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Clinical Features and Risk Factors for Mortality in Patients with *Stenotrophomonas maltophilia* Infection

Stenotrophomonas maltophilia İnfeksiyonu Geçiren Hastaların Klinik Özelliklerinin İncelenmesi ve Mortaliteyle İlişkili Risk Faktörlerinin Araştırılması

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ABSTRACT

Introduction: *It is important to know the risk factors for death in reducing mortality in patients with Stenotrophomonas maltophilia infections. The purpose of this study was to examine the risk factors associated with mortality in hospitalized patients with S. maltophilia infections.*

Materials and Methods: *Patients with S. maltophilia infections aged 18 years and older who were hospitalized in Haseki Research and Training between January 1, 2017, and April 30, 2022, were included in the study. The patients were divided into two groups, non-survivors and survivors, and the clinical features and laboratory parameters of the groups were compared. Mortality risk factors were analyzed by logistic and Cox regression analyses.*

Results: *A total of 75 patients with S. maltophilia infections were included. The mortality rate was 38.6% (n= 29). Advanced age (OR= 1.05, 95% CI= 1.012-1.085, p= 0.009), COVID-19 pneumonia (OR= 9.52, 95% CI= 1.255-72.223, p= 0.029), and presence of central venous catheter (CVC) (OR= 18.25, 95% CI= 2.187-152.323, p= 0.007) were risk factors for death.*

Conclusion: *Physicians should be aware of the potential risk of S. maltophilia infections for mortality, particularly in patients with predefined risk factors such as advanced age, the presence of CVC, and COVID-19. Performing CVC care in accordance with infection prevention and control measures and timely removal of CVC may be beneficial in reducing deaths due to S. maltophilia infection.*

Key Words: *Stenotrophomonas maltophilia; Mortality; Risk factors; COVID-19*

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ÖZ

Stenotrophomonas maltophilia İnfeksiyonu Geçiren Hastaların Klinik Özelliklerinin İncelenmesi ve Mortaliteyle İlişkili Risk Faktörlerinin Araştırılması

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Giriş: *Stenotrophomonas maltophilia infeksiyonu olan hastalarda mortaliteyi azaltmak için ölümle ilişkili risk faktörlerinin bilinmesi önemlidir. Bu çalışmada hastanede yatan S. maltophilia infeksiyonu olan hastalarda mortaliteyle ilişkili risk faktörlerinin incelenmesi amaçlanmıştır.*

Materyal ve Metod: *1 Ocak 2017 ve 30 Nisan 2022 tarihleri arasında Haseki Eğitim ve Araştırma Hastanesinde yatarak tedavi gören 18 yaş ve üzeri S. maltophilia infeksiyonu olan hastalar çalışmaya dahil edildi. Hastalar ölenler ve sağ kalanlar olarak iki gruba ayrıldı ve grupların klinik özellikleri ve laboratuvar parametreleri karşılaştırıldı. Mortalite risk faktörlerini belirlemede lojistik ve Cox regresyon analizleri kullanıldı.*

Bulgular: *S. maltophilia infeksiyonu olan toplam 75 hasta çalışmaya dahil edildi. Mortalite oranı %38.6 (n= 29) idi. İleri yaş (OR= 1.05, %95 GA= 1.012-1.085, p= 0.009), COVID-19 pnömonisi (OR= 9.52, %95 GA= 1.255-72.223, p= 0.029) ve santral venöz kateter (SVK) (OR= 18.25, %95 GA= 2.187-152.323, p= 0.007) varlığı ölüm için risk faktörleriydi.*

Sonuç: *Hekimler, özellikle ileri yaş, CVC varlığı ve COVID-19 gibi önceden tanımlanmış risk faktörleri olan hastalarda S. maltophilia infeksiyonlarının potansiyel olarak ölüme yol açabileceğinin bilincinde olmalıdır. SVK bakımının infeksiyon önleme ve kontrol önlemlerine uygun olarak yapılması ve SVK'nin zamanında çıkarılması, S. maltophilia infeksiyonuna bağlı ölümlerin azaltılmasında faydalı olabilir.*

