Characterizing Bacterial Colonization in Pilonidal Sinus Abscesses: Insights from 159 Clinical Evaluations

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ABSTRACT

Objective: This study aimed to evaluate the gender predisposition, risk factors, clinical outcomes, and microbiological profile of patients with pilonidal sinus disease (PSD) and to compare these findings with existing literature.

Materials and Methods: A prospective analysis was conducted on 159 patients diagnosed with PSD at Haydarpasa Numune Hospital between 2022 and 2023. Demographic data, BMI, smoking status, presence of diabetes, and treatment outcomes were collected. Pathogens isolated from abscesses and antibiotic treatments were analyzed, and recurrence rates were documented post-treatment.

Results: The study cohort had a mean age of 26.0±9.8 years, predominantly male (71.1%). Significant differences in mean age and body mass index were observed between females (n=46) and males (n=113), with females averaging 21.6 years and males 27.8 years (p<0.001), and BMI values of 22.06 and 24.33, respectively (p=0.003). Anaerobic bacteria were slightly more prevalent in abscess cultures (50.9%), and the most commonly used antibiotic regimen was ciprofloxacin with metronidazole (54.7%).

Conclusion: This study confirms a male gender predisposition to PSD and highlights significant age and BMI differences between genders. Specific antibiotic therapies may contribute to reducing relapse rates. These findings underscore the importance of targeted therapeutic strategies, particularly considering the higher recurrence rates in females and the predominant antibiotic resistance patterns.

Keywords: Pilonidal Sinus Disease, Risk Factors, Gender Differences, Microbial Flora, Antibiotic Treatment, Recurrence Rates.

INTRODUCTION

Pilonidal sinus disease (PSD), characterized by its onset in the sacrococcygeal region, is a chronic inflammatory condition primarily affecting the subcutaneous tissues atop the intergluteal fold (1). PSD presents in two primary forms: an acute presentation often accompanied by a suppurative abscess, and a chronic form characterized by intermittent painful drainage via one or more sinus tracts. This ailment predominantly affects the male population, particularly during puberty and young adulthood, signifying a notable gender inclination (2).

Globally, the incidence of PSD is on an upward trajectory, currently estimated to be 26 cases per 100,000 individuals (3). Historically, the sacrococcygeal region has been a focal point for various medical anomalies, with PSD emerging as a predominant concern over the past few decades (4). Various etiological factors have been identified, including young age, male predisposition, obesity, Mediterranean lineage, pronounced natal cleft, significant hair growth, and inadequate hygiene practices. A notable correlation between increasing body mass index (BMI) and PSD susceptibility (5-6) has been observed.
The complexity surrounding the precise etiology of PSD has been the subject of numerous studies. The initial onset can be multifaceted, presenting as draining sinus or acute abscess formation. Following the management of an acute episode, a range of treatment options exists, each with its advantages and disadvantages (7). The primary therapeutic strategy for symptomatic PSD is surgical intervention, particularly excision. However, non-excisional techniques, though less popular due to their high recurrence rates, are also employed in some instances. These interventions often require extended postoperative care, highlighting the socioeconomic implications of the disease in terms of prolonged hospital stays, subsequent medical evaluations, and potential work incapacitation (8).

In light of these factors, this study aims to enhance our understanding of PSD by focusing on patients diagnosed with the condition at Haydarpasa Numune Hospital. We aim to elucidate the gender predisposition, risk factors, clinical outcomes, and microbiological profile of PSD and to compare our findings with existing literature, thereby fostering a more comprehensive understanding of the disease.

**MATERIAL and METHODS**

The principal aim of this investigation was to discern the risk determinants of pilonidal sinus disease, particularly focusing on factors such as the pathogens associated with the abscess, antibiotic administration patterns, and subsequent recurrence rates.

**Study Design**

This study was a prospective analysis of patients who presented to the General Surgery Clinic of Haydarpasa Numune Research and Training Hospital between January 2022 and January 2023.

**Patient Selection and Data Collection**

Patients were selected based on a primary diagnosis of pilonidal sinus disease as defined by the International Classification of Diseases (ICD) version 10 codes L05.0 (representing pilonidal cyst and sinus with abscess) and L05.9 (denoting pilonidal cyst and sinus without abscess).

For the duration of the study period, we also examined data from patients who had undergone surgical intervention for pilonidal sinus, irrespective of whether reconstructive procedures such as primary closure, Karydakis flap, or Limberg repair were implemented.

Data were systematically retrieved from the hospital's electronic health record system. To ensure consistency and quality of our dataset, patients who had incomplete records, those who had multiple admissions related to the disease, or individuals who underwent several surgeries for the same condition were excluded from our study.

