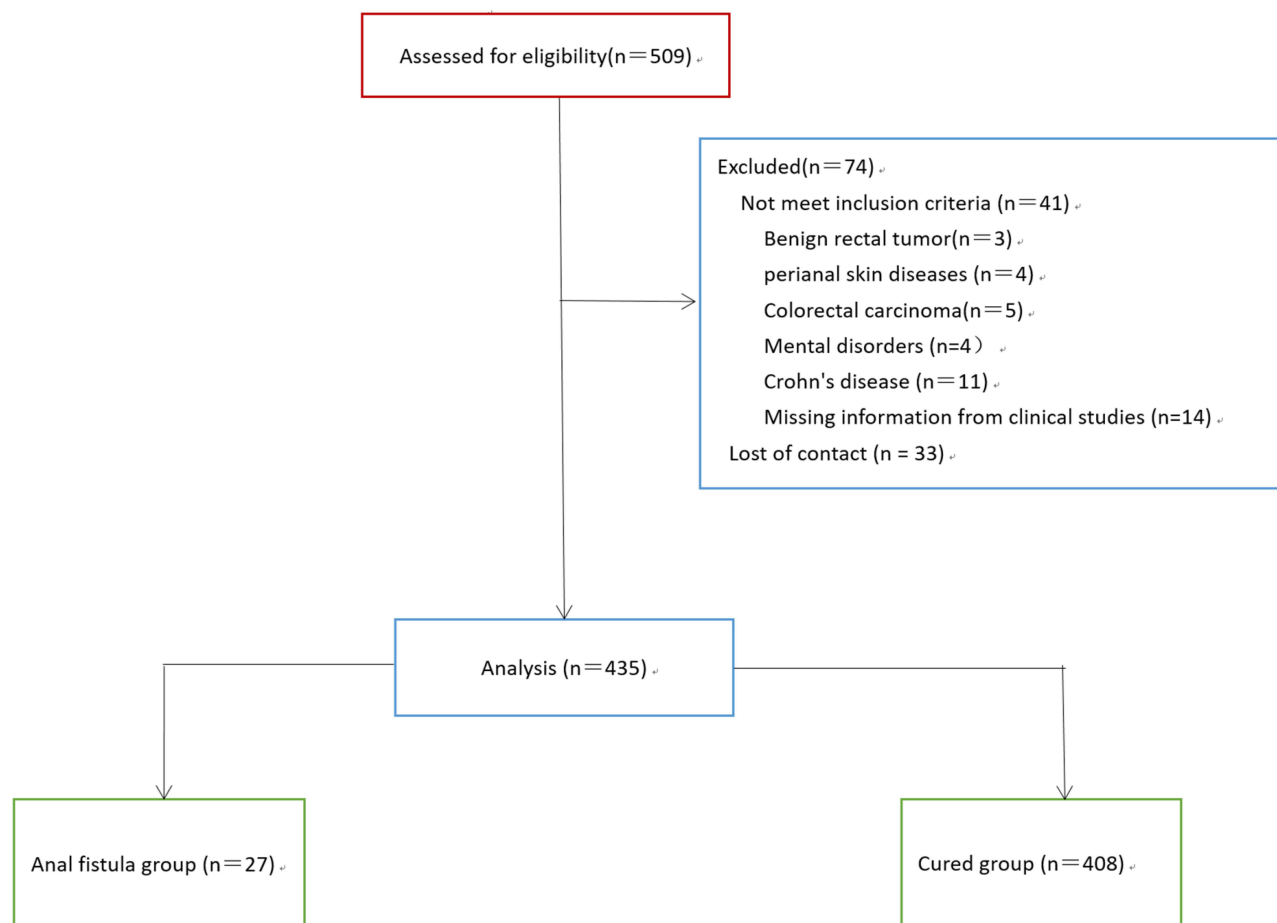


Figure 1 Participant flow diagram.

Lasso Logistic Analysis of Influencing the Formation of Anal Fistula After Perianal Abscess Surgery

Lasso logistic regression can eliminate multicollinearity among variables and improve the predictive accuracy of the model when used to screen variables. In this study, 10 potential relevant factors were selected when the maximum λ value was within one standard deviation of the mean error: Wexner score, intraoperative pus cavity residue, history of abscesses, surgeon's specialty, standardized dressing changes after discharge, enteritis, operation time, Parks classification, preoperative examination and postoperative urinary retention (Figure 3).

