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Predictors of Recurrence in Pediatric Perianal Abscess and Fistula-In-Ano: Insights From a 5-Year Surgical Cohort Study

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Background: Perianal abscess (PA) and fistula-in-ano (FIA) are common in children, particularly infants. Despite their frequency, their pathophysiology, diagnostic accuracy, and optimal treatment remain debated. This study aimed to evaluate recurrence rates after surgical treatment of PA and FIA and identify clinical factors associated with fistula formation, including ultrasound findings, antibiotic therapy, abscess size, and symptom duration in otherwise healthy pediatric patients.

Material/Methods: We retrospectively reviewed 108 pediatric patients (0-17 years) treated surgically for PA and/or FIA between January 2019 and February 2024 at a tertiary care center. Inclusion criteria were PA diagnosis and incision and drainage as primary management. Data included intraoperative findings, recurrence, antibiotic use, ultrasound results, symptom duration, and abscess size (infants only).

Results: Intraoperative FIA was identified in 19/108 patients (17.8%). Overall recurrence occurred in 29 patients (26.9%). Recurrence of PA was more frequent in those with initial FIA (36.8%) than without (24.7%) but was not significant ($P>0.05$). However, FIA recurrence was significantly higher in patients with initial FIA (31.6% vs 10.1%, $P=0.024$). Among 99 patients undergoing ultrasound, diagnostic accuracy for PA was 100%. Regarding FIA, there were 3 false negatives and 5 false positives; in 67 cases, no definitive conclusion was provided. Antibiotic therapy, abscess size, and symptom duration showed no significant association with recurrence or FIA development.

Conclusions: Initial intraoperative detection of FIA significantly predicts future recurrence. Antibiotic use, symptom duration, and abscess size were not predictive. Findings highlight the need for improved diagnostic tools and standardized management protocols in pediatric PA and FIA.

Keywords: Abscess • Fistula • Pediatrics • Perianal Glands • Surgery Department, Hospital

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Introduction

Perianal abscess (PA) and fistula-in-ano (FIA) are common diseases of the same origin, arising from abnormal anal crypts. They show a male predominance in childhood, with up to 95% of pediatric patients being boys [1,2]. More than 96% of FIA cases occur in children younger than 1 year, highlighting the higher incidence in infants [2,3]. Patients usually present with a soft, tender swelling near the anus, often located at the 3 or 9 o'clock positions [4] and accompanied by local redness and purulent drainage. According to the scientific literature, PA can lead to the formation of fistulae [5]. PA and fistula often coexist in affected patients. Fistula formation is a common complication of PA; studies suggest that a wide range of patients with PA – from 35% [6] up to 85% – will develop FIA [4].

The pathogenesis of PA is not fully understood. Some studies suggest that it is caused by infection of the anal glands. When the glandular ducts become blocked, bacterial infection occurs, leading to the formation of an abscess. If the abscess is not adequately drained, or if the infection becomes chronic, a fistula may develop. Spontaneous or surgically induced abscess drainage that does not heal properly can result in epithelialization of the drainage tract, ultimately leading to fistula formation [4,7,8]. In addition, the literature points to the possibility of congenital factors influencing the formation of PA and FIA, such as abnormal Morgagni crypts [5,9].

Despite extensive research into this condition, it remains a significant clinical challenge, with risk factors for fistula development, diagnostic approaches, and treatment strategies yet to be fully defined. Treatment protocols for abscesses and fistulae vary considerably between countries and healthcare facilities, reflecting a lack of standardization. The optimal management of perianal abscesses and fistulae remains controversial in the literature. Some studies advocate conservative management as the preferred approach [2,9], while the majority of reports suggest that incision and drainage of abscesses, followed by fistulotomy in cases of confirmed fistula, provide superior outcomes such as significantly lower recurrence rates [10-14].

In our study, we analyzed a cohort of patients with PA or FIA or both, who were admitted to our center over a 5-year period (2019-2024) and treated exclusively with surgical intervention. The primary aim of this research was to determine the recurrence rates of PA and FIA and the relationship between presence of fistula during the initial surgical procedure and recurrence of PA or FIA. In addition, we aimed to assess the role of preoperative ultrasound in fistula diagnosis, examine the impact of antibiotic therapy, and investigate whether abscess size and time since symptoms onset influence the risk of fistula formation among patients without comorbidities.