Anahtar Kelimeler: *Stenotrophomonas maltophilia; Mortalite; Risk faktörleri; COVID-19*

INTRODUCTION

Stenotrophomonas maltophilia is a non-fermenting, gram-negative *bacillus* that causes opportunistic infections and is associated with high morbidity, especially in immunocompromised and/or hospitalized patients. This microorganism is also found in nature, plants, water, soil, organic residues, and around structural buildings such as hospitals. It is common in the environment and medical devices and has adhesion and biofilm formation abilities[1,2].

Although *S. maltophilia* has low pathogenicity, it can cause serious infections in patients hospitalized with invasive devices and in immunosuppressive conditions, and receiving broad-spectrum antibiotics[1,2]. The risk of infection is increased in respiratory tract diseases such as cystic fibrosis, hematological malignancies, and human immunodeficiency virus (HIV) infection, in hemodialysis patients and newborns. In these patients, *S. maltophilia* causes systemic infections such as sepsis, ventilator-associated pneumonia, bacteremia, urinary tract infection, meningitis, and peritonitis[2]. The majority of *S. maltophilia* infections are hospital-acquired and have been reported to cause epidemics[3,4]. Environmental sources (invasive equipment, plumbing, etc.) rather than human-to-human transfer are the sources of transmission from the hospital. Most of these infections can be prevented by strict adherence to infection control measures, rational use of antibiotics, observance of asepsis rules in the use of invasive devices, and avoidance of unnecessary invasive instrumentation[5,6].

Stenotrophomonas maltophilia exhibits intrinsic resistance to carbapenems, many other β-lactams, and aminoglycosides. It may also show acquired resistance to antimicrobials such as trimethoprim-sulfamethoxazole and quinolones. Treatment of infections caused by *S. maltophilia* is difficult due to both intrinsic and acquired resistance mechanisms[2]. Among the other reasons for the difficulty of treatment, it can be shown that the patients are usually hospitalized and depressed, especially in the intensive care unit. Colonization of bacteria to the invasive instrument and subse-

quent biofilm formation makes the treatment of these infections more difficult and complicated [7-10].

In our country, where the prevalence of antimicrobial resistance is high, there are limited studies on antibiotic resistance, especially in *S. maltophilia* strains. The rate of trimethoprim-sulfamethoxazole resistance has been reported by up to 20% in *S. maltophilia* strains[11-17]. Cikman et al. found 20.3% resistance to trimethoprim-sulfamethoxazole and 72% to ceftazidime in *S. maltophilia* strains[11]. In a study conducted in İstanbul between 2007 and 2017, the rate of resistance to trimethoprim-sulfamethoxazole was 7.7%, while this rate was 27% in 2011[12].

S. maltophilia infections can rapidly progress and result in mortality since treatment options are limited. Mortality rates in *S. maltophilia* infections were reported to be between 12% and 69% in two review studies[18,19]. In studies, staying in the ICU and the presence of an invasive device (CVC, urinary catheter, and mechanical ventilation), and prior antibiotic use have been shown as risk factors associated with death in patients with *S. maltophilia* infections[20-22]. To reduce deaths, it is important to know the treatment options and poor prognostic risk factors in patients with *S. maltophilia* infections. This study aimed to determine the risk factors associated with mortality in hospitalized patients with *S. maltophilia* infections and to examine the antibiotic susceptibility of *S. maltophilia* strains.

MATERIALS and METHODS

Study Design and Patients

Patients with *S. maltophilia* infections aged 18 years and older who were hospitalized at Haseki Research and Training Hospital between January 1, 2017, and April 30, 2022, were included in this single-center and retrospective study. Patients with *S. maltophilia* growth in microbiological samples were evaluated as colonization and outpatients were excluded. In case of more than one growth of the same patient, only the first isolated strain was evaluated. All stages of this study comply with the ethical standards of the National Research Committee and the Declaration of Helsinki. This study was approved by the Haseki Training and Research Hospital Ethics Committee (Approval Number: 149-2022, Date: 10.08.2022). Written informed consent was waived given the retrospective nature of this study.