Multifactorial Logistic Regression Analysis of Influencing the Formation of Anal Fistula After Perianal Abscess Surgery

Based on the results of the Lasso logistic analysis, multifactorial logistic regression analysis was performed to determine the risk factors affecting recurrence of anal fistulae following perianal abscess surgery. The different groups were the dependent variables, while the independent variables were the Wexner score, intraoperative pus cavity residue, surgeon specialism, standardized dressing changes after discharge, enteritis, operation time, Parks classification, preoperative examination and postoperative urinary retention. The results of the logistic regression analysis are shown in Table 2. These results revealed that a history of abscesses, enteritis, intraoperative pus cavity residue, standardized dressing changes after discharge, the surgeon's title, preoperative ultrasound or MRI examinations, Parks classification and the Wexner score were all independently influential factors in the postoperative cure of perianal abscesses ($P < 0.05$).

Table 1 Baseline Comparison of Clinical Characteristics Between the Two Groups

Factor	Cured Group (n=408)	Anal Fistula Group (n=27)	Z/ χ^2	P
Age (years)	38.30±12.81	34.70±7.44	1.442	0.150
Sex				
Male	353(86.50)	24(88.90)	0.003	0.953
Female	55(13.50)	3(11.10)		
History of abscesses				
No	370(90.70)	18(66.70)	12.771	0.000***
Yes	38(9.30)	9(33.30)		
Anemia				
No	405(99.30)	27(100.00)	/	1.000
Yes	3(0.70)	0(0.00)		
Enteritis				
No	407(99.80)	24(88.90)	21.975	0.000***
Yes	1(0.20)	3(11.10)		
Diabetes				
No	393(96.30)	27(100.00)	/	0.613
Yes	15(3.70)	0(0.00)		
Preoperative inflammatory indicators				
WBC	9.39±3.36	9.02±3.79	0.4	0.69
NUET%	68.04±10.33	67.46±13.11	0.18	0.85
Operation time				
<15min	27(6.60)	2(7.4)	0.000	1.000
≥15min	381(93.40)	25(92.60)		
Time of dressing changes (min)	5.00(5.00, 5.00)	5.00(5.00, 5.00)	-1.704	0.088
Title of surgeon				
Attending	193(47.30)	10(37.00)	8.546	0.014*
Deputy Chief Physician	187(45.80)	10(37.00)		
Chief Physician	28(6.90)	7(25.90)		
Parks classification				
Intersphincteric	204(50)	8(29.6)	16.785	0.001***
Transsphincteric	133(32.6)	5(16.5)		
Suprasphincteric	61(15)	10(37)		
Extrasphincteric	10(2.5)	4(14.8)		

(Continued)

Table I (Continued).

Factor	Cured Group (n=408)	Anal Fistula Group (n=27)	Z/ χ^2	P
Location of abscess				
Anterior	97(23.80)	4(14.80)	6.676	0.193
Lateral	80(19.60)	6(22.20)		
Posterior	164(40.20)	9(33.30)		
Lateral- posterior	39(9.60)	4(14.80)		
Lateral- anterior	10(2.50)	0(0.00)		
Anterior- posterior	18(4.40)	4(14.80)		
Preoperative examination				
No	295(72.30)	7(25.90)	36.629	0.000***
CT	44(10.80)	2(7.40)		
Ultrasound	32(7.80)	4(14.80)		
MRI	36(8.80)	14(51.90)		
PET	1(0.20)	0(0.00)		
Intraoperative pus residue				
No	393(96.30)	18(66.70)	37.228	0.000***
Yes	15(3.70)	9(33.30)		
Preoperative fever				
No	393(96.30)	25(92.60)	0.208	0.648
Yes	15(3.70)	2(7.40)		
Number of incisions				
Single incision	317(77.70)	17(63.00)	3.083	0.079
Multiple incisions	91(22.30)	10(37.00)		
Standardized dressing changes after discharge				
Yes	395(96.80)	20(74.10)	24.895	0.000***
No	13(3.20)	7(25.90)		
Postoperative Wexner score				
0	401(98.30)	11(40.70)	156.155	0.000***
1	7(1.70)	16(59.30)		
Postoperative urinary retention				
No	401(98.30)	27(100.00)	/	1.000
Yes	7(1.70)	0(0.00)		

Notes: *P <0.05; ***P <0.001.

