Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Mortality and independent risk factors in pediatric Stenotrophomonas maltophilia bacteremia: a retrospective cohort study

İlanay Duran
University of Health Science, Ankara Bilkent Children City Hospital
Belgin Gülhan
docbelgin@yahoo.com

University of Health Science, Ankara Bilkent Children City Hospital
Saliha Kanık-Yüksek
Ankara Yıldırım Beyazıt Medicine Faculty, Ankara Bilkent Children City Hospital
Tuğba Erat
University of Health Science, Ankara Bilkent Children City Hospital
Seval Özen
University of Health Science, Ankara Bilkent Children City Hospital
Aysun Yahşi
University of Health Science, Ankara Bilkent Children City Hospital
Gülsüm İclal Bayhan
Ankara Yıldırım Beyazıt Medicine Faculty, Ankara Bilkent Children City Hospital
Aslınur Özkaya Parlakay
Ankara Yıldırım Beyazıt Medicine Faculty, Ankara Bilkent Children City Hospital

Research Article

Keywords: S. maltophilia, nosocomial infection, children, pediatric, mortality, risk factors

Posted Date: June 7th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9527836/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

Stenotrophomonas maltophilia is an intrinsically multidrug-resistant Gram-negative bacillus increasingly implicated in nosocomial bloodstream infections. Mortality rates in pediatric populations remain high, yet data on independent predictors of adverse outcomes are limited. We aimed to evaluate clinical characteristics, antimicrobial susceptibility patterns, and risk factors associated with mortality in pediatric patients with *S. maltophilia* bacteremia.

Methods

We conducted a retrospective cohort study including hospitalized children (0–18 years) with blood cultures positive for *S. maltophilia*. Demographic and clinical data were extracted from medical records. Risk factors for mortality were assessed using univariate and multivariate logistic regression analyses.

Results

Seventy-three patients were included (67.1% male), with a median age of 1.96 years. Underlying conditions included hematologic malignancy (22%), solid tumors (17.8%), and neurologic disorders (16%). Intensive care unit (ICU) admission was required in 67.1% of cases. Crude mortality was 41.1%, and attributable mortality was 23.2%. In multivariate analysis, ICU admission, mechanical ventilation, and corticosteroid use were independently associated with mortality.

Conclusions

Pediatric *S. maltophilia* bacteremia is associated with substantial mortality. Adverse outcomes appear to be primarily driven by severity of illness and immunosuppressive factors. Early recognition of high-risk patients requiring intensive care support may improve clinical management and outcomes.

Introduction

Stenotrophomonas maltophilia is a bacterium associated with high mortality rates, particularly in cases of pneumonia and bacteremia, where mortality can range from 23% to 77% and 22% to 62%, respectively (1, 2). In pediatric populations, studies have reported crude mortality rates between 12.5% and 61%, with attributable mortality ranging from 0% to 18%. Additionally, a 30-day mortality rate of approximately 30% has been frequently documented (3). Given these high mortality rates, the identification and understanding of risk factors become critically important. With the increasing survival rates and life expectancy of at-risk patients, the mortality associated with this bacterium is also on the rise (4, 5). Key risk factors include underlying malignancies, neutropenia, the presence of central venous catheters, the

use of foreign devices during hospital treatment, prolonged hospitalization and stays in the intensive care unit, recent re-isolation of *S. maltophilia* within the past month, the development of antibiotic resistance, particularly with the use of beta-lactams, carbapenems, and aminoglycosides, as well as underlying conditions such as cystic fibrosis and severe trauma (6–9). A significant concern is its ability to develop resistance to antibiotics, with the potential for this resistance to escalate over time. Given the risk of the emergence of untreatable resistant strains, research on this bacterium is of critical importance (10).

This study aims to evaluate the clinical findings, comorbid conditions, treatment options, antibiotic resistance, and mortality risk factors associated with *S. maltophilia* in pediatric patients hospitalized at our institution.

Material and Methods

Between September 2019 and July 2022, we conducted a retrospective cohort study by identifying all *S. maltophilia*-positive blood cultures from hospitalized pediatric patients (aged 0–18 years) in the microbiology laboratory database. The medical records of these patients were reviewed to collect demographic characteristics and clinical data. Risk factors associated with mortality in patients with *S. maltophilia* bacteremia were assessed using univariate and multivariate analyses.