Microbiological Analysis

S. maltophilia identification and antibiotic susceptibility studies were performed using conventional methods and an automated system (VITEK2, bioMérieux, France). The minimum inhibitory concentration (MIC) values specified in the "European Committee on Antimicrobial Susceptibility Testing: Breakpoint tables for interpretation of MICs and zone diameters" were used to determine the sensitivity to trimethoprim-sulfamethoxazole[22]. Sensitivity to ceftazidime and levofloxacin was determined by disk diffusion test using the Kirby-Bauer method. Zone diameters for ceftazidime and levofloxacin were evaluated according to the CLSI M100-S25 criteria[23].

Definitions

The differentiation between infection and colonization was made according to the diagnostic criteria of the consultation notes of infectious disease specialists and the national health service-associated infections surveillance guideline[24]. Appropriate treatment was considered as the treatment initiated within the first 48 hours from the isolation of *S. maltophilia* and based on antibiotic susceptibility. The primary outcome was 30-day all-cause in-hospital mortality.

Patients' Data

The demographic characteristics, clinical features, laboratory parameters, microbiological culture results, and clinical outcomes were obtained retrospectively from the hospital system and patient files.

Statistical Analysis

Statistical analysis was performed using SPSS 15.0 for Windows software. Descriptive statistics were expressed as numbers and percentages for categorical variables; as mean, standard deviation, minimum, and maximum for numerical variables. The Chi-square test was used to compare the ratios between groups. Numerical variables between two independent groups were compared

using the Mann-Whitney U test since the normal distribution condition was not met. Logistic and Cox regression analysis was applied to determine the independent risk factors of mortality after excluding parameters with correlation and with less than ten events. The p< 0.05 value was accepted as the alpha significance level.

RESULTS

A total of 203 *S. maltophilia* strains were identified during the study. Twelve strains from the same patient with multiple growths, four strains for which no patient information was available, and 112 strains considered colonization were excluded from the study. Finally, 75 patients with *S. maltophilia* infections were included. Of these, 40 (53.3) were male, 35 (46.7) were female, and their median age was 64 (19-92). All-cause in-hospital mortality rate was 38.6% (n= 29). In the non-survivor group, the median age was significantly higher than in the survivor group [80 (35-94) vs. 62 (19-90), p= 0.017]. In-hospital death was significantly higher in patients in the ICU than those in the general wards (93.1% vs 32.6, which have been isolated p< 0.001) (Table 1). Other microorganisms in patients with *S. maltophilia* were as follows; Coagulase-negative *Staphylococcus* (n= 6), *Enterococcus* spp. (n= 5), *Klebsiella pneumoniae* (n= 16), *Staphylococcus aureus* (n= 2), *Escherichia coli* (n= 2), *Enterobacter cloacae* (n= 2), *Citrobacter* spp. (n= 2), *Acinetobacter baumannii* (n= 1), and Alpha-hemolytic *Streptococci* (n= 1). The number of patients with at least one invasive device was 65 (86.7%). While the rate of using appropriate antibiotics was found to be higher in non-survivors,

Table 1. General characteristics of patients with *Stenotrophomonas maltophilia* infection