The analysis primarily focused on the following parameters: age, sex, Body Mass Index (BMI), tobacco use, presence of diabetes, history of pilonidal sinus abscess, identified pathogens, administered antibiotics, and recurrence history.

**Data Analyses**

Data were analyzed using IBM SPSS Statistics software (version 25, specifically for Mac systems; IBM Corp., Armonk, NY, USA). The results are presented as the mean and standard deviation for continuous variables. Categorical variables, on the other hand, are represented using frequencies. To assess the differences between categorical datasets, we employed the chi-square test. The threshold for statistical significance was established at a 95% confidence interval, with a p-value of less than 0.05 indicative significance.

**RESULTS**

The present study evaluated patients diagnosed and treated for PSD consisting of 159 cases with an average age of 26.0±9.8 years and males 113 (71.1 5) cases.

The females had an average age of 21.6 years with a median of 20.0 years, and the range extended from 15 to 40 years. In contrast, males presented with a higher average age of 27.8 years, a median of 25 years, and a broader range spanning from 14 to 60 years.

Regarding Body Mass Index (BMI), females had an average BMI of 22.06 with a median of 22, ranging between 18.2 and 26.4. Males, on the other hand, exhibited a higher average BMI of 24.33, with a median value of 23, and the values ranged between 18.6 30.2.

The prevalence of smoking was noticeably higher in males (64.6%) than in women (28.3%). Diabetes Mellitus (DM) was relatively uncommon in both sexes, although it was slightly more prevalent in males (8.8%) than females (2.2%).

Abscess was reported in 26.1% of females and 15.9% of males. A notably high percentage of participants, both females (84.8%) and males (95.6%), underwent PSD. Lastly, relapse was documented in 21.7% of females and 12.4% of males.

In our cohort of participants, demographic and clinical characteristics were analyzed separately for females and males; the findings are detailed in Table 1.

In the assessment of pathogens cultured from abscesses based on aerobic and anaerobic growth characteristics, aerobes were found in 49.1% (n=78) of the samples, whereas anaerobes were slightly more prevalent, accounting for 50.9% (n=81) of the samples. When classifying these pathogens based on Gram staining, 48.4% (n=77) were gram-negative and 51.6% (n=82) were gram-positive.

Regarding the choice of antibiotic in the treatment of Pilonidal Sinus Disease (PSD), the combination of amomoklovin with klavunat acid was administered in 32.1% (n=51) of cases. The combination of ciprofloxacin and metronidazole was the preferred choice in 54.7% (n=87) of cases, while cefuroxime alone was used in 13.2% (n=21) of cases.
Lastly, the analysis of post-treatment relapse rates indicated that 84.9% (n=135) of the patients did not experience any recurrence, while 15.1% (n=24) experienced relapse.

In this study, pathogens proliferating at the lesion sites of all patients monitored for PSD were investigated. Table 3 provides a detailed account of the numbers and frequencies of all identified pathogens.

For age, a statistically significant difference was observed between male and female patients, with a p-value of <0.001. Similarly, Body Mass Index (BMI) showed a significant variation between the two sexes, with a p-value of 0.003.

When assessing lifestyle and health-related factors, smoking appeared to be a differential risk factor between males and females, with a significant p value of 0.047. The presence of diabetes mellitus (DM) as a comorbid condition also showed a significant sex difference (p = 0.032).

The different presentations or severity levels of the disease (with or without abscess) did not exhibit any significant difference between sexes (p=0.873). The recurrence or relapse rate post-treatment or intervention did not seem to vary significantly between sexes, as indicated by a p-value of 0.571.

<table>
<thead>
<tr>
<th>Table 1. Demographic and Clinical Characteristics of the Patients by Gender</th>
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<td>Gender</td>
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<tr>
<td>Age</td>
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<td>Male</td>
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<td>Operation for PSD</td>
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<td>Relapse</td>
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<td>Male</td>
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PSD: Pilonidal Sinus Diseases  BMI: Body Mass Index  SD: Standard Deviation  N: Number  DM: Diabetes Mellitus

