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Original Research Article

Prevalence and antimicrobial susceptibility pattern of *Stenotrophomonas maltophilia* isolated from peritoneal fluid cultures of dialysis patients

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ABSTRACT

Background: *Stenotrophomonas maltophilia* (*S. maltophilia*) is an important cause of nosocomial infections, particularly in immunocompromised patients, such as patients with indwelling catheters. Blood stream infections are a leading cause of morbidity among patients undergoing dialysis. Prevalence and Antimicrobial Susceptibility pattern of *Stenotrophomonas maltophilia* isolated from peritoneal fluid cultures of Dialysis Patients.
Methods: This single-center, retrospective, case–control study was conducted between April 2025 and January 2026. Patients who were undergoing dialysis at a tertiary care hospital, south Kerala and were diagnosed with *S. maltophilia* were included in this study. The demographic data, clinical characteristics and initial treatment data of the patients were analyzed to determine the risk factors for peritoneal dialysis- related S. maltophilia peritonitis.
Results: A total of 370 peritonitis cases were recorded during the study period. Seven patients with S. maltophilia peritonitis and 21 controls (three controls to one case) were included in this study. The incidence of S. maltophilia peritonitis was significantly more frequent among patients with diabetes mellitus compared with controls (80.0% vs. 20.0%, p=0.004) and among patients with higher white blood cell counts in the dialysate after appropriate antibiotic therapy 2561/µl (349–4654/µl) vs. 20/µl (20–23/µ), p<0.001) than among the control patients. Although all the patients were treated with appropriate antibiotics following the identification of S. maltophilia, they had a significantly higher rate of catheter removal than the controls (80.0% vs. 0.0%, p=0.0003).
Conclusions: Diabetes mellitus may be an important risk factor for S. maltophilia peritonitis in patients undergoing peritoneal dialysis.

Keywords: Catheter removal, Diabetes mellitus, Peritoneal dialysis, Peritonitis, *Stenotrophomonas maltophilia*

INTRODUCTION

Stenotrophomonas maltophilia is a Gram-negative aerobic non fermentative bacterium widely distributed in hospital environment. Patients undergoing dialysis are vulnerable due to vascular access, immunocompromised status and regular exposure to health care settings. *S. maltophilia* is becoming a relevant opportunistic pathogen, causing bacteraemia, pneumonia and intra-abdominal infections The treatment of *S. maltophilia* infections can become strenuous effort because the pathogen exhibits intrinsic resistance to several classes of antibiotics, through beta-lactamase production, efflux pump mechanism and decreased permeability and this resistance might also

emerge during the course of therapy.[1,2] Most *S. maltophilia* strains are in general resistant to extended-spectrum penicillin, third-generation cephalosporins and carbapenems but sensitive to the newest generation of quinolones, aminoglycosides and trimethoprim/sulfamethoxazole.[3-6] Although *S. maltophilia* is an uncommon cause of PD related peritonitis, its clinical impact is substantial due to treatment challenges and adverse outcomes. Limited data are available regarding its epidemiology and resistance patterns in dialysis populations, particularly in developing regions.

This study aims to evaluate the prevalence, clinical characteristics and antimicrobial susceptibility of *S. maltophilia* isolated from peritoneal fluid cultures in PD patients and to identify associated risk factors.

METHODS

Study population

This single-centre, retrospective, case–control study was conducted between April 2025 and January 2026. Patients who were undergoing dialysis at a tertiary care hospital, south Kerala and were diagnosed with *S. maltophilia* were included. The demographic data, clinical features and initial treatment data of the patients were analyzed to identify the risk factors associated peritoneal dialysis-related *S. maltophilia* peritonitis. S. maltophilia peritonitis was defined as the presence of characteristic clinical features, including peritonitis, dialysate leucocytosis. Controls were randomly selected from among patients who underwent PD during the same period and were diagnosed with peritonitis caused by microorganisms other than S. maltophilia; Twenty-one controls were matched to each case as far as possible for age and sex on a 3:1 basis. Patients were excluded if they had incomplete or missing clinical or laboratory data, negative or inconclusive culture results or were not undergoing peritoneal dialysis.