	Overall n= 75 (100%)	Non-survivor n= 29 (38.7%)	Survivor n= 46 (61.3%)	p
Sex				
Male	40 (53.3%)	15 (51.7%)	25 (54.3%)	0.824
Female	35 (46.7%)	14 (48.3%)	21 (45.7%)	
Age median (IQR) (years)	64 (50-82)	80 (60-86)	62 (47-74)	**0.017**
Charlson comorbidity index	4 (1-10)	4 (1-8)	4 (1-10)	0.165
Comorbid condition				
Heart failure	11 (14.7%)	6 (20.7%)	5 (10.9%)	0.319
Diabetes mellitus	13 (17.3%)	3 (10.3%)	10 (21.7%)	0.204
COPD	14 (18.7%)	4 (13.8%)	10 (21.7%)	0.390
Chronic renal failure	14 (18.7%)	7 (24.1%)	7 (15.2%)	0.334
Cause of hospitalization				
Infections (not related to *S. maltophilia*)				
Respiratory tract infections	20 (26.7%)	14 (48.3%)	6 (13.0%)	**0.001**
COVID-19 pneumonia	13 (17.3%)	10 (34.5%)	3 (6.5%)	**0.002**
Non-COVID-19 pneumonia	7 (9.3%)	4 (13.7%)	3 (6.5%)	0.847
Intra-abdominal infection	4 (5.3%)	1 (3.4%)	3 (6.5%)	1.000
Urinary tract infection	4 (5.3%)	0 (0.0%)	4 (8.7%)	0.154
Bacteremia	2 (2.7%)	0 (0.0%)	2 (4.3%)	0.519
Wound infection	3 (4.0%)	0 (0.0%)	3 (6.5%)	0.279
Type of in-patient unit during the infection				
General/Surgery ward	33 (44.0%)	2 (6.9%)	31 (67.4%)	**<0.001**
ICU	42 (56.0%)	27 (93.1%)	15 (32.6%)	

Chronic obstructive pulmonary disease (COPD), ICU: Intensive care unit.

there was no statistically significant difference between non-survivors and survivors (20.7% vs. 15.2%, p= 0.542) (Table 2). The laboratory parameters of patients with *Stenotrophomonas maltophilia* infections was shown in Table 2. The rate of resistant *S. maltophilia* strains was 12% (n= 9/66) for trimethoprim-sulfamethoxazole and 37.5% (n= 15/40) for ceftazidime. No resistance to levofloxacin was detected in *S. maltophilia* strains (n= 0/35).

In multivariate regression analysis, advanced age (OR= 1.05, 95% CI= 1.012-1.085, p= 0.009), hospitalization for COVID-19 pneumonia (OR= 9.52, 95% CI= 1.255-72.223, p= 0.029) and CVC (OR= 18.25, 95% CI= 2.187-152.323, p= 0.007) were found to be risk factors for death in hospitalized patients with *S. maltophilia* infections (Table 3). A second model with laboratory parameters revealed, high MCV (HR= 1.09, 95% CI= 1.010-1.184,

Table 2. Clinical and laboratory characteristics of patients with *Stenotrophomonas maltophilia* infection

