

Retrospective Study on Risk Factors for Perianal Infections in Patients with Neutropenia

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Abstract

Objective: To explore the risk factors for perianal infections in patients with neutropenia and evaluate the effectiveness of different preventive measures. **Methods:** A retrospective analysis of 173 cases of neutropenia in inpatients at the Department of Hematology, First People's Hospital of Jingzhou, from January 2022 to December 2023. Patients were divided into three preventive groups based on their self-care ability and willingness: 1) KMnO₄ dilution sitz bath, 2) povidone-iodine perianal disinfection, and 3) a combination of both. The study investigated the risk factors for perianal infections and evaluated the effectiveness of these preventive measures. **Results:** The incidence rate of perianal infections was 9.8% (17/173). Binary logistic regression analysis showed that the duration of neutropenia (8 - 14 days vs ≤7 days OR = 16.522, P = 0.013; ≥15 days vs ≤7 days OR = 39.963, P = 0.001) and constipation (OR = 5.979, P = 0.009) were independent risk factors for perianal infections in neutropenic patients. The effectiveness of KMnO₄ sitz bath was inferior to the combination of sitz bath and povidone-iodine disinfection (OR = 10.774, P = 0.035), while the effectiveness of povidone-iodine perianal disinfection was similar to the combination method (OR = 0.91, P = 0.095). **Conclusion:** For patients with prolonged neutropenia or constipation, the use of povidone-iodine for perianal skin disinfection may help reduce the incidence of perianal infections in neutropenic patients.

Keywords

Perianal Infection, Neutropenia, Prevention, Risk Factors, Povidone-Iodine

1. Introduction

Perianal infections represent a common complication among hospitalized pa-

tients with hematological malignancies, particularly those with neutropenia, with an incidence rate of approximately 6.7% - 28.57% [1]-[3]. Perianal infections can manifest with a spectrum of severity, ranging from mild manifestations such as localized pain and anal ulcers to life-threatening complications like sepsis. These conditions not only exacerbate patient distress and increase the associated economic burden but also exert an adverse impact on subsequent therapeutic strategies. Reducing the incidence of perianal infections is critical to maintaining the continuity of treatment for hematological malignancies and enhancing the quality of life of affected patients. This retrospective study was conducted to identify the risk factors for perianal infections and evaluate the efficacy of corresponding preventive interventions.

2. Materials and Methods

1) A total of 173 neutropenic inpatients admitted to the Department of Hematology between January 2022 and December 2023 were enrolled in this study. The demographic and clinical characteristics of the study cohort are summarized as follows: Age distribution: <18 years (n = 38, 22.0%), 18 - 60 years (n = 67, 38.7%), and >60 years (n = 68, 39.3%). Gender distribution: Male (n = 94, 54.3%) and Female (n = 79, 45.7%).

2) Primary Diagnoses: The cohort comprised patients with the following primary hematological disorders: acute leukemia (n = 83, 48.0%), myelodysplastic syndrome (n = 17, 9.8%), lymphoma (n = 39, 22.5%), multiple myeloma (n = 13, 7.5%), hematopoietic stem cell transplantation recipients (n = 8, 4.6%), chronic myeloid leukemia (n = 2, 1.2%), and aplastic anemia (n = 11, 6.4%).

Comorbidities and Treatment Exposure: Comorbid diabetes mellitus was documented in 31 patients (17.9%). A total of 133 patients (76.9%) had received chemotherapy prior to or during hospitalization. This study was approved by the Institutional Review Board (IRB) of the hospital.

Diagnostic Criteria for constipation following the Rome IV Criteria: The frequency of defecation is reduced (less than 3 times a week), the defecation is laborious or incomplete, and the stool is dry and hard, and the symptoms last for at least 6 months (nearly 3 months meet the standard). At the same time, intestinal organic lesions, metabolic diseases or drug effects should be excluded.

Diagnostic Criteria for Neutropenia: is a disease in which the absolute neutrophil count (ANC) of peripheral blood is less than $1.5 \times 10^9/L$.

Diagnostic Criteria for Perianal Infections: Perianal infections were defined as including perianal abscesses and anal fistulas, in accordance with previously established criteria [2]. Perianal abscesses were characterized by the presence of localized perianal pain associated with palpable induration or fluctuance. Anal fistulas were defined as epithelialized sinus tracts originating from a breach in the perianal skin, which may extend deeply into the surrounding soft tissues or communicate with the rectal lumen. Notably, perianal infections were frequently accompanied by concurrent fever.