Peripheral venous blood and catheter blood cultures were incubated in a BACTEC automated blood culture system. All samples that exhibited a positive growth signal were subjected to Gram staining and cultured on blood agar, eosin methylene blue (EMB) agar, and chocolate agar media. The plates were incubated at 37°C for 24–48 hours. The identification of isolated strains was performed at the species level based on colony morphology, Gram staining, catalase test, oxidase test, slide and tube coagulase tests, and through the use of the MALDI-TOF (Bruker Biotyper, BD, USA) automated system alongside the Vitek 2 Compact (bioMérieux, France) system.

Statistical analyses were performed using SPSS version 25 (IBM Corp., Chicago, IL, USA). Normality was assessed with the Kolmogorov–Smirnov and Shapiro–Wilk tests. Continuous variables were expressed as median (min–max) or mean ± standard deviation, as appropriate, and categorical variables as frequencies and percentages. Group comparisons were performed using the Student's t-test or Mann–Whitney U test for continuous variables and the chi-square or Fisher's exact test for categorical variables. Pearson's chi-square test was applied when expected cell counts were ≥ 5; otherwise, Fisher's exact test was used. Variables with $p < 0.05$ in univariate analysis were entered into multivariate logistic regression analysis to identify independent risk factors for mortality. Results were reported as odds ratios (ORs) with 95% confidence intervals (CIs). A two-sided p value < 0.05 was considered statistically significant.

The study protocol was approved by the Health Sciences University Ankara City Hospital Health Practice and Research Clinical Research Ethics Committee with the decision dated 01/02/2023 and numbered E2-23-3296. The study was conducted in accordance with the ethical principles of the Declaration of

Helsinki. Due to the retrospective design of the study, the requirement for informed consent was waived by the ethics committee

Results

Of the patients, 49 (67.1%) were male, with a median age of 1.96 years (IQR 0–17.69 years). Among the cohort, 28 patients (38.4%) were hospitalized in the pediatric intensive care unit (PICU), 17 patients (23.3%) in the hematology-oncology wards, and 8 patients (11.0%) in the older children's wards. Hematologic malignancies were present in 16 patients (22%), 13 patients (17.8%) had solid tumors, and 12 patients (16%) had neurological disorders. The median duration of hospitalization was 60 days (IQR 5–308 days), with 49 patients (67.1%) requiring intensive care. The median duration of stay in the PICU was 6 days (IQR 0–227 days) (Table 1).

Table 1
Demographic characteristics, invasive procedures and treatment of patients

Gender	**Number of patients** **N = 73**	**Percentage** **%**
Male	24	32,9
Female	49	67,1
Age, median month (min-max)	23,08 (0–215,33)	
Age, median year (min-max)	1,96 (1–3	
Age classification, month		
<12	26	35,6
13–36	18	24,7
>36	29	39,7
Primary diagnosis		
Hematologicial malignancy	16	22
Systemic lupus erythematosus	2	2,7
Gastroenterologic disease	7	9,6
Chronic renal failure	1	1,4
Non-malignancy hematologic disease	5	6,8
Trauma	3	4,1
Onkological disease	13	17,8
Endocrinological disease	1	1,4
Cardiac disease	3	4,1
Metabolic disease	3	4,1
Respiratory disease	7	9,6
Neurological disease	12	16,4
Min:minimum, **max**:maximum		
*P value has been calculated using Chi squared test.		
**Significant at p ≤ 0,05		

Gender	Number of patients N = 73	Percentage %
Hospital stay, day median (min-max)	60 (5-308)	
Intensive care hospitalization		
No	24	32,9
Yes	49	67,1
Intensive care stay, median day (min-max)	6 (0-227)	
Intubation		
No	40	54,8
Yes	27	37,0
Tracheostomy	6	8,2
Catheter insertion		
No	24	32,9
Yes	49	67,1
Catheter stay, day median (min-max)	17 (2-166)	
Previous bacteremia		
Yes	36	49,3
No	37	50,7
Steroid use		
No	37	50,7
Yes	36	49,3
The underlying malignant disease		
Yes	29	39,7
No	44	60,3
Chemotherapy		
Min:minimum, **max**:maximum		
*P value has been calculated using Chi squared test.		
**Significant at p ≤ 0,05		