Material and Methods

This retrospective cohort study included 108 patients diagnosed with PA and hospitalized in the Pediatric Surgery Clinic of the Medical University of Warsaw at the Józef Polikarp Brudziński Children's Clinical Hospital in Warsaw between 01.01.2019 and 05.02.2024. Inclusion criteria: patients diagnosed with PA who underwent incision and drainage (I&D) of the abscess during the study period. Patients with recurrence were defined as those who returned to our clinic with a PA either with or without FIA and needed surgical management.

The remaining patients without recurrence were followed up in our hospital outpatient clinic and were instructed to return to our facility in the event of concerning symptoms. Data were collected for all patients in the 0-17 group, with the exception of abscess size, which was only recorded in the 0-1 group due to significant variability in patient size and perianal anatomy due to different stages of development. This could compromise the accuracy of statistical comparisons.

Exclusion criteria included patients with all additional conditions that may have predisposed them to the formation of PA (eg Crohn's disease, leukemia) and those who received conservative treatment.

The study was conducted after the local bioethics committee approved the research.

Data collected for analysis included patient age, intraoperative detection of a fistula, ultrasound findings, abscess and fistula management techniques, recurrence of abscesses or fistulas, date of initial surgery, time to recurrence, antibiotic use, comorbidities, duration from symptom onset (based on patient history), and ultrasound abscess size (calculated as the product of the 2 longest dimensions). For analysis, patients were divided into 2 age groups: 73 infants (0-1 year) and 35 children older than 1 year. This categorization is commonly used in the literature, allowing for easier comparison with other studies [1]. These groups were analyzed to investigate risk factors for recurrence.

PA was diagnosed based on clinical presentation and, in the majority of cases, confirmed by ultrasound imaging. Once diagnosed, the standard surgical management at our center is to firstly incise and drain the abscess, then to identify the internal (anal) opening of the fistula by gently inserting a fine lacrimal probe into the fistulous tract, either through the anal opening or via the abscess cavity. Once the probe has been successfully passed through the fistulous tract, the tract is opened using diathermy dissection along the probe. Fistulotomy is performed if a fistula is confirmed. Antibiotic therapy is administered at the discretion of the treating physician based on the patient's

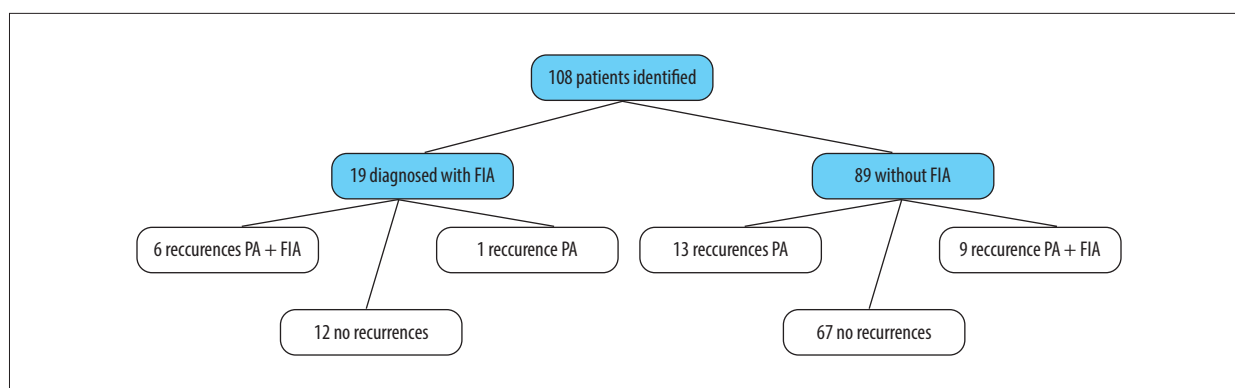


Figure 1. Summary of the intraoperative fistula identification and final outcome.

Table 1. Infants (0-1 year old) with an intraoperatively diagnosed fistula and outcomes.

	FIA+	FIA-	P
Total	17	56	
Recurrence only with PA, n (%)	1 (5.88%)	10 (17.86%)	>0.05
Recurrence with PA and FIA, n (%)	5 (29.41%)	5 (8.93%)	0.017
No recurrences, n (%)	11 (64.71%)	41 (73.21%)	>0.05

Table 2. Children (1-18 years old) with an intraoperatively diagnosed fistula and outcomes.

