

Clinical Presentation and Inflammatory Markers in Acute Versus Chronic Sacrococcygeal Pilonidal Disease: A 15-Year Single-Center Experience with 246 Cases

Michael Ardelt

`michael.ardelt@med.uni-jena.de`

University Hospital Jena

Falk Rauchfuss

University Hospital Jena

Oliver Rohland

University Hospital Jena

Laura Schwenk

University Hospital Jena

Aladdin Ali Deeb

University Hospital Jena

Astrid Bauschke

University Hospital Jena

Utz Settmacher

University Hospital Jena

Research Article

Keywords: pilonidal disease, C-reactive protein, leukocyte count, abscess, recurrence, retrospective study

Posted Date: August 11th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10603612/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Purpose

To compare clinical presentation and routinely available preoperative inflammatory markers between acute and chronic sacrococcygeal pilonidal disease (PD) in a large, single-center surgical cohort.

Methods

This retrospective, case-based study included adults treated surgically for PD at a single tertiary center. Demographic characteristics, primary versus recurrent disease, clinical symptoms, white blood cell (WBC) count, and C-reactive protein (CRP) level were extracted from hospital records. Cases with missing WBC or CRP values were excluded. Acute and chronic episodes were compared using the Mann-Whitney U test or Fisher exact test, as appropriate.

Results

Of 256 eligible treatment episodes in 217 patients, 10 episodes were excluded because of missing laboratory values, leaving 246 episodes for the principal analysis. Of these, 203 were classified as acute and 43 as chronic disease. Acute episodes had higher median WBC counts than chronic episodes ($10.2 [7.8-12.4]$ vs $7.1 [6.2-8.2] \times 10^9/L$; $p < 0.001$) and higher median CRP levels ($15.4 [4.3-32.2]$ vs $3.0 [2.0-6.1]$ mg/L; $p < 0.001$). Pain was documented in all acute episodes and in none of the chronic episodes, whereas secretion was more frequent in chronic disease (90.7% vs 30.0%; $p < 0.001$). Among acute episodes, recurrent disease was associated with lower WBC counts and CRP levels than primary disease.

Conclusion

Acute PD was associated with higher preoperative CRP levels and WBC counts than chronic PD. These markers can support clinical classification but should not be used as stand-alone criteria for treatment timing, because normal values do not exclude clinically significant acute disease. Local examination and symptom severity, particularly pain, remain central to decision-making.

Introduction

Sacrococcygeal pilonidal disease (PD) is an acquired inflammatory disorder of the natal cleft that predominantly affects adolescents and young adults, with a clear male predominance (1–3). The condition is thought to result from penetration of loose hair into vulnerable skin or dilated follicles, followed by a foreign-body reaction, secondary infection, and formation of pits, sinus tracts, or abscesses (4–7). Clinical presentation ranges from asymptomatic pits to chronic discharge and recurrent pain, or an acutely painful abscess requiring urgent treatment.

The distinction between acute abscess-forming and chronic fistulizing disease is clinically important. Current European and German guidelines recommend drainage for an acute abscess, whereas treatment of chronic disease is generally elective and should be individualized according to symptoms, disease complexity, prior procedures, and patient preference (8–10). However, classification systems remain heterogeneous, and clinical pathways vary substantially between institutions (8, 11–13).

White blood cell (WBC) count and C-reactive protein (CRP) are inexpensive and widely available markers of systemic inflammation. Although both are routinely used in the assessment of soft-tissue infection and abscesses (14–17), their distribution across acute and chronic PD has not been well characterized. Contemporary studies of PD have primarily addressed operative technique, wound healing, recurrence, and patient-reported outcomes rather than the diagnostic contribution of preoperative laboratory markers (11, 12).

The primary objective of this study was therefore to compare preoperative WBC count and CRP level between acute and chronic PD. Secondary objectives were to describe the associated symptom profile and to explore differences between primary and recurrent disease.

Methods

Study design and setting:

This retrospective, single-center observational study was conducted at the Department of General, Visceral and Vascular Surgery, University Hospital Jena, Germany. Adult treatment episodes recorded between 2005 and 2020 were identified from the institutional hospital information system. The manuscript was prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations (18).

Participants and data source:

The hospital database was searched for International Classification of Diseases, 10th Revision, German Modification (ICD-10-GM) codes L05.0-L05.9. Eligible episodes involved patients aged more than 18 years who underwent surgical treatment for sacrococcygeal pilonidal disease. Demographic variables, including age, sex, smoking status, and body mass index (BMI), were recorded together with recurrence status, acute or chronic presentation, preoperative WBC count, CRP level, and documented symptoms.