Gender	Number of patients N = 73	Percentage %
No	57	78,1
Yes	16	21,9
Fungemia		
No	53	72,6
Yes	20	27,4
Min:minimum, **max**:maximum		
*P value has been calculated using Chi squared test.		
**Significant at p ≤ 0,05		

A total of 27 patients (37%) were intubated, and 6 patients (8.2%) had a tracheostomy. 49 patients (67.1%) had an indwelling catheter. The median catheterization duration was 17 days (IQR 2–166 days). A history of steroid use was noted in 36 patients (49.3%), and 16 patients (21.9%) had undergone chemotherapy within the past month. Additionally, 48 patients (65.8%) received meropenem. Among the patients, 41 (56%) were classified as catheter-associated bloodstream infections, while 32 (44%) were categorized as bloodstream infections not associated with a catheter.

Regarding antimicrobial susceptibility, 69 blood cultures were analyzed: 76.9% (53/69) were susceptible to TMP-SMX, 14.4% (10/69) showed intermediate susceptibility, and 8.7% (6/69) were resistant. For levofloxacin, 95.7% (66/69) of the blood cultures were susceptible, while 4.3% (3/69) were resistant. Ceftazidime susceptibility was tested in 21 blood cultures, with 61.9% (13/21) showing susceptibility and 38.1% (8/21) showing resistance (Fig. 1).

In terms of treatment, 44 patients (60.2%) did not receive any treatment specifically targeting *S. maltophilia*, while 29 patients (39.8%) received treatment. Among those treated, 18 patients (24.7%) received TMP-SMX, 5 patients (7%) received ceftazidime, 2 patients (2.7%) received levofloxacin, 2 patients (2.7%) received a combination of TMP-SMX and levofloxacin, and 2 patients (2.7%) received a combination of TMP-SMX and ceftazidime (Fig. 2).

Risk factors for mortality

In a total of 73 patients, mortality was observed in 30 (41.1%) patients. 17 (17/73; 23.2%) died due to *S. maltophilia* bacteremia (mortality attributable to *S. maltophilia*), while the remaining 13 patients (13/73; 17.8%) died from other causes (Fig. 3).

When comparing patients who succumbed to *Stenotrophomonas maltophilia* infection with those who survived, several factors were found to be statistically significantly associated with increased mortality. These included admission to the intensive care unit ($p = 0.034$; OR = 4.85; 95% CI, 1.01–23.32), the need for mechanical ventilation ($p = 0.01$; OR = 11.45; 95% CI, 2.83–46.35), and corticosteroid use ($p = 0.015$; OR = 4.66; 95% CI, 1.35–16.13) (Table 2).

Table 2
Comparison of patients with mortality due to *S. maltophilia* infection and other patients

Gender	**All patients** **n = 73**	***S. maltophilia* mortality** **n = 17**	**Other patients** **n = 56**	**P value†**	**Regression analysis** **P value;** **OR (95% CI)**
				0,155[a]	
Female	24 (32,9)	9 (52,9)	16 (43,3)		
Male	49 (67,1)	8 (47,1)	40 (71,4)		
Age, month				0.620[b]	
Median (min-max)	23,08 (0-215,33)	26,37 (2,63–205,97)	23,17 (0-215,33)		
Age, year				0,620[b]	
Median (min-max)	1,96 (0–17,69)	2,17 (0,22 – 16,92)	1,90 (0–17,69)		
Age, classification				0,759[a]	
<12	26 (35,6)	5 (29,4)	21 (37,5)		
13–36	18 (24,7)	4 (23,5)	14 (25)		
>36	29 (39,7)	8 (47,1)	21 (37,5)		
Primary diagnosis				0,250[a]	
Hematologicial malignancy	8 (11)	2 (11, 8)	6 (10, 7)		
Systemic lupus erythematosus	2 (2, 7)	2 (11, 8)	0		
Gastroenterologic disease	7 (9, 6)	1 (5, 9)	6 (10, 7)		
Nephrological disease	1 (1, 4)	0	1 (1, 8)		
Non-malignancy hematologic disease	5 (6, 8)	2 (11, 8)	3 (5, 4)		

S. maltophilia: *Stenotrophomonas maltophilia*, **min**:minimum, **max**:maksimum

†P value has been calculated using Chi squared test.