	Overall n= 75 (%)	Non-survivor n= 29 (%)	Survivor n= 46 (%)	p
Site of infection				
Overall pneumonia	31 (41.3)	22 (75.9)	9(19.5)	**<0.001**
Ventilator-associated pneumonia	22 (29.3)	16 (55.2)	6 (13.0)	**<0.001**
Pneumonia	9 (12.0)	6 (20.7)	3 (6.5)	0.081
Bacteremia	21 (28.0)	5 (17.2)	16 (34.8)	0.099
Systemic urinary tract infection	11 (14.7)	0 (0.0)	11 (23.9)	0.005
Intra-abdominal infection	6 (8.0)	1 (3.4)	5 (10.9)	0.396
Other systemic infections	6 (8.0)	1 (3.4)	5 (10.9)	0.396
Presence of invasive devices	65 (86.7)	29 (100)	36 (78.3)	0.005
Central venous catheter	43 (57.3)	27 (93.1)	16 (34.8)	**<0.001**
Urinary catheterization	61 (81.3)	27 (93.1)	34 (73.9)	**0.038**
Endotracheal tube	34 (45.3)	23 (79.3)	11 (23.9)	**<0.001**
Appropriate antibiotic therapy	62 (82.7)	23 (79.3)	39 (84.8)	0.542
	Median (min-max)	Median (min-max)	Median (min-max)	
Length of hospital stay	30 (3-372)	34 (3-145)	27 (3-372)	0.272
Time of appropriate antibiotic therapy	5 (0-31)	6 (0-28)	5 (0-31)	0.883
Laboratory parameters	Median (IQR)	Median (IQR)	Median (IQR)	
Leukocyte count $x10^3/mm^3$	9.9 (1.6-32.8)	13.5 (1.6-32.8)	8.5 (2.2-27.6)	**0.001**
MCV (fL)	86 (68-101)	87 (81-99)	83 (68-101)	**0.001**
Neutrophil count $x10^3/mm^3$	7.7 (1.4-30.7)	11 (1.4-30.7)	6.55 (1.5-25.7)	**<0.001**
Lymphocyte count $x10^3/mm^3$	0.9 (0.09-4.2)	0.7 (0.1-3.4)	1.1 (0.09-4.2)	**0.007**
Neutrophil/Lymphocyte ratio	8.2 (0.79-152)	15.8 (4-152)	5.6 (0.79-72.2)	**<0.001**
Urea (mg/dL)	49 (8-191)	62 (14-191)	41 (8-162)	**0.002**
Creatinine (mg/dL)	0.71 (0.06-5.2)	0.8 (0.17-2.8)	0.655 (0.1-5.2)	0.718
ALT U/L	27 (3-1534)	35 (3-1517)	21 (3-1534)	0.115
AST U/L	31 (6-1898)	41 (6-1898)	24 (9-1020)	**0.014**
Ferritin (mL/ng)	574 (189-2928)	1476.5 (408-2928)	424 (189-1472)	**0.012**
C-reactive protein (mg/dL)	105 (1.4-488)	114 (8-488)	92 (1.4-308)	0.144
Procalcitonin (ng/mL)	1.35 (0.08-48)	1.8 (0.08-48)	1.05 (0.08-29)	0.637

MCV: Mean corpuscular volume, MPV: Mean platelet volume, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase.

Table 3. Logistic regression analysis of risk factors for mortality in patients with *Stenotrophomonas maltophilia* infection

	p	OR	95% CI
Age	**0.009**	1.05	1.012-1.085
COVID-19 pneumonia	**0.029**	9.52	1.255-72.223
Central venous catheter	**0.007**	18.25	2.187-152.323
Urinary catheterization	0.540	0.45	0.035-5.748
Endotracheal tube	0.096	4.27	0.774-23.656

OR: Odds ratio, CI: Confidence interval.

Table 4. Cox regression analysis of mortality risk factors in laboratory values in patients with *Stenotrophomonas maltophilia* infection

	p	HR	95% CI
Leukocyte count x10^3/mm^3	0.159	0.495	0.186-1.316
MCV (fL)	**0.028**	1.093	1.010-1.184
Neutrophil count x10^3/mm^3	0.128	2.194	0.799-6.028
Lymphocyte count x10^3/mm^3	0.282	2.417	0.484-12.069
Neutrophil/lymphocyte ratio	0.441	1.009	0.987-1.030
Urea (mg/dL)	0.182	1.007	0.997-1.017
AST U/L	**0.021**	1.002	1.000-1.003

HR: Hazard ratio, CI: Confidence interval, MCV: Mean corpuscular volume, AST: Aspartate aminotransferase.

p= 0.028) and AST (HR= 1.00, 95% CI= 1.000-1.003, p= 0.021) values as independent predictors for in-hospital death (Table 4).

DISCUSSION

In this study, the mortality rate was 36%, and being in the geriatric age group, co-infection with COVID-19 and the presence of CVC were found to be risk factors for death in patients with *S. maltophilia* infections.