	FIA+	FIA-	P
Total	2	33	
Recurrence only with PA, n (%)	0 (0%)	3 (9.09%)	>0.05
Recurrence with PA and FIA, n (%)	1 (50%)	4 (12.12%)	>0.05
No recurrences, n (%)	1 (50%)	26 (78.79%)	>0.05

clinical condition and intraoperative findings. In our institution, there are currently no uniform guidelines regarding the use of antibiotic therapy in this patient population.

All statistical analyses were performed using Prism version 10 (GraphPad Software, San Diego, CA, USA). Categorical variables were assessed using Fisher's exact test due to small sample sizes and expected frequencies. The distributions of continuous variables, including abscess size and time to presentation, were evaluated for normality using the Shapiro-Wilk test and found to be non-normally distributed. Consequently, group comparisons for these variables were conducted using the non-parametric Mann-Whitney U test. A *P*-value of <0.05 was considered statistically significant for all analyses. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were followed for reporting.

During the preparation of this work, to assist with translation to ensure accuracy and consistency throughout the study, the

authors used Chat GPT and English professional help. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Results

In this study, we analyzed a cohort of 108 patients diagnosed with PA (**Figure 1**). Of these, 19 patients (17.8%) were found to have a fistula intraoperatively during their initial surgery at our center, while 89 patients (83.2%) presented with no detectable fistula. Overall, the outcomes were comparable between the 2 age groups, but the lack of statistical significance in older children may be attributed to the limited sample size in the FIA+ subgroup. All the results are summarized in the tables below (**Tables 1, 2**).

Of the 19 patients with both a PA and a fistula identified during the initial procedure, 7 patients (36.8%) had a recurrence of the

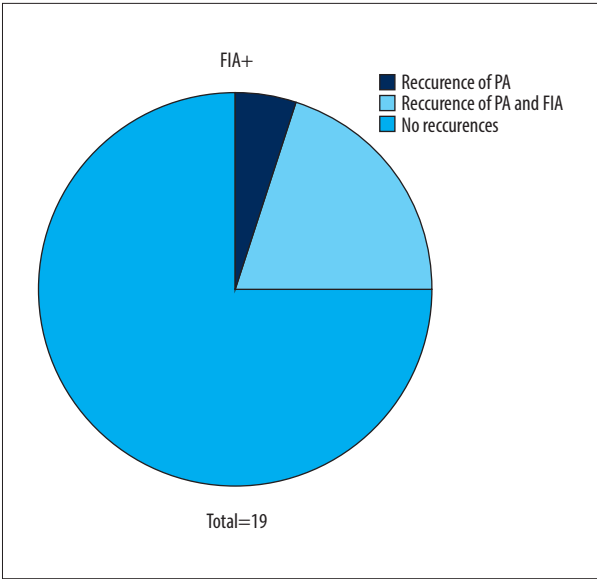


Figure 2. Clinical outcome distribution (%) among patients with intraoperatively confirmed fistula.

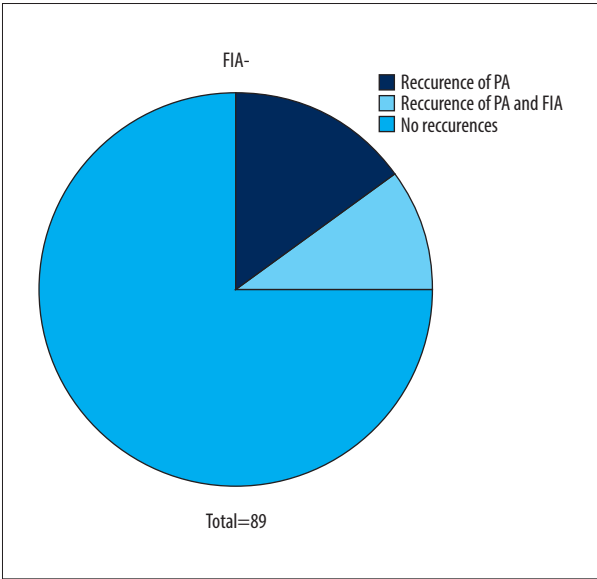


Figure 3. Clinical outcome distribution (%) among patients without intraoperatively confirmed fistula.

abscess, of which 6 (31.6%) had a recurrent fistula (**Figure 2**). In contrast, of the 89 patients in whom no fistula was identified at initial surgery, 22 patients (24.7%) had a recurrence of abscess, including 9 patients (10.1%) with a newly identified fistula (**Figure 3**). The difference in abscess recurrence between the groups was not statistically significant (RR=1.49, 95% CI 0.75-2.98; OR=1.78, 95% CI 0.62-5.07; $P>0.05$).