*Significant at p ≤ 0,05

Gender	**All patients** **n = 73**	***S. maltophilia* mortality** **n = 17**	**Other patients** **n = 56**	**P value†**	**Regression analysis** **P value;** **OR (95% CI)**
				0,155[a]	
Trauma	3 (4, 1)	0	3 (5, 4)		
Oncological disease	13 (17,8)	3 (17,6)	10 (17,9)		
Other hematologicial malignancy	8 (11)	4 (23,5)	4 (7, 1)		
Endocrine system	1 (1, 4)	0	1 (1, 8)		
Cardiac system	3 (4, 1)	0	3 (5, 4)		
Metabolic system	3 (4, 1)	0	3 (5, 4)		
Respiratory system	7 (9, 6)	1 (5, 9)	6 (10, 7)		
Neurological system	12 (16,4)	2 (11, 8)	10 (17,9)		
Intensive care hospitalization					
No	24 (32,9)	2 (11, 8)	22 (39,3)	**0,034[a]**	**P = 0,049**; OR = 4,85
Yes	49 (67,1)	15 (88,2)	34 (60,7)		(1,01–23,32)
Intubation					
No	40 (54,8)	3 (17,6)	37 (66,1)	**0,01[a]**	**P = 0,01**; OR = 11,45
Yes	27 (37,0)	13 (76,5)	14 (25)		(2,83 – 46,35)
Tracheostomy	6 (8, 2)	1 (5, 9)	5 (8, 9)		
Catheter insertion					
No	24 (32,9)	3 (17,6)	21 (37,5)	0,127[a]	
Yes	49 (67,1)	14 (82,4)	35 (62,5)		
Catheter type					

S. maltophilia: *Stenotrophomonas maltophilia*, **min**:minimum, **max**:maksimum

†P value has been calculated using Chi squared test.

*Significant at p ≤ 0,05

Gender	**All patients** **n = 73**	***S. maltophilia* mortality** **n = 17**	**Other patients** **n = 56**	**P value†**	**Regression analysis** **P value;** **OR (95% CI)**
				0,155[a]	
No	24 (32,9)	3 (17,6)	21 (37,5)	0,352[a]	
Central venous	34 (46,6)	9 (52,9)	25 (44,6)		
Port	14 (19,2)	5 (29,4)	9 (16,1)		
Subclavian vein	1 (1, 4)	0	1 (1, 8)		
Previous bacteremia					
Yes	36 (49,3)	7 (41,2)	29 (51,8)	0,443[a]	
No	37 (50,7)	10 (58,8)	27 (48,2)		
Steroid use					
No	37 (50,7)	4 (23,5)	33 (58,9)	**0,011[a]**	**P = 0,015**; OR = 4,66 (1,35 – 16,13)
Yes	36 (49,3)	13 (76,5)	23 (41,1)		
Chemotherapy					
No	57 (78,1)	15 (88,2)	42 (75)	0,329[c]	
Yes	16 (21,9)	2 (11, 8)	14 (25)		
S. maltophilia: *Stenotrophomonas maltophilia*, **min**:minimum, **max**:maksimum					
†P value has been calculated using Chi squared test.					
*Significant at p ≤ 0,05					

Discussion

Stenotrophomonas maltophilia has emerged as a clinically significant nosocomial pathogen, particularly in critically ill and immunocompromised populations. Its intrinsic resistance to multiple antimicrobial classes and its capacity for biofilm formation on indwelling medical devices complicate both prevention and treatment strategies (1, 10). Mortality associated with *S. maltophilia* bacteremia remains substantial, with reported rates ranging from 22% to 62% in heterogeneous patient populations (1, 2). Pediatric data are comparatively limited but consistently demonstrate considerable mortality, particularly among children with underlying malignancies or intensive care exposure (3, 11–13).