S. maltophilia infections are seen especially in immunocompromised patients who are hospitalized with invasive devices and have high mortality. Mortality rates have been reported between 21% and 69%[10,11]. In this study, crude mortality was observed as 36% in hospitalized patients with *S. maltophilia* infections. This difference in mortality rates may be due to differences between the patient populations and control groups used in the studies. It has been reported that factors such as inappropriate antibiotic therapy, staying in the ICU, CV or urinary catheter use, prior antibiotic use, and mechanical ventilation are associated with mortality in *S. maltophilia* infections in hospitalized patients[18,20-22,25-29].

Pulmonary diseases have been found to be associated with mortality in *S. maltophilia* infections[29-31]. In our study, the Charlson comorbidity score in patients with *S. maltophilia* infection was not associated with mortality. In addition, chronic obstructive pulmonary disease was more common in survivors than non-survivors (13.8% vs 21.7%, p= 0.204). On the other hand, death was observed more frequently in patients who were hospitalized due to respiratory tract infections (13% vs. 48.3%, p= 0.001) and COVID-19 pneumonia (6.5% vs. 34.5%, p= 0.002). Further analysis found that the presence of COVID-19 pneumonia increased the risk of death in the hospital by 9.5 times in those with *S. maltophilia* infections (OR= 9.52, 95% CI= 1.255-72.223, p= 0.029). Today, there is a limited number of studies on the impact of COVID-19 in patients with *S. maltophilia* infections. In a multicenter study of 92 hospitalized patients with COVID-19 pneumonia in the ICU,

it was reported that VAP developed in 62% (n= 57) of the patients, and *S. maltophilia* was the infectious agent in 18.7% (n= 14). The investigators found that bacterial superinfection was associated with a 10.5-fold increased risk of 28-day mortality in patients with COVID-19[32]. In a study of 119 patients with *S. maltophilia* infections or colonization, COVID-19 was associated with death in the univariate analysis but was not an independent risk factor in the multivariate analysis[33]. However, in the same study, patients with *S. maltophilia* colonization were included in the analysis, which may have affected the results.

Mortality studies in *S. maltophilia* infections have generally been performed in patients with bacteremia[20,21,34-37]. However, this study evaluated all *S. maltophilia* infections. Metan et al. showed that the mortality rate was higher in those with *S. maltophilia* bacteremia than in those without[13]. In this study, the frequency of VAP caused by *S. maltophilia* bacteria was shown to be higher in non-survivors than in survivors. However, there was no significant difference in mortality between patients with and without bacteremia. In some studies, the presence of an invasive device was associated with mortality in *S. maltophilia* infections[20-22,26-29]. In a study of 100 hospitalized patients with *S. maltophilia* infections, the proportion of those who received urinary catheterization (OR= 4.83, C= 1.87-12.47), intravascular catheterization (OR= 4.43, CI= 1.79-10.92), mechanical ventilation support (OR= 4.44 CI= 1.90-10.39) reported to be higher in the non-survivors group[20]. Another study conducted with patients with *S. maltophilia* bacteremia found a high SOFA score to be associated with increased mortality, while removal of the CVP catheter (OR= 0.33; 95% CI= 0.109, 0.996; p= 0.049) was shown to reduce mortality[21]. According to the results of our study, the presence of a CVC was associated with an 18-fold increased risk of in-hospital death. In another study examining patients with *S. maltophilia* bacteremia, ICU admission and the use of mechanical ventilation were found to be associated with mortality. They reported that hospitalization and delay in appropriate treatment are independent risk factors for death due to *S. maltophilia* infections[22]. In a review, appropriate empirical and definitive treatment was not found to be associated with mortality[18]. Similarly, in our study, although the rate of those who received appropriate antibiotic treatment was higher in the surviving patient group, it was not found to be associated with mortality.