Variables and definitions:

The unit of analysis was the treatment episode. Age at surgery, sex, body mass index (BMI), primary or recurrent presentation, acute or chronic presentation, operative approach, and documented symptoms were extracted from the medical record. Symptoms included pain, swelling, secretion, fever, and chills. Acute versus chronic and primary versus recurrent status were based on the diagnosis documented by the treating surgical team.

WBC counts below $4.4 \times 10^9/L$ were categorized as leukopenia and values above $11.3 \times 10^9/L$ as leukocytosis. CRP values above 5 mg/L were considered elevated. Continuous data are presented as medians with interquartile ranges (IQRs), and categorical data as counts and percentages.

Outcomes:

The primary outcome was the difference in preoperative WBC count and CRP level between acute and chronic PD. Secondary outcomes were the frequency of clinical symptoms in acute disease and exploratory differences in inflammatory markers between primary and recurrent episodes.

Statistical analysis:

Analyses were performed using SPSS version 17 (SPSS Inc., Chicago, IL, USA). Continuous variables were compared using the Mann-Whitney U test and categorical variables using Fisher exact test. A two-sided p value < 0.05 was considered statistically significant. No imputation was performed for missing laboratory values. Because some patients contributed more than one treatment episode, all analyses were episode-based.

Ethics:

The study was conducted in accordance with the Declaration of Helsinki and was approved by the responsible ethics committee (approval number 4653-01/16).

Results

Study population:

A total of 256 treatment episodes in 217 adult patients were identified. Ten episodes involving nine patients were excluded because WBC and/or CRP data were missing, leaving 246 episodes for the principal laboratory and clinical analyses. Among these, 168 episodes were primary and 78 were recurrent; 203 were classified as acute and 43 as chronic disease. The separately supplied demographic table contains 247 cases and different recurrence totals; these figures require verification before submission (Table 1).

Table 1
Demographic data

Age (years)	All cases <i>N</i> = 247	Patients without recurrence <i>N</i> = 179	Patients with recurrence <i>N</i> = 68	p-value, comparing patients with and without recurrence
	25 [21; 31]	25 [21; 30]	27 [21,3; 35]	.018
Female sex	41 (16,6%)	33 (18,4%)	8 (11,8%)	.209
Smoker	98 (39,7%)	74 (41,3%)	24 (35,3%)	.665
BMI	26,2 [23,6; 29,3]	26,2 [23,6; 29,2]	26,2 [23,7; 29,4]	.284
Descriptive statistics as median [interquartile range] or N (%). P values obtained by Mann-Whitney U test or Fisher's exact test as appropriate.				

Inflammatory markers in acute versus chronic disease:

Preoperative inflammatory markers were significantly higher in acute than chronic pilonidal disease. Median WBC count was $10.2 \times 10^9/L$ (IQR 7.8–12.4) in acute episodes and $7.1 \times 10^9/L$ (IQR 6.2–8.2) in chronic episodes ($p < 0.001$). Median CRP level was 15.4 mg/L (IQR 4.3–32.2) and 3.0 mg/L (IQR 2.0–6.1), respectively ($p < 0.001$). Abnormal WBC counts were recorded in 33.5% of acute and 2.3% of chronic episodes, and elevated CRP levels in 71.9% and 27.9%, respectively (all $p < 0.001$; Table 3).

Table 3
Difference between acute PSD and chronic PSD

WBC	All cases N = 246	Patients with aPSD N = 203	Patients with cPSD N = 43	p-value, comparing patients with and without recurrence
	9.2{7.3;11.9}	10.2 [7.8;12.4]	7.1{6.2;8.2}	< .001
CrP	11.0 [3.0;29.2]	15.4 [4.3;32.2]	3.0 [2.0;6.1]	< .001
Number of pathol. WBC	69 (28.0)	68 (33.5)	1 (2.3)	< .001
Number of pathol. CrP	158 (64.2)	146 (71.9)	12 (27.9)	< .001
Number of pathol. WBC + CrP	68 (27.6)	67 (33.0)	1 (2.3)	< .001
Swelling	179 (72.8)	152 (74,9)	27 (62,8)	.131
Secretion	100 (40.7)	61 (30,0)	39 (90,7)	< .001
Pain	203 (82.5)	203 (100)	0 (0)	< .001
Fever	9 (3.7)	9 (4, 4)	0 (0)	.366
Descriptive statistics as median [interquartile range] or N (%). P-values obtained by Mann-Whitney U test or Fisher's exact test as appropriate.				