In our cohort, crude mortality reached 41.1%, with an attributable mortality of 23.2%, figures that align with the upper range of previously reported pediatric outcomes (3, 11). Importantly, our multivariate analysis identified intensive care unit admission, mechanical ventilation, and corticosteroid exposure as independent predictors of mortality. These findings suggest that mortality in pediatric *S. maltophilia* bacteremia is primarily driven by host-related and severity-of-illness factors rather than microbiological characteristics alone.

Several prior investigations support this interpretation. Tokatly Latzer et al. demonstrated that septic shock and prior chemotherapy were strongly associated with mortality in critically ill children (11). Similarly, Alsuhaibani et al. reported high short-term mortality in pediatric cases and highlighted the impact of invasive support and malignancy (13). Comparative bloodstream infection analyses further indicate that outcomes of S. maltophilia bacteremia are worse than those caused by other Gram-negative pathogens, emphasizing its clinical relevance (12).

The association between mechanical ventilation and mortality observed in our study likely reflects a convergence of factors: advanced respiratory failure, increased exposure to biofilm-prone surfaces, and overall physiological instability. Biofilm formation is a well-recognized virulence mechanism of *S. maltophilia* and contributes to persistent infection, particularly in the presence of invasive devices (10). Corticosteroid exposure, on the other hand, may exacerbate immune dysfunction and reduce the host's ability to control bacteremia, further amplifying the risk of poor outcomes.

Although carbapenem exposure has been repeatedly identified as a risk factor for the emergence of *S. maltophilia* bacteremia due to ecological selection pressure (6–9), our findings suggest that once bloodstream infection is established, the clinical trajectory is more strongly influenced by organ dysfunction and immunosuppression than by prior antimicrobial exposure alone. This distinction is clinically relevant, as it shifts the focus from purely microbiological considerations to comprehensive risk stratification in critically ill children.

From a therapeutic perspective, trimethoprim–sulfamethoxazole remains the cornerstone of treatment (10). However, susceptibility was not universal in our cohort, underscoring the importance of local epidemiological surveillance and timely susceptibility-guided therapy. Given the organism's intrinsic resistance profile and the limited number of effective agents, antimicrobial stewardship strategies aimed at reducing unnecessary broad-spectrum antibiotic exposure are essential to mitigate ecological selection pressure.

Collectively, our results reinforce the concept that *S. maltophilia* bacteremia in children represents not merely a microbiological event but a marker of critical illness. Early identification of high-risk patients—particularly those requiring intensive care support or receiving corticosteroids—may facilitate closer monitoring, earlier targeted therapy, and optimized supportive management. Future multicenter prospective studies incorporating standardized severity scores and molecular resistance profiling are warranted to better delineate modifiable risk factors and refine therapeutic strategies in pediatric populations.

Declarations

Competing Interests

The authors declare that they have no financial or non-financial competing interests that are directly or indirectly related to this work.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Author Contribution

İ.D. and B.G. conceptualized and designed the study. İ.D. collected the data. İ.D. and B.G. performed the data analysis and interpreted the results. S.K.Y., T.E., S.Ö., A.Y., G.İ.B., and A.Ö.P. contributed to data interpretation and critically revised the manuscript for important intellectual content. İ.D. drafted the initial manuscript. B.G. supervised the study and revised the manuscript. All authors reviewed and approved the final version of the manuscript.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

References

1. Paez JI, Costa SF. Risk factors associated with mortality of infections caused by *Stenotrophomonas maltophilia*: a systematic review. J Hosp Infect. 2008;70(2):101–8.
2. Singhal L, Kaur P, Gautam V. *Stenotrophomonas maltophilia*: From trivial to grievous. Indian J Med Microbiol 2017 Oct-Dec;35(4):469–79.
3. Zöllner SK, Kampmeier S, Froböse NJ, et al. *Stenotrophomonas maltophilia* Infections in Pediatric Patients - Experience at a European Center for Pediatric Hematology and Oncology. Front Oncol. 2021;11:752037.
4. Senol E, DesJardin J, Stark PC, et al. Attributable mortality of *Stenotrophomonas maltophilia* bacteremia. Clin Infect Dis. 2002;34(12):1653–6.
5. Victor MA, Arpi M, Bruun B, et al. *Xanthomonas maltophilia* bacteremia in immunocompromised hematological patients. Scand J Infect Dis. 1994;26(2):163–70.
6. Muder RR, Harris AP, Muller S, et al. Bacteremia due to *Stenotrophomonas (Xanthomonas) maltophilia*: a prospective, multicenter study of 91 episodes. Clin Infect Dis. 1996;22(3):508–12.