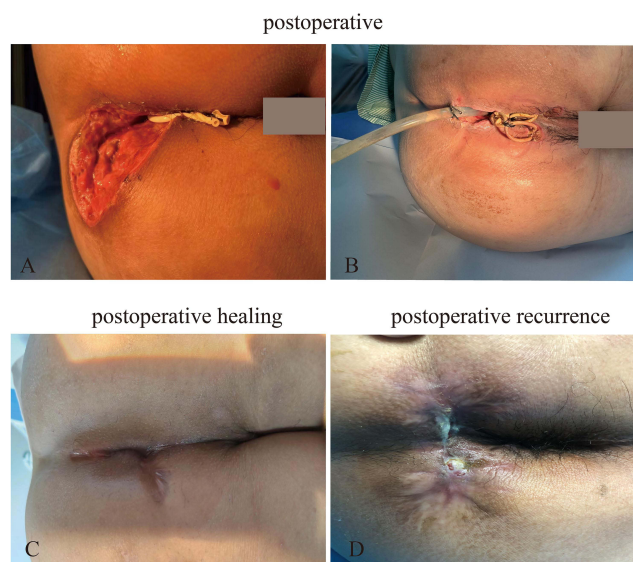


Figure 2 Surgical and postoperative images ((A and B) incision and drainage; (C) postoperative healing; (D) postoperative recurrence).

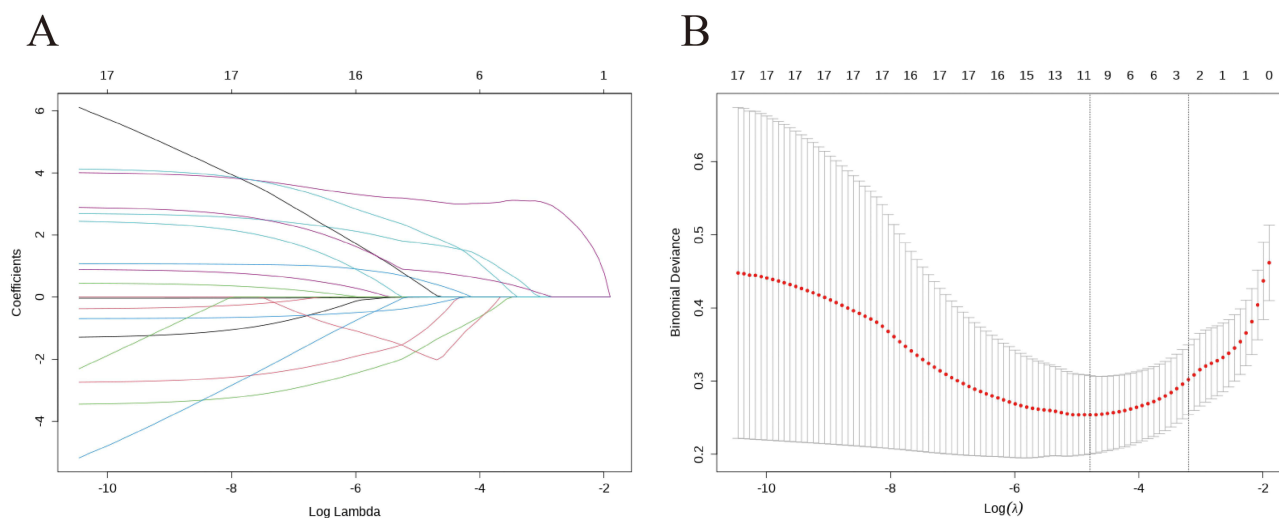


Figure 3 (A): Lasso regression coefficient path; (B) Lasso regression cross-validation curve.