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<tr>
<th>Table 2. Distribution of Pathogens in Abscess Cultures, Treatment Choices, and Relapse Rates.</th>
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<tr>
<td>Features of the pathogen in abscess culture</td>
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<tr>
<td>Aerobe</td>
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<tr>
<td>Anaerobe</td>
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<tr>
<td>Gramm staining Negative</td>
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<tr>
<td>Gramm staining Positive</td>
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<tr>
<td>Antibiotics used in the treatment of PSD</td>
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<tr>
<td>Amoclavine+clavunate</td>
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<tr>
<td>Ciprofloxacin+metronidazole</td>
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<tr>
<td>Cefuroxine</td>
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<td>Relapse after surgery + antibiotherapy treatment</td>
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<tr>
<td>None</td>
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<tr>
<td>Yes</td>
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</tbody>
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PSD: Pilonidal Sinus Diseases
The Pathogens | N | %
--- | --- | ---
Escherichia coli | 17 | 10.7
Staphylococcus Aerus | 15 | 9.4
Staphylococcus Epidermidis | 11 | 6.9
Staphylococcus Saprophyticus | 9 | 5.7
Bacteroides Fragilis | 6 | 3.8
Bacteroides Miformis | 6 | 3.8
Peptostreptococcus Anaerobius | 6 | 3.8
Prevotella bivia | 6 | 3.8
Streptococcus Constellatus | 6 | 3.8
Campylobacter rectus | 5 | 3.1
Enterococcus avium | 5 | 3.1
Pantoea agglomerans | 5 | 3.1
Porphyromonas gingivalis | 5 | 3.1
Staphylococcus Hominis | 5 | 3.1
Actinomyces europaues | 4 | 2.5
Fusobacterium nucleatum | 4 | 2.5
Prevotella disiens | 4 | 2.5
Prevotella intermedia | 4 | 2.5
Proteus mirabilis | 4 | 2.5
Streptococcus Mutans | 4 | 2.5
Actinomyces meyeri | 3 | 1.9
Bacteroides Vulgatus | 3 | 1.9
Bifidobacterium spp. | 3 | 1.9
Streptococcus Anginosus | 3 | 1.9
Enterococcus spp | 2 | 1.3
Peptococcus spp. | 2 | 1.3
Porphyromonas Asaccharolytica | 2 | 1.3
Bacteroides Eggerthii | 1 | 0.6
Clostridium spp. | 1 | 0.6
Corynebacterium spp. | 1 | 0.6
Fusobacterium spp. | 1 | 0.6
Klebsiella pneumoniae | 1 | 0.6
Peptostreptococcus Prevoti | 1 | 0.6
Prevotella buccae | 1 | 0.6
Prevotella dentalis | 1 | 0.6
Prevotella oralis | 1 | 0.6
Streptococcus Agalactiae | 1 | 0.6

DISCUSSION

Investigations into Pilonidal Sinus Disease (PSD) offer profound insights into the risk determinants, demographic predispositions, and clinical outcomes of the disease. Several findings from this study parallel or diverge from existing literature, indicating the multifaceted nature of PSD.

A striking observation from this study was the gender predisposition of PSD, with males comprising 71.1% of the total diagnosed cases. This male predominance aligns with literature, which consistently reports a male to female ratio ranging from 3:1 to 4:1 (9). The gender difference can be attributed to factors such as pronounced natal cleft, significant hair growth, and inadequate hygiene practices, which are more prevalent in males (6). The age range and median values presented in this study support previous research indicating the disease's prevalence during puberty and young adulthood (10).

Body Mass Index (BMI) has emerged as a notable parameter for PSD susceptibility. Both sexes displayed elevated BMI values, with males having a slightly higher average BMI. The correlation between elevated BMI and PSD has been corroborated by numerous studies, emphasizing the role of obesity and a sedentary lifestyle in the etiology of the disease (11,12). This relationship can be attributed to increased intergluteal moisture and pressure, fostering an environment conducive to hair penetration and subsequent infection (13). However, some studies with contradictory claims suggest that obesity alone is not a crucial factor in the etiology of pilonidal sinus disease (14).

The disparity in smoking prevalence between sexes is noteworthy. Smoking, a recognized risk factor for compromised wound healing, has been linked to increased PSD occurrence due to delayed wound healing, leading to recurrent infections (15). Some studies suggest that while smoking influences the recurrence of PSD, it does not solely determine its onset (16). However, other studies highlight the detrimental effect of smoking on wound healing after PSD treatment, linking it with the development of pilonidal abscesses, wound infections, and recurrent episodes (17). This negative influence of smoking appears to be related to its deleterious effects on tissue perfusion following surgical procedures (15,16,18). The observed higher prevalence in males aligns with overarching epidemiological patterns, underscoring its implications for wider public health considerations.

Interestingly, while Diabetes Mellitus (DM) has been identified as a risk factor, its prevalence is minimal. However, a slightly elevated occurrence was observed in men. Although studies linking DM directly to PSD are sparse, impaired glucose metabolism may compromise immunity and enhance susceptibility (19, 20).