7. Hotta G, Matsumura Y, Kato K, et al. Risk factors and outcomes of *Stenotrophomonas maltophilia* bacteraemia: a comparison with bacteraemia caused by Pseudomonas aeruginosa and Acinetobacter species. PLoS ONE. 2014;9(11):e112208.
8. Metan G, Hayran M, Hascelik G, et al. Which patient is a candidate for empirical therapy against *Stenotrophomonas maltophilia* bacteraemia? An analysis of associated risk factors in a tertiary care hospital. Scand J Infect Dis. 2006;38(6–7):527–31.
9. Sumida K, Chong Y, Miyake N, et al. Risk Factors Associated with *Stenotrophomonas maltophilia* bacteremia: A Matched Case-Control Study. PLoS ONE. 2015;10(7):e0133731.
10. Brooke JS. *Stenotrophomonas maltophilia*: an emerging global opportunistic pathogen. Clin Microbiol Rev. 2012;25(1):2–41.
11. Tokatly Latzer I, Paret G, Rubinstein M, et al. Management of *Stenotrophomonas maltophilia* Infections in Critically Ill Children. Pediatr Infect Dis J. 2018;37(10):981–6.
12. Gayretli Aydın ZG, Tanir G, Bayhan GI, et al. Risk Factors of *Stenotrophomonas maltophilia* blood stream infections: Comparison With Other Gram-Negative Blood Stream Infections in Children. Pediatr Infect Dis J. 2020;39(12):e406–9.
13. Alsuhaibani M, Aljarbou A, Althawadi S, et al. *Stenotrophomonas maltophilia* bacteremia in children: risk factors and mortality rate. Antimicrob Resist Infect Control. 2021;10(1):19.