Discussion

The average age of patients with perianal abscesses was around 40 years, and men were twice as likely to develop them as women.³ A retrospective study showed that 77.5% of patients were male, with a mean age of 43.2 years,¹¹ and another study found that 83.6% of patients were male.¹² Our study produced similar results to previous studies, showing that 86.7% of patients were male. During the follow-up period, retrospective studies showed that, of patients with anal fistula who were treated with fistulectomy, recurrence developed in 23.8% of cases within the first year, with a mean recurrence time of 4.9 months.¹³ Our median follow-up period was 25 months (range 18–40 months).

In our study, a history of abscesses, enteritis, and intraoperative pus cavity residue were identified as independent risk factors for postoperative recurrence. A multicentre retrospective cohort study found that the risk factors for fistulae following treatment with incision and drainage of perianal abscesses were Crohn's disease, recurrent anal abscesses, and a history of repeated surgery.^{14,15} Chronic diarrhoea and a history of perianal surgery were identified as independent risk factors associated with a poor prognosis in patients with deep perianal abscesses.^{16,17} A history of abscesses and intraoperative pus cavity residue, as well as a high Parks classification, indicated a deeper and more extensive location

Table 2 Logistic Regression Analysis of Anal Fistula Formation After Perianal Abscess Surgery

Factor	B	S.E.	Wald	P	OR	95% CI
Standardized dressing changes	-2.364	0.522	-4.53	0.001	0.094	0.03–0.26
Intraoperative pus residue	2.5726	0.4857	5.2972	0.001	13.1	5.04–34.03
Operation time	-0.121	0.761	-0.159	0.874	0.886	3.96–0.874
Postoperative urinary retention	-11.853	882.743	-0.013	0.989	0.00	0.00-Inf
Enteritis	3.929	1.174	3.348	0.001	50.875	5.07–510.88
Title of surgeon						
Surgeon (1)	-1.542	0.533	-2.894	0.004	0.2139	0.08
Surgeon (2)	-1.574	0.533	-2.955	0.003	0.2073	0.07
Preoperative examination						
Preoperative examination (1)	0.65	0.8179	0.7947	0.427	1.9156	0.38–9.56
Preoperative examination (2)	1.6616	0.6538	2.5414	0.011	5.2679	1.46–19.04
Preoperative examination (3)	2.7966	0.4954	5.6448	0.001	16.3889	6.19–43.4
Preoperative examination (4)	-10.825	882.7435	-0.0123	0.99	0.000	0.00-Inf
Wexner score	4.4227	0.5466	8.0915	0.001	83.325	28.47–243.97
Parks classification						
Parks classification (1)	-0.892	0.6829	-1.3061	0.192	0.4098	0.11–1.57
Parks classification (2)	-2.3646	0.7467	-3.1669	0.002	0.094	0.02–0.41
Parks classification (3)	-2.3224	0.6927	-3.3524	0.001	0.098	0.03–0.38
History of abscesses	1.583	0.442	3.578	0.001	4.868	2.04–11.61

Notes: Title of surgeon (1): Comparison of Deputy Chief Physician and Attending; Title of surgeon (2): Comparison of Chief Physician and Attending; Preoperative examination (1): Comparison of CT and No. Preoperative examination (2): Comparison of Ultrasound and No. Preoperative examination (3): Comparison of MRI and No. Preoperative examination (4): Comparison of PET and No. Parks classification (1): Comparison of Transsphincteric and Intersphincteric. Parks classification (2): Comparison of Suprasphincteric and Intersphincteric. Parks classification (3): Comparison of Extrasphincteric and Intersphincteric.

of the perianal abscess, thereby increasing the probability of postoperative recurrence. During surgery, multiple counter-incisions can be made depending on the size of the abscess cavity, and drainage tubes can be placed based on the depth of the abscess to ensure adequate drainage. Most patients with enteritis had dysregulated intestinal flora, which could deplete the mucin protective layer of the anal glands, thereby damaging the local barrier. Therefore, the treatment of perianal abscesses required the regulation of intestinal flora.