In the overall cohort, abnormal WBC counts were present in 69 episodes (28.0%), elevated CRP levels in 158 (64.2%), and both abnormalities in 68 (27.6%). Primary disease was associated with higher WBC counts and CRP levels than recurrent disease (10.3 vs 8.1 x 10⁹/L and 14.6 vs 5.0 mg/L, respectively; both p < 0.001). Pain was more frequent in primary disease, whereas secretion was more frequent in recurrent disease (Table 2).

Table 2
Difference between primary and recurrent PSD

WBC	All cases <i>N</i> = 246	Patients without recurrence <i>N</i> = 168	Patients with recurrence <i>N</i> = 78	p-value comparing patients with and without recurrence
	9.2{7.3;11.9]	10,3 [7,7; 12,5]	8,1 [6,4; 9,7]	< .001
CrP	11.0 [3.0;29.2]	14,6 [4,7; 32,3]	5,0 [2,0; 19,1]	< .001
Number of pathol. WBC	69 (28.0)	61 (36.3)	8 (10.3)	< .001
Number of pathol. CrP	158 (64.2)	119 (70.8)	39 (50.0)	.003
Number of pathol. WBC + CrP	68 (27.6)	60 (35.7)	8 (10.3)	< .001
Swelling	179 (72.8)	123 (73,2)	56 (71,8)	.878
Secretion	100 (40.7)	56 (33,3)	44 (56,4)	< .001
Pain	203 (82.5)	149 (88,7)	54 (69,2)	< .001
Fever	9 (3.7)	8 (4, 8)	1 (1, 3)	.279
Descriptive statistics as median [interquartile range] or N (%).P values obtained by Mann-Whitney-U test or Fisher's exact test as appropriate.				

Acute versus chronic disease:

Clinical presentation differed markedly between acute and chronic disease. Pain was documented in all 203 acute episodes and in none of the 43 chronic episodes ($p < 0.001$). Swelling occurred in 74.9% and 62.8%, respectively ($p = 0.131$). Secretion was substantially more frequent in chronic than acute disease (90.7% vs 30.0%; $p < 0.001$), while fever was uncommon and did not differ significantly (4.4% vs 0%; $p = 0.366$). Chills were documented in one acute episode (Table 3).

Subgroup analyses by recurrence status:

Within acute disease, recurrent episodes had lower median WBC counts than primary episodes (8.9 vs $10.7 \times 10^9/L$; $p < 0.001$) and lower median CRP levels (7.7 vs 16.6 mg/L; $p = 0.012$). Abnormal WBC counts and simultaneous WBC/CRP abnormalities were also less frequent in recurrent acute disease, whereas the proportion with elevated CRP alone did not differ significantly (Table 4). In chronic disease, no statistically significant differences between primary and recurrent episodes were observed for inflammatory markers or recorded symptoms (Table 5).

Table 4
Difference between primary and recurrent aPSD

WBC	All cases N = 203	Patients without recurrence N = 149	Patients with recurrence N = 54	p-value comparing patients with and without recurrence
	10.2 [7.8;12.4]	10.7 [8.2;12.8]	8.9 [7.0;10.4]	< .001
CrP	15.4 [4.3;32.2]	16.6 [5.1; 32.6]	7.7 [2.0;29.2]	.012
Number pathol. WBC	68 (33.5)	60 (40.3)	8 (14.8)	< .001
Number pathlog. CrP	146 (71.9)	112 (75.2)	34 (63.0)	.111
Number pathol. WBC + CrP	67 (33.0)	59 (39.6)	8 (14.8)	< .001
Swelling	152 (74,9)	114 (76.5)	38 (70.4)	.367
Secretion	61 (30,0)	39 (26.2)	22 (40.7)	.057
Pain	203 (100)	149 (100)	54 (100)	-
Fever	9 (4, 4)	8 (5.4)	1 (1.9)	.450
Descriptive statistics as median [interquartile range] or N (%).P values obtained by Mann-Whitney-U test or Fisher's exact test as appropriate.				

Table 5
Difference between primary and recurrent cPSD

WBC	All cases N = 43	Patients without recurrence N = 19	Patients with recurrence N = 24	p-value comparing patients with and without recurrence
	7.1{6.2;8.2}	7.6 [6.2;8.7]	6.6 [6.1;8.1]	.455
CrP	3.0 [2.0;6.1]	5.0 [2.0;8.7]	2.8 [2.0;4.4]	.331
Number pathol. WBC	1 (2.3)	1 (5.3)	0 (0)	.442
Number patholog. CrP	12 (27.9)	7 (36.8)	5 (20.8)	.314
Number pathol. WBC + CrP	1 (2.3)	1 (5.3)	0 (0)	.442
Swelling	27 (62.8)	9 (47.4)	18 (75.0)	.111
Secretion	39 (90.7)	17 (89.5)	22 (91.7)	1.000
Pain	0 (0)	0 (0)	0 (0)	-
Fever	0 (0)	0 (0)	0 (0)	-
Descriptive statistics as median [interquartile range] or N (%). P-values obtained by Mann-Whitnes U test or Fisher's exact test, as appropriate.				