Figures

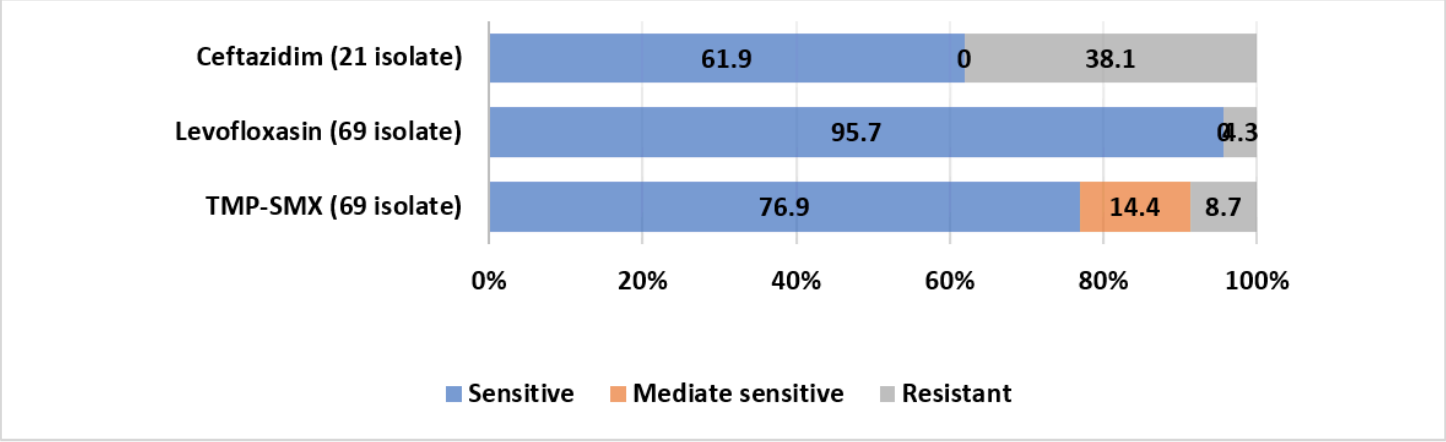

Figure 1

Antibiotic susceptibility of *S. maltophilia*

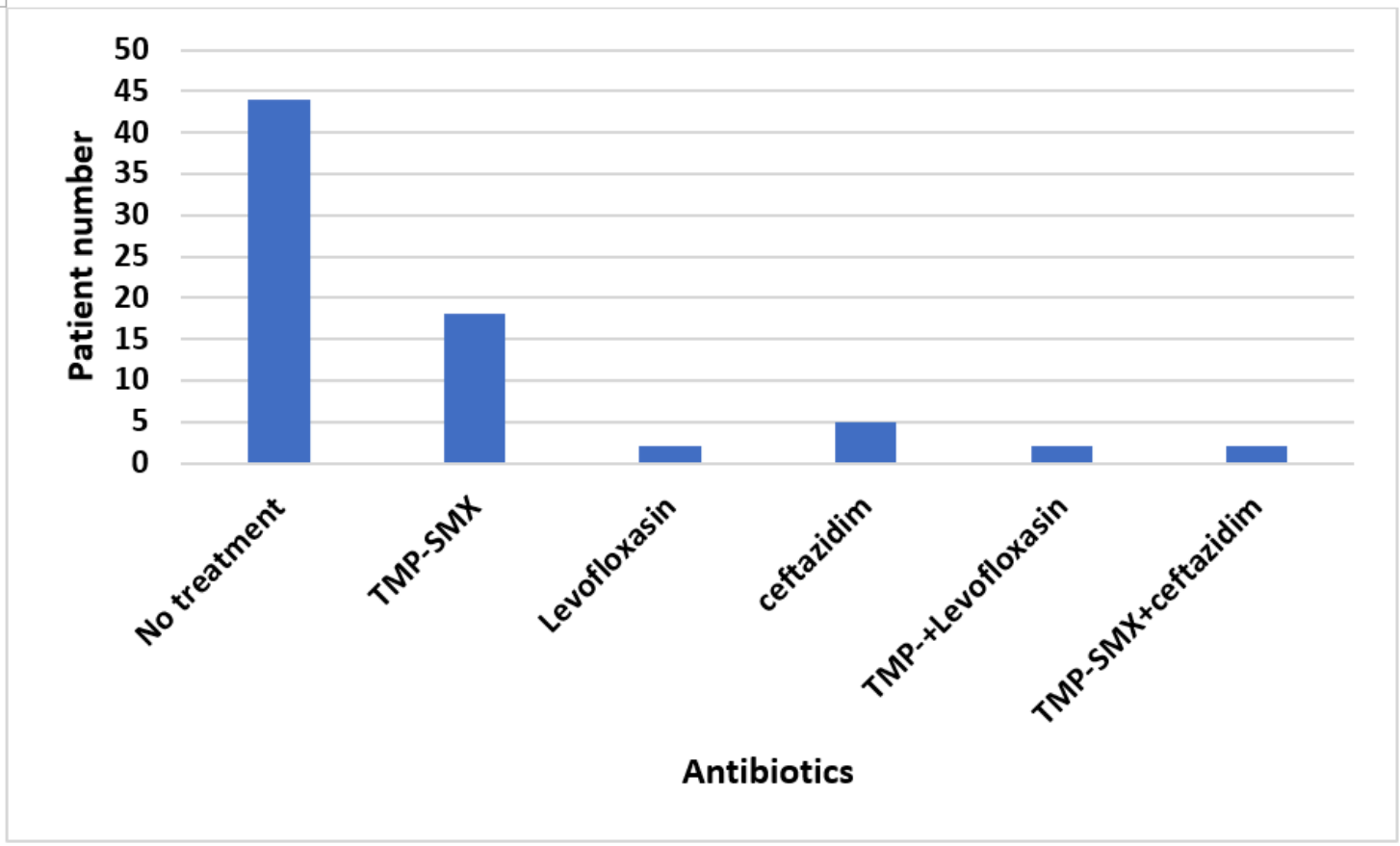