In this study, the incidence of anal fistula after abscess incision and drainage treatment was lower when the surgeon's title was deputy chief attending physician, while the incidence of anal fistula was higher when the surgeon's title was chief physician. This may be related to the difficulty of the surgery on patients' abscesses; when the Parks classification of the abscess was suprasphincteric or extrasphincteric, the surgery was more difficult and required more surgical experience. In such cases, a physician with a higher title may have been chosen to perform the surgery. The involvement of senior clinicians was found to improve the identification and definitive treatment of potential fistulas.¹ Our study found that the Parks classification was an independent influential factor in the postoperative formation of anal fistulas. By comparing the extrasphincteric and intersphincteric types, we found that patients were more likely to have recurrent anal fistulas. A significant association was also found between complex fistulas, higher Parks grades and the total length of the fistula tract.¹⁸ This indicated that the surgical procedure was more challenging.

The Wexner score was an important variable for assessing a patient's ability to control their bowel movements. Compared to the Wexner score of 1.2 for simple fistulas, incontinence was worse after surgery for complex fistulas (Wexner score of 4.7).¹⁹ In this study, we found that the postoperative Wexner incontinence score was an independent predictor of anal fistula formation after treatment involving incision and drainage of perianal abscesses. Preventing abscess extension and fistula formation was crucial for preventing faecal incontinence. Intraoperative protection of anal sphincter function and postoperative assessment of anal function were important for the prognosis of perianal abscesses.

MRI patterns of perianal fistulas revealed that over one-third of patients have complex fistulas,¹⁸ and these can significantly reduce postoperative recurrence by 75% in complex cases.²⁰ In this study, we investigated whether patients had received the relevant examinations prior to surgery. We found that patients who underwent local ultrasound and MRI examinations before surgery were less likely to experience a recurrence of anal fistulas. This may be because auxiliary examinations enable surgeons to recognize the scope of the abscess and clarify the surgical method. Additionally, our study investigated patients' standardized dressing changes after discharge and found that the rate of postoperative anal fistula formation was lower. Studies have found that adequate drainage and the prevention of premature skin healing over the abscess pocket were crucial targets of postoperative treatment.²¹ Postoperative perianal abscesses can be avoided by cleaning the wound with each dressing change after surgery. This reduced the probability of wound infection and inflammatory reactions, allowing the wound to heal quickly and promoting earlier granulation tissue formation.²²

In summary, a history of abscesses and enteritis, intraoperative pus cavity residue, standardized dressing changes after discharge, preoperative ultrasound or MRI examinations, Parks classification, and Wexner scores were all independently influential factors in the formation of anal fistulas after perianal abscess surgery. Standardized dressing changes after discharge and preoperative ultrasound or MRI examinations were protective factors against anal fistula formation after surgery. Therefore, it was important to prevent enteritis, conduct necessary auxiliary examinations to assess Parks classification before surgery and inform patients that they should attend a regular medical appointment for standardized dressing changes to prevent anal fistula.

This retrospective study has certain limitations. Firstly, the current psychosomatic status of some patients may affect the accuracy of reports on past data. Secondly, the relatively small sample size of patients with anal fistulas in this study could cause bias, and baseline information such as smoking status, BMI and immunosuppressive therapy was insufficient. Further multicentre, large-sample, prospective, randomized controlled studies could be conducted to obtain a higher level of evidence.

Conclusion

Analysis of prognostic factors after treatment involving incision and drainage of perianal abscesses showed that a history of abscesses, enteritis, intraoperative pus cavity residue, standardized dressing changes, preoperative ultrasound or MRI examinations, Parks classification and Wexner scores were independent factors influencing the formation of anal fistulas after surgery for perianal abscesses. In future, it would be worthwhile discussing how to prevent enteritis and complete examinations before surgery, as well as increasing the population's awareness of perianal abscesses and standardized dressing changes.

Abbreviations

MRI, Magnetic Resonance Imaging; CT, Computed Tomography; PET, Positron Emission Tomography; CI, Confidence Interval; OR, Odds Ratio; WBC, White Blood Cell; NEUT%, Neutrophil Percentage.

Data Sharing Statement

The data presented in this study are available on request from the corresponding author.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agreed to be accountable for all aspects of the work.

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Disclosure

The authors declare no competing interests.

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