The presentation and recurrence of PSD in terms of abscess formation and relapse were not significantly different between sexes. This negates the presumption that one sex might experience more severe manifestations than the other, consistent with findings from global studies (3).

Microbial assessment showed the presence of both aerobic and anaerobic bacteria, consistent with the findings of previous studies (21). The antibiotic selection in our study,
favoring a combination of Ciprofloxacin and Metronidazole, underscores the wide-ranging nature of the infections. This antibiotic combination has been recognized for its potency against both Gram-positive cocci and anaerobic bacteria (22). Previous studies have identified a mix of Gram-negative and Gram-positive bacteria in PSD specimens, with a significant proportion presenting a polymicrobial profile. The dominant bacteria included Escherichia coli and Enterococcus faecalis, with anaerobes like Bifidobacterium also being prevalent. These findings align with our study, which also highlights the dominance of anaerobic bacteria in primary PSD infections. The recurrence rate observed in this study (15.1%) deviated from the global norm, which typically stands between 20-30% (3). This variation not only underscores the potential efficiency of the treatment modalities employed in our research but also hints at exceptional postoperative care standards that might have been delivered. Historical data provides an enlightening perspective. For instance, the range of published patient groups spans from a cohort of 6,439 patients, with 130 instances of recurring disease in 1930, to a more considerable cohort of 42,537 patients accompanied by 3,548 recurrent cases by 2000. The variance in surgical interventions for recurrent cases ranged from 2% in 1930 to 14% a decade later. However, discerning clear trajectories or trends remains elusive.

Remarkably, when comparing the recurrence rates between 1930 and the two most recent decades, there was an absence of any significant downturn. This observation casts a shadow on the often-held belief that medical advancements would inevitably lead to reduced recurrence rates. The prevailing narrative is further complicated by the increasing incidence of PSD in contemporary times. One cannot help but postulate that, while we might be witnessing advances in therapeutic modalities, latent and yet-to-be-identified factors could be at play, countering the gains made in treatment efficacy. This dynamic interplay warrants further scrutiny and research to holistically understand and address the challenges posed by PSD recurrence.

Strengths of the study:

1. Innovation: This study is one of the few of its kind to offer a detailed biogram in PSD, and it pioneers the examination of relapses after abscess treatment when supplemented with antibiotic therapy.

2. Comprehensive Approach: The dual focus on both the detailed biogram in PSD and the effects of antibiotic treatment on abscess relapse rates suggests a multifaceted approach to this problem.

3. Potential for Improved Patient Outcomes: By studying relapse rates after abscess treatment with antibiotics, this study could contribute to better treatment protocols, potentially benefiting many patients.

Study limitations

This study, which examined pilonidal sinus patients in detail, has some limitations. Although novel and potentially impactful, our findings may not be generalizable to all patient populations or healthcare settings. Further research is required to validate our results in diverse groups and contexts. Although we introduced antibiotics in a controlled manner, we acknowledge broader concerns regarding antibiotic resistance. Our study may not have fully accounted for the long-term implications of increased antibiotic use, particularly if adopted on a larger scale.

The follow-up duration may have limited our assessment of post-treatment relapses. A more extended observation period may yield different insights into the long-term effects of our interventions.

CONCLUSION

This comprehensive investigation into Pilonidal Sinus Disease (PSD) has unveiled significant insights into its demographic predispositions, risk factors, and clinical outcomes. The notable male predominance, the critical role of elevated BMI, and the influence of lifestyle factors such as smoking provide a detailed understanding of the disease profile. The microbial landscape of PSD, dominated by aerobic and anaerobic bacteria, highlights the complexities of managing this condition. Despite advancements in treatment, the persistent recurrence rates over the decades underscore the urgent need to refine therapeutic strategies and explore potential unknown determinants. As the prevalence of PSD continues to rise, it is imperative for the medical community to remain committed to continuous research, innovative interventions, and upholding the highest standards of patient care.

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Authors’ Contribution

Conceptualization: MT
Data curation: MT, İES
Formal analysis: MT
Funding acquisition: None
Investigation: MT, İES
Methodology: MT, İES
Project administration: MT
Resources: MT
Software: Microsoft
Supervision: MT
Validation: MT, İES
Visualization: MT, İES
Writing–original draft: MT, İES
Writing–review & editing: MT

Ethical approval: The present study was conducted in strict accordance with the principles outlined in the Declaration of Helsinki. Informed consent was obtained from the participant of this study.

REFERENCES