Discussion

In this single-center cohort of 246 evaluable surgical episodes, acute pilonidal disease was associated with substantially higher preoperative WBC counts and CRP levels than chronic disease. The distinction was also clinically pronounced: pain characterized every acute episode, whereas secretion predominated in chronic disease. These findings support the use of routinely available inflammatory markers as adjuncts to clinical classification, while confirming that symptom pattern remains central.

The observed biomarker pattern is biologically plausible. Acute PD commonly presents as an abscess with tissue inflammation, bacterial contamination, and a variable systemic acute-phase response. Chronic PD, by contrast, may remain localized to sinus tracts and granulation tissue, producing recurrent drainage or discomfort without a marked systemic response. CRP generally rises rapidly in response to inflammatory cytokines and may provide a broader reflection of acute-phase activation than WBC count (16, 17). In the present cohort, 67% of episodes had elevated CRP, whereas only 68 of 246 episodes had leukocytosis. This numerical difference suggests that CRP may be the more frequently abnormal marker, although the study was not designed to compare diagnostic accuracy and did not include receiver-operating-characteristic analysis.

The results should be interpreted as an adjunct to, rather than a replacement for, clinical assessment. Contemporary guidelines define acute abscess and chronic sinus disease primarily by history and examination and recommend incision and drainage for acute abscesses (9, 10). Normal WBC or CRP values therefore should not delay treatment when pain, swelling, fluctuance, or other local findings indicate an abscess. Conversely, an isolated laboratory elevation is nonspecific and does not establish the diagnosis or mandate emergency surgery. The clinically useful role of these markers is to support classification, identify unexpected systemic inflammation, and provide a baseline when the clinical picture is equivocal.

The high proportion of acute episodes in our cohort differs from a recent Dutch nationwide audit that included 208 acute abscesses and 405 chronic cases (11). Referral pathways probably explain part of this difference: chronic PD is often managed in outpatient surgical practice, whereas tertiary centers more frequently receive painful abscesses and complicated or recurrent disease. The broad variation in treatment pathways documented in contemporary multicenter cohorts also highlights the influence of local organization and case selection (11, 12).

The recurrence-stratified analyses add nuance to the principal findings. Primary disease was associated with higher WBC counts and CRP levels than recurrent disease in the overall cohort, and the same pattern was present within acute disease. In contrast, no significant recurrence-related differences were detected among chronic episodes. Recurrent acute disease may be recognized and treated earlier, or may present with altered local anatomy and a less pronounced systemic inflammatory response after previous procedures. These interpretations remain hypotheses because timing of symptom onset, prior operations, antibiotic exposure, and abscess size were not available for adjustment.

This study has several strengths. It includes a comparatively large number of treatment episodes from routine clinical practice and evaluates inexpensive laboratory tests that are universally available. The analysis also integrates laboratory findings with the symptom profile, which is directly relevant to surgical triage.

Several limitations must be acknowledged. First, the retrospective design is vulnerable to incomplete or inconsistent documentation, particularly for symptoms and the classification of acute versus chronic disease. Second, the analysis was episode-based and included repeated treatment episodes in some patients; the statistical tests did not account for within-patient clustering. Third, no multivariable adjustment was performed for potential confounders such as age, sex, BMI, smoking, prior antibiotic treatment, abscess size, or symptom duration. Fourth, the exact timing of blood sampling relative to surgery was not standardized. In addition, the study period ended in 2020, and subsequent changes in referral or treatment pathways may limit direct applicability to current practice. Fifth, the supplied demographic table and the principal analytical tables contain discordant total and recurrence counts, which must be reconciled against the source dataset before submission. Finally, because the study was conducted at a tertiary surgical center, the high proportion of acute disease may not reflect outpatient or community practice.

Conclusion

Preoperative CRP levels and WBC counts were higher in acute than chronic sacrococcygeal pilonidal disease. Pain was strongly associated with acute presentation, whereas secretion was characteristic of chronic disease. Within acute disease, recurrent episodes showed a less pronounced inflammatory response than primary episodes. Laboratory markers may support clinical classification and urgency assessment, but they should not be used as stand-alone criteria to exclude an abscess or determine operative timing.

Declarations

Funding: The authors received no funding for this study.

Competing interests: The authors declare no competing interests.