However, of the 19 patients with initial FIA and PA, 6 had a recurrence with FIA and PA. In comparison, out of 89 patients who were initially diagnosed without a fistula, 9 developed

Table 3. Descriptive statistics of the time interval between symptom onset and hospital presentation in infants (0-1 years old).

	FIA+	FIA-
Number of patients	17	56
Mean (days)	3.2	4.6
Median (days)	3	3
Standard deviation (days)	2.2	4.5
P	>0.05	

Table 4. Descriptive statistics of abscess size on ultrasound, calculated as the product of the 2 largest dimensions recorded by the radiologist, in infants (0-1 year old).

	FIA+	FIA-
Number of patients	17	56
Mean (mm ²)	125.2	142.1
Median (mm ²)	120	108
Standard deviation (mm ²)	80.9	133.9
P	>0.05	

one after a recurrence. This finding was statistically significant (RR=3.12, 95% CI 1.26-7.73; OR=4.10, 95% CI 1.25-13.45; $P=0.024$).

Out of all 108 patients after I&D, 29 patients had a recurrence of PA (26.9%). Moreover, 13 patients (44.8%) had a recurrence of PA in less than 30 days, including 6 cases (20.7%) of FIA. The remaining 16 PA recurrences (55.2%) were documented after more than 30 days, of which 9 were diagnosed with FIA (31%).

Preoperative ultrasound was performed in 99 patients. An abscess was visualized in all cases, showcasing 100% accuracy. In 9 patients in whom the radiologist identified a fistula on ultrasound, only 4 cases were confirmed intraoperatively. Conversely, in 23 patients in whom the radiologist excluded a fistula, 3 fistulas were identified intraoperatively. In 67 cases, the radiologists did not provide a definitive answer regarding the presence of a fistula; 11 of these cases were later confirmed intraoperatively.

Of the 108 patients, 72 (67.3%) were treated with antibiotics (the most commonly used antibiotics were amoxicillin, cefuroxime, cefazolin, and clindamycin). Of these, 20 patients had a recurrent abscess (12 with FIA). In comparison, of the 36 patients who did not receive antibiotics, 9 developed a recurrence (3 with FIA). These results did not show a difference that was statistically significant (RR=1.11, 95% CI 0.56-2.19; OR=1.15, 95% CI 0.46-2.88; $P>0.05$).

Within the 0- to 1-year age group, we examined the relationship between abscess size as measured by ultrasound and the risk of recurrence. No significant association was found ($P>0.05$). We also examined whether the time interval from symptom onset, as reported by parents, influenced the risk of fistula formation. The most common symptoms presented by patients were perianal pain, perianal swelling and erythema, localized tenderness on digital rectal examination, fever, malaise, and irritability. These factors also showed no significant association between the groups ($P>0.05$). Selected statistical data are presented in **Tables 3 and 4**.

A post hoc power analysis was conducted based on the total sample size ($n=108$), including 15 patients who developed a recurrent fistula. For the comparison of fistula recurrence between patients with and without an initially identified fistula (31.6% vs 10.1%), the estimated statistical power was approximately 75%, assuming a significance level of 0.05 and a 2-sided test. This indicates that the study was sufficiently powered to detect a moderate-to-large difference in this primary outcome.

Discussion

Out of 19 patients with PA and FIA, 7 recurrences of PA were recorded in our study (36.8%), which is consistent with results from other studies, which show a recurrence range of between 8% and 50% [12,13]. It is possible that patients with FIA may have a higher risk of recurrence compared with those without a diagnosed fistula. This hypothesis is supported by the elevated RR and OR (1.49 and 1.78) observed in our study; however, these findings did not reach statistical significance.

The overall percentage of recurrent PAs in our study (26.9%) is consistent with the literature, where the recurrence rate ranges from 0-30% [1,12,15]. The rate of fistula recurrence in our cohort of patients in whom no fistula was found intraoperatively (despite thorough exploration) is also consistent with previously published studies. The percentage of patients initially without FIA but diagnosed with FIA at the time of PA recurrence (10.1%) is significantly lower compared with other data reported in the literature, which range from 30 to 60% [10,16]. However, in our study, the recurrence rate of FIA in patients with a previously identified fistula was high (31.6%), but within the range of data reported in the literature, which mentions the rates from a low of 2.7% up to as high as 68% [1,4,12,13,16]. In our cohort, the P -value ($P=0.0024$) for this finding indicates that it is statistically significant.