3) Preventive Interventions

Three distinct prophylactic regimens were implemented for the prevention of perianal infections, as detailed below: a) Perineal sitz bath with 1:5000 potassium permanganate (KMnO₄) solution administered immediately after defecation. b) Topical application of 0.5% povidone-iodine to the perianal area twice daily, with an extra application added post-defecation. c) Combined regimen integrating the above two interventions.

4) Statistical Analysis

Statistical analyses were performed using SPSS version 26.0 software. Univariate analyses were conducted via chi-square tests, whereas binary logistic regression analyses were performed to identify independent risk factors associated with perianal infections. A two-tailed P-value < 0.05 was considered statistically significant.

3. Results

1) Baseline Characteristics: Of the 173 enrolled patients, neutropenia duration was stratified as follows: ≤7 days (n = 57, 32.9%), 8 - 14 days (n = 79, 45.7%), and ≥15 days (n = 37, 21.4%). Prophylactic interventions were distributed across three regimens: sitz bath monotherapy (n = 104, 60.1%), topical povidone-iodine monotherapy (n = 42, 24.3%), and the combined regimen of both interventions (n = 27, 15.6%). Overall, 17 patients (9.8%) developed perianal infections during the study period.

2) Univariate Analysis: Chi-square tests demonstrated that perianal infection occurrence was significantly associated with the following factors: primary diagnosis (P = 0.049), neutropenia duration (P = 0.007), prophylactic intervention type (P = 0.044), and constipation (P = 0.001). Detailed results are presented in **Table 1**.

Table 1. Single factor analysis of perianal infection in 173 patients with hematological diseases during hospitalization.

Factor	N	Perianal infection		χ^2	P
		N	%		
Age (years)					
<18	38	3	7.9%	1.474	0.478
18 - 60	67	5	7.5%		
>60	68	9	13.2%		
Diagnosis					
Acute leukemia	83	10	12.0%	12.656	0.049
Myelodysplastic syndrome	17	5	29.4%		
Lymphoma	39	1	2.6%		

Continued

Multiple myeloma	13	0	0.0%		
HSCT transplantation	8	0	0.0%		
Chronic myeloid leukemia	2	0	0.0%		
Aplastic anemia	11	1	9.1%		
Sex					
Male	94	8	8.5%	0.402	0.526
Female	79	9	11.4%		
Agranulocytosis duration					
≤7 days	57	1	1.8%	10.009	0.007
8 - 14 days	79	8	10.1%		
≥15 days	37	8	21.6%		
Preventive measure					
Hip bath	104	15	14.4%	6.25	0.044
Povidone-iodine method	42	1	2.4%		
Combined method	27	1	3.7%		
Diabetes mellitus					
Yes	31	2	6.5%	0.485	0.486
No	142	15	10.6%		
Constipation					
Yes	25	7	28.0%	10.892	0.001
No	148	10	6.8%		
Chemotherapy during hospitalization					
Yes	133	13	9.8%	0.002	0.966
No	40	4	10.0%		

3) Binary logistic regression analysis, employing a forward stepwise approach based on maximum likelihood estimation, was performed to identify independent risk factors for perianal infections. The analysis revealed the following significant predictors: Neutropenia duration: 8 - 14 days (odds ratio [OR] = 16.522, P = 0.013) and ≥ 15 days (OR = 39.963, P = 0.001), Constipation (OR = 5.979, P = 0.009)

With respect to the efficacy of prophylactic interventions, the potassium permanganate (KMnO₄) sitz bath monotherapy was associated with significantly inferior effectiveness compared with the combined regimen (OR = 10.774, P = 0.035). By contrast, topical povidone-iodine monotherapy demonstrated compa-

orable efficacy to the combined intervention, though this difference did not reach statistical significance (OR = 0.91, P = 0.095). A comprehensive summary of these results is presented in **Table 2**.

Table 2. Logistic regression analysis of perianal infection in patients with hematological diseases during hospitalization.