Ethics approval: The study was performed in accordance with the Declaration of Helsinki and was approved by the responsible ethics committee (approval number 4653-01/16).

Consent to participate: requirement for consent waived by the ethics committee owing to the retrospective design.

Consent for publication: Not applicable; no identifiable individual data are presented.

Data availability: The data supporting the findings of this study are not publicly available because they contain sensitive clinical information. De-identified data may be available from the corresponding author upon reasonable request and subject to institutional and ethical requirements.

Clinical trial registration: Not applicable.

Reporting guideline: The manuscript was prepared in accordance with the STROBE recommendations for observational studies.

Author contributions: All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Michael Ardelt, Falk Rauchfuss, Oliver Rohland, Laura Schwenk, Aladdin Ali Deeb, Astrid Bauschke, and Utz Settmacher. The first draft was written by Michael Ardelt. All listed authors reviewed and approved the final manuscript.

Acknowledgements: None.

References

1. Søndena K, Andersen E, Nesvik I, Søreide J (1995) Patient characteristics and symptoms in chronic pilonidal sinus disease. *Int J Colorectal Dis* 10(1):39–42

2. Ardel M, Dennler U, Fahrner R, Hallof G, Tautenhahn H-M, Dondorf F et al (2017) Die Pubertät ist ein wichtiger Faktor bei der Pilonidalsinuserkrankung. *Chirurg* 88(11):961–967
3. Center AFHS (2013) Pilonidal cysts, active component, US Armed Forces, 2000–2012. *MSMR* 20(12):8–11
4. Hodges R (1946) *Boston med. surg. J.*, 103. 485. Patey, DH. and Scarfl. RW *Lancet*. 1880;2:484
5. Mayo H (1834) Observations on injuries and diseases of the rectum. *Am J Med Sci* 28:435
6. Doll D, Bosche FD, Stauffer VK, Sinicina I, Hoffmann S, van der Zypen D et al (2017) Strength of occipital hair as an explanation for pilonidal sinus disease caused by intruding hair. *Dis colon rectum* 60(9):979–986
7. Von Laffert M, Stadie V, Ulrich J, Marsch WC, Wohlrab J (2012) Morphology of pilonidal sinus disease: some evidence of its being a unilocalized type of hidradenitis suppurativa. *Dermatology* 223(4):349–355
8. Beal E, Lee M, Hind D, Wysocki A, Yang F, Brown S (2019) A systematic review of classification systems for pilonidal sinus. *Tech Coloproctol* 23(5):435–443
9. Iesalnieks I, Ommer A, Herold A, Doll D (2021) German National Guideline on the management of pilonidal disease: update 2020. *Langenbeck's Archives Surg* 406(8):2569–2580
10. Ojo D, Gallo G, Kleijnen J, Haas S, Danys D, Dardanov D et al (2024) European Society of Coloproctology guidelines for the management of pilonidal disease. *Br J Surg* 111(10):znae237
11. Huurman EA, den Otter AS, de Raaff CA, van den Berg R, Baart SJ, Wijnhoven BP et al (2025) Acute pilonidal abscess: Prospective nationwide audit in the Netherlands. *Colorectal Dis* 27(1):e17254
12. Brown SR, Hind D, Strong E, Bradburn M, Din F, Lee E et al (2024) Real-world practice and outcomes in pilonidal surgery: Pilonidal Sinus Treatment Studying The Options (PITSTOP) cohort. *Br J Surg* 111(3):znae009
13. Brown S, Lund J (2019) The evidence base for pilonidal sinus surgery is the pits. *Tech Coloproctol* 23(12):1173–1175
14. Cheng C, Lai JM, Mori K (2020) The role of wound swab microbial cultures and antibiotic sensitivity results in the management of sacrococcygeal pilonidal abscess. *J Acute Care Surg* 10(1):5–9
15. Ardel M, Dittmar Y, Kocijan R, Rödel J, Schulz B, Scheuerlein H et al (2016) Microbiology of the infected recurrent sacrococcygeal pilonidal sinus. *Int Wound J* 13(2):231–237
16. Chan Y-L, Liao H-C, Tsay P-K, Chang S-S, Chen J-C, Liaw S-J (2002) C-reactive protein as an indicator of bacterial infection of adult patients in the emergency department. *Chang Gung Med J* 25(7):437–445
17. Gauger EM, Mitchell PM, Halverson SJ, O'Neill DE, Reasoner K, Desai MJ et al (2021) Acute-phase reactants in operatively treated upper extremity infections: a retrospective review. *Hand* 16(4):546–550
18. Vandembroucke JP, Von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ et al (2007) Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and