It remains difficult to determine the underlying cause of these discrepancies. One possible explanation is the risk of overdiagnosis of fistulas due to overly aggressive intraoperative

exploration [17]. However, this scenario seems unlikely as it would probably also affect the group in whom no fistula was found. Some studies suggest that fistula probing may aid in complete resolution of the condition [18].

Another possible explanation for these findings may be the overdiagnosis of fistula recurrence. In our study, 40% of recurrences were diagnosed within less than 30 days. This raises the possibility that these cases may not represent true recurrences, but rather incomplete healing of the primary fistula. Unfortunately, we were unable to identify comparable statistics in other published studies; therefore, we cannot refer to existing literature to support this observation. As such, it remains a hypothesis that requires further validation in future research.

An alternative hypothesis involves anatomical predisposition, whereby abnormalities in Morgagni crypts render certain patients more susceptible to fistula formation, particularly those who already had a fistula present prior to surgery [4,5,9].

Our findings have prompted us to reconsider this approach and to propose alternative therapeutic strategies for the management of PA and FIA. Beyond traditional I&D or fistulotomy, other treatments for PA and FIA include seton placement to allow drainage while protecting the sphincter, as well as fibrin glue and fistula plugs, which aim to close the tract but show variable success. Sphincter-sparing techniques like video-assisted anal fistula treatment (VAAFT) and ligation of the intersphincteric fistula tract (LIFT) have reported healing rates around 70-85% in adults [19]. Data on these approaches in children are limited; however, some of the latest studies show 90% therapeutic success including lack of recurrence. Those promising results highlight the need for further studies in the pediatric population.

Similarly, the role of antibiotics in the treatment of PA remains controversial. Some reports suggest that antibiotics are beneficial and even superior to surgery in certain cases [3,10]. Other studies associate the use of antibiotics with lower FIA rates, but do not show a significant effect on PA recurrence [1]. However, several authors disagree, arguing that antibiotics do not significantly influence non-operative outcomes [20] or that their use during PA treatment does not reduce the risk of FIA development [4]. Our findings are consistent with the latter perspective, suggesting that antibiotic use does not significantly affect the recurrence rate of PA or reduce the risk of fistula formation ($P=0.82$). The higher percentage of recurrent abscesses observed in medicated patients may be due to selection bias. Given that antibiotic administration was based on the individual physician's discretion, no definitive conclusions can be drawn from these findings. Addressing this question will require multicenter, randomized controlled trials specifically designed to evaluate the role of antibiotic therapy in this patient population.

In our clinic, despite the norm of the use of ultrasound, its effectiveness in detecting perianal fistulas was limited. This may be due to operator variability, postoperative changes, inflammation obscuring visualization, or the complex anatomy of the perianal tissues. In addition, small or early-stage fistulas may not be adequately visualized. Another contributing factor is that in our clinic, ultrasound examinations are performed on an on-call basis, and each examination is carried out by a different radiologist, many of whom do not specialize in perianal ultrasonography. This may result in incomplete or inaccurate identification of PA. There are studies suggesting that transcutaneous perianal ultrasound may be an important diagnostic tool [21], but results may vary between institutions due to radiologist experience or differences in diagnostic protocols and approaches. In contrast, the detection of PA via ultrasound in our center proved highly reliable, with a 100% detection rate in the patients examined. This confirms the utility of ultrasound as a primary diagnostic tool for PA identification in the pediatric population [22].

Our study is limited primarily by its retrospective design, which introduces potential selection bias and reliance on the accuracy of medical records. The lack of fully standardized follow-up may have reduced the ability to detect late recurrences or subtle associations, and these factors should be considered when interpreting the findings. Nevertheless, this is, to our knowledge, one of the few studies to specifically address the management and outcomes of PA and FIA in the pediatric

population, providing clinically relevant data that may inform future prospective research and contribute to the development of standardized treatment protocols.

Conclusions

This study highlights the complexity of PA and FIA in the pediatric population. Detecting a fistula during the initial procedure was strongly associated with a higher risk of recurrence, underscoring the need for meticulous intraoperative assessment and long-term follow-up. Preoperative ultrasound was highly accurate for identifying PA but less reliable for detecting fistulas, indicating a need for more standardized imaging protocols. Antibiotic therapy, abscess size, and symptom duration were not significantly associated with recurrence or fistula formation.

Ultimately, based on our results and literature search, resolving some of these uncertainties will require larger-scale, preferably randomized, studies, also involving promising methods like VAAFT and LIFT in specific groups of patients.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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