Data collection

Clinical and laboratory data were retrospectively collected from the patients' medical records. Combined conditions including diabetes mellitus and cardiovascular diseases were documented. Laboratory investigations included white blood cell and platelet counts; hemoglobin, liver enzymes, sodium, potassium, corrected calcium, phosphate, β2-microglobulin and C-reactive protein levels.

Statistical analysis

Data were expressed as mean±standard deviation or median depending on distribution of data. Categorical variables were evaluated using Fisher's exact test or Chi-square test, whereas continuous variables were compared using Student's t-test or Mann–Whitney U test. All analyses were performed using IBM SPSS and Excel.

RESULTS

A total of 370 peritonitis cases were recorded during the study period (Approved by ethical committee MZMC/IEC/043/2026), of which seven were caused by *S. maltophilia,* accounting for approximately 1.9% of all the peritonitis cases. These cases were included in the study group, along with 21controls selected in 3:1 ratio. The mean age of the patients was 60.7 years. Among them 4 (57.1%) were male.

Diabetic nephropathy was identified as the main cause of end stage of renal disease in 2 (28.6%) patients. Microbiological analysis showed that 1 (14.3%) patient had a polymicrobial infection, co-infection with Enterococcus faecalis. However, the peritoneal effluent of six patients did not clear up, resulting in the removal of their peritoneal catheters.

Comparative analysis of clinical and laboratory parameters

A total of 28 participants were included in the study, comprising 7 cases and 21 matched controls. The mean age was 66.0±9.7 years in the case group and 66.0±7.8 years in the control group, with no significant difference between the groups. Males constituted 57.1% of both cases and controls. Diabetes mellitus was significantly more frequent among cases than controls (85.7% vs. 23.8%, p=0.008).

Similarly, cardiovascular disease was more prevalent in the case group (71.4% vs. 23.8%, p=0.03). No significant differences were observed in dialysis duration, serum creatinine, alkaline phosphatase, potassium, sodium or white blood cell count between the groups. However, serum albumin and hemoglobin levels were significantly lower in cases than in controls. Catheter removal was required in 85.7% of cases, whereas no catheter removal was performed in the control.

Figure 1: Colony morphology of *Stenotrophomonas maltophilia* on blood agar.

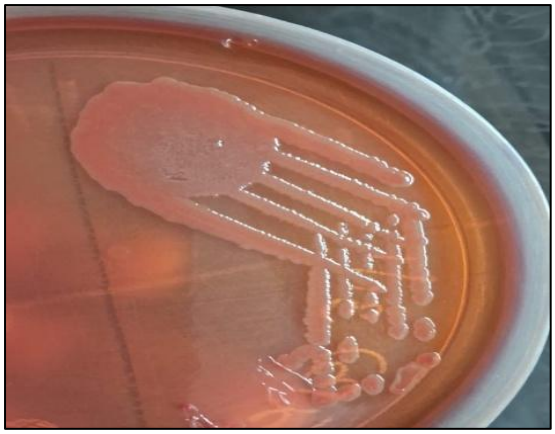

Figure 2: Growth of *Stenotrophomonas maltophilia* on MacConkey agar.

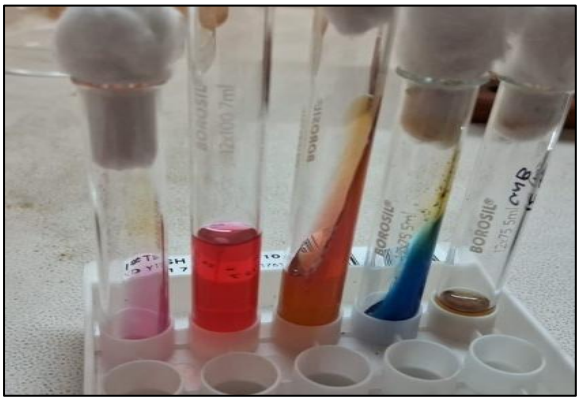

Figure 3: Biochemical identification profile of *Stenotrophomonas maltophilia*.