Factor	Regression coefficient	Standard error	Wald	P	OR	95%
Agranulocytosis duration			10.315	0.006		
8 - 14 days vs ≤7 days	2.805	1.133	6.132	0.013	16.522	1.795 - 152.109
≥15 days vs ≤7 days	3.688	1.157	10.152	0.001	39.963	4.134 - 386.269
Preventive measure			8.7	0.013		
Hip bath vs combined method	2.377	1.127	4.45	0.035	10.774	1.184 - 98.078
Povidone-iodine vs combined method	-0.094	1.485	0.004	0.095	0.91	0.050 - 16.729
Constipation						
Yes vs No	1.788	0.683	6.846	0.009	5.979	1.566 - 22.822

4. Discussion

The incidence of perianal infections observed in this cohort was 9.82%, which is consistent with the findings reported in prior literature. However, this rate was notably lower than that documented in certain other studies (9.82% vs. 34.29%) [4]. This discrepancy may be attributed to the enhanced clinical focus on targeted prophylactic interventions for patients with limited self-care capacity. Univariate analysis indicated a statistically significant association between primary hematological diagnosis and the occurrence of perianal infections. However, this correlation did not retain independent predictive value in the subsequent multivariate logistic regression analysis. This phenomenon may be attributable to the heterogeneity across different hematological malignancies, including variations in disease severity, chemotherapy regimen intensity, and the duration of neutropenic episodes [5]. Notably, the duration of neutropenia was confirmed as an independent risk factor for perianal infections, with the associated risk escalating progressively as neutropenia persisted. This finding is consistent with the conclusions of a recent study by Jing *et al.* [6], which also emphasized that prolonged neutropenia constitutes a critical risk factor for infectious complications in neutropenic patients.

Constipation, a prevalent adverse effect of chemotherapy, can compromise the integrity of perianal mucosa and skin, thereby elevating the susceptibility to perianal infections during the neutropenic phase. Consistent with this pathological mechanism, our study verified constipation as an independent risk factor for perianal infections in this patient cohort. Prophylactic strategies including dietary fiber supplementation and prophylactic laxative administration have been demonstrated to alleviate constipation and potentially reduce the incidence of subse-

quent perianal infections [7] [8]. Collectively, these findings underscore the necessity of active intervention for constipated patients to prevent disease exacerbation and the development of more severe clinical sequelae.

Hematopoietic stem cell transplantation (HSCT) is associated with more profound immunosuppression and myelosuppressive toxicity compared with conventional chemotherapy regimens, primarily owing to the high-dose conditioning chemotherapy administered prior to transplantation. On theoretical grounds, HSCT recipients thus face a higher probability of developing perianal infections than patients undergoing conventional chemotherapy under equivalent clinical conditions. Notably, constraints related to laminar flow ward capacity, coupled with the marked thrombocytopenia observed in HSCT patients, necessitate prolonged bed rest for this cohort. In such cases, patient-performed sitz baths are deemed impractical and potentially unsafe. Consequently, topical povidone-iodine application was selected as the sole prophylactic strategy for all HSCT patients in the present study. Strikingly, none of the HSCT recipients developed perianal infections during the observation period. These outcomes exceeded our initial expectations and strongly corroborate the clinical efficacy of the povidone-iodine-based prophylaxis.

Potassium permanganate (KMnO_4) sitz bath remains the most widely adopted prophylactic measure against perianal infections in patients with hematological disorders [9]-[11]. Nevertheless, this intervention is associated with several notable limitations: inappropriate concentration preparation may induce local cutaneous burns; patients with severe anemia are at an elevated risk of falls when rising from the sitz bath; and individuals with limited self-care capacity often encounter difficulties in performing this procedure independently [12]. Owing to the absence of quantitative metrics for assessing patient compliance in the present study cohort, a statistical evaluation of the correlation between compliance levels and perianal infection occurrence could not be conducted. Admittedly, the poor compliance of patients cannot deny the efficacy of potassium permanganate, but it is indeed a part of Sitz Bath. That said, clinical observations indicate that suboptimal patient awareness regarding perianal infection prevention, coupled with poor adherence to sitz bath protocols, may constitute another critical factor compromising the efficacy of this intervention. Thus, targeted patient education initiatives are warranted to enhance compliance. For patients in whom compliance remains difficult to optimize, topical povidone-iodine application may represent a more practical and feasible alternative strategy. Our findings also demonstrated that the combined prophylactic regimen yielded significantly superior efficacy in perianal infection prevention compared with the KMnO_4 sitz bath monotherapy. While the combined approach can partially mitigate the limitations associated with poor patient compliance and inadequate disease awareness, it still carries the inherent risks of cutaneous burns and fall-related injuries. Moreover, this regimen does not exhibit distinct advantages over the povidone-iodine monotherapy. Collectively, these observations suggest that the clinical necessity of the combined prophylactic strategy merits further validation in studies with larger sample sizes.

In conclusion, topical perianal disinfection with povidone-iodine represents a viable and effective strategy for reducing the incidence of perianal infections, particularly in hematological malignancy patients with prolonged neutropenia or comorbid constipation.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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