Figure 2

Treatment modality of patients

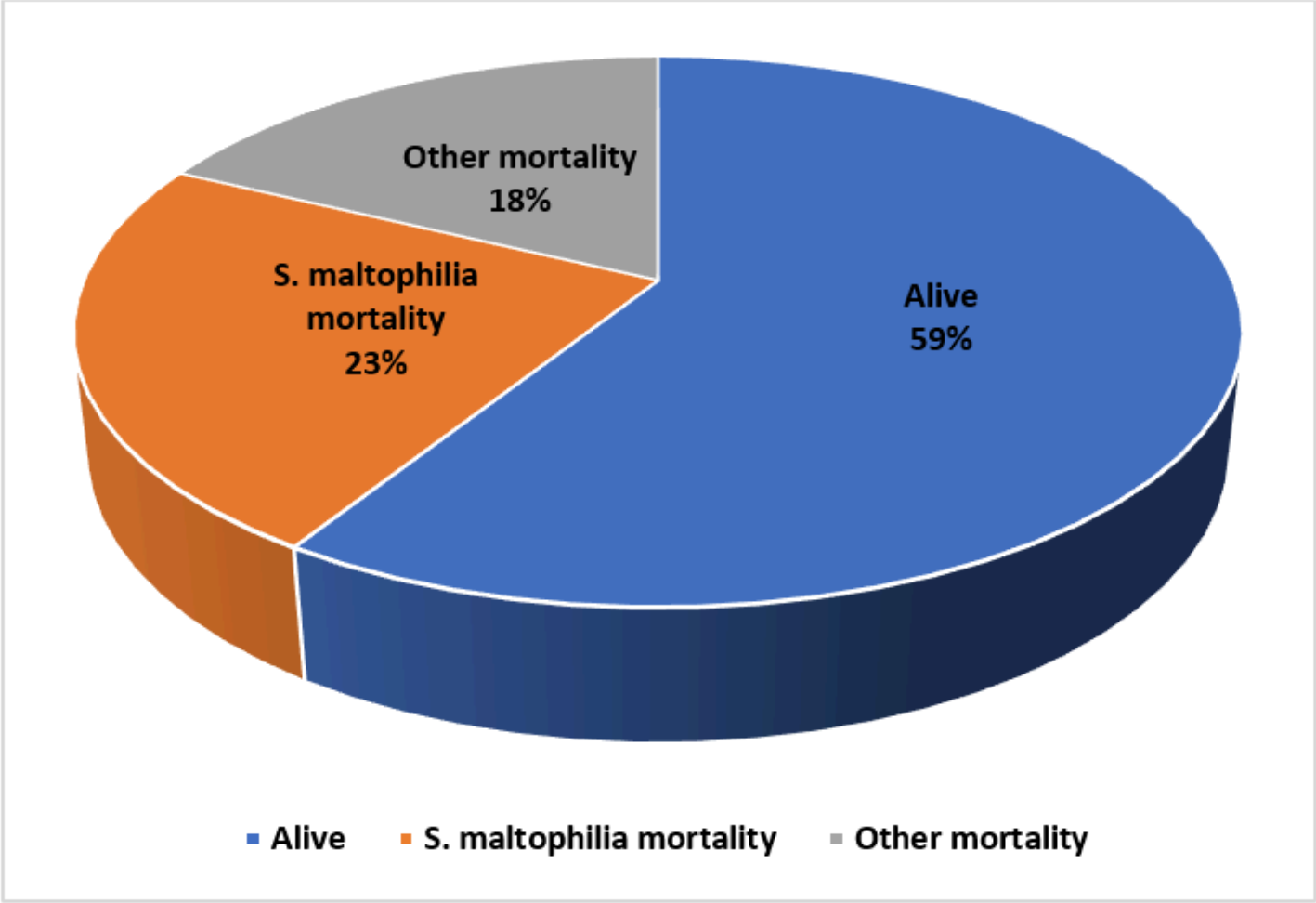

Figure 3

Mortality rate and causes of mortality in patients