In a study investigating risk factors for 30-day mortality in patients with *S. maltophilia* bacteremia, high AST, LDH, and CRP values have been reported as poor prognostic risk factors[38]. In another study, it was stated that the rate of those with serum albumin <3 g/dL (p= 0.043) was higher in patients who died. In the same study, when multivariate analysis was performed, only mechanical ventilation and immunosuppressive therapy were reported as independent risk factors for mortality in *S. maltophilia* infections[20]. In our study, when cox regression analysis was performed with laboratory parameters, high MCV and AST were found to be associated with poor prognosis in *S. maltophilia* infections.

S. maltophilia has multi-drug resistance (MDR) due to its intrinsic resistance mechanisms. Antibiotic options that can be used in the treatment of these infections are limited. Resistance to trimethoprim-sulfamethoxazole used in primary treatment is between 0-20%[11-17,38-41]. In this study, the rate of resistant *S. maltophilia* strains was 12% (n= 9/66) for trimethoprim-sulfamethoxazole and 37.5% (n= 15/40) for ceftazidime. No resistance to levofloxacin was detected in *S. maltophilia* strains (n= 0/35). Gajdács et al. showed an increase in strains resistant to trimethoprim-sulfamethoxazole (between 2008-2012: 6.12%, between 2013-2017: 18.06%; p= 0.034 and levofloxacin (between 2008-2012: 7.86%, between 2013-2017: 10.12%; p> 0.05)[39]. Long hospitalization and prior antibiotic use have been shown to be among the causes of acquired antibiotic resistance in *S. maltophilia* strains[40,41]. In their study on cancer patients, Ansari et al. found that prior carbapenem or quinolone antibiotic use, admission to the intensive care unit within 30 days of *S. maltophilia* isolation, were both risk factors for the development of MDR *S. maltophilia* (p< 0.02) and general mortality (p= 0.04)[41]. However, in our study, previous

antibiotic use was not found to be a risk factor for death (p= 1.00).

When the results of our study and the literature are examined, it is important to know the risk factors of *S. maltophilia* infections, which are associated with high antibiotic resistance and high mortality, which make treatment difficult in *S. maltophilia* strains. Compliance with infection control measures and rational antibiotic use policies plays a key role in reducing *S. maltophilia infections* and infection-related poor outcomes. Strict environmental cleaning, disinfection of common medical instruments, rigid compliance with hand hygiene rules, and contact isolation are essential in infection control[5,6,42]. Avoiding unnecessary invasive device use, and employing aseptic techniques during catheter placement, catheter care, and tracheal aspiration, are vital for infection control measures in reducing *S. maltophilia* infections and related deaths[42-45]. Environmental microbiological sampling to identify potential sources during the epidemic, maintenance of water installations, and their disinfection are recommended methods to limit contamination[42-44]. Choosing adhesion-resistant materials for invasive devices is also helpful in reducing the incidence of infection[46].

Study Limitation

Our study has some limitations. First, the retrospective design of the study may have prevented accurate discrimination of true infection, colonization, and coinfection. Second, this study was conducted in a single center. Thus, the generalizability of our results is limited. Finally, because our primary endpoint was all-cause in-hospital deaths, deaths from other causes could not be excluded. However, since the end-point of this study was 30-day in-hospital mortality, deaths can be attributed to infections with *S. maltophilia*.

CONCLUSION

In conclusion, physicians should be aware of the potential risk of *S. maltophilia* infections for mortality, particularly in patients with predefined risk factors such as advanced age, the presence of CVC, and COVID-19. Strict adherence to infection prevention and control measures in all procedures especially catheter care and placement, and timely removal of CVC are essential in preventing deaths due to this dreadful infection.

ETHICS COMMITTEE APPROVAL

This study was approved by Haseki Training and Research Hospital Clinical Research Ethics Committee (Decision no: 149-2022, Date: 10.08.2022).

CONFLICT of INTEREST

None of the authors had conflict of interest.

AUTHORSHIP CONTRIBUTIONS

Concept and Design: BÇ, SS, GT, RGK

Analysis/Interpretation: BÇ, SS, GT, RGK, HE

Data Collection or Processing: RGK, HE

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Final Approval: All of authors

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