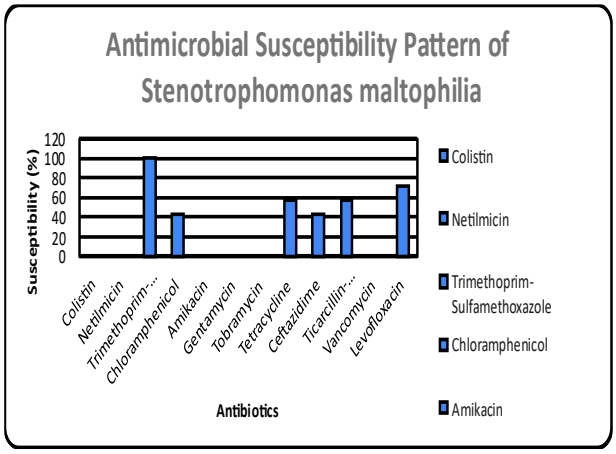

Figure 4: Antibiotic susceptibility profile of *Stenotrophomonas maltophilia*.

Microbiological analysis

The recovered isolates were identified as *Stenotrophomonas maltophilia* through an exhaustive approach integrating phenotypic characteristics, cultural features on Blood agar and Mac Conkey agar (Figure 1 and Figure 2) and biochemical profiling (Figure 3) under the standard microbiological protocols. Automated identification was carried out using VITEK2 compact system, which employs an automated biochemical profiling combined with algorithm-based species identification with high confidence. Proteomic confirmation was performed by MALDI-TOF mass spectrometry, in which organisms' specific protein spectra were generated and compared with reference databases for precise identification. All procedures were conducted in accordance with internationally accepted standard as outlined by the Clinical and Laboratory Standard Institute. All isolates showed 100% concordance between VITEK2 and MALDI-TOF MS identification method.

Antimicrobial profile of Stenotrophomonas maltophilia

Recovered seven isolates of Stenotrophomonas maltophilia were analysed to evaluate antimicrobial utilization patterns by CLSI Guidelines (The method involves a 0.5 Mc Farland suspension on Muller- Hinton agar disc diffusion method and incubated for 16–20 hours, with results interpreted using CLSI guidelines). The isolates exhibited a typical multidrug-resistant phenotype, with restricted susceptibility to a limited group of therapeutic agents.

Trimethoprim-sulfamethoxazole (TMP-SMX) was administered in all cases (100%, 7/7) and demonstrated a statistically significant predominance compared with other antibiotics (p=0.01)

Additional antibiotics, including chloramphenicol, aminoglycosides (such as gentamicin, amikacin and tobramycin) and β-lactam combinations like Ticarcillin-clavulanate, were also prescribed (100%, 7/7). However, these agents did not show statistically meaningful associations with definitive therapy (p>0.05), suggesting their use was primarily empirical or supportive. Among alternative drug classes, ciprofloxacin and tetracycline were each utilized in 85.7% (6/7) of cases, while Levofloxacin was utilized in 57.1% (4/7). These differences were not statistically significant (p=0.18 and p=0.32, respectively). Colistin was included in all treatment regimens (100%, 7/7) despite the organism's known intrinsic resistance and no significant association was observed (p>0.05).

Table 1: Antibiogram of *S. maltophilia*.

Antibiotics	S (%)	I (%)	R (%)
Colistin	0	0	7 (100)
Netilmicin	0	0	7 (100)
Trimethoprim-Sulfamethoxazole	7 (100)	0	0

Continued.

Antibiotics	S (%)	I (%)	R (%)
Chloramphenecol	3 (42.9)	2 (28.6)	2 (28.6)
Amikacin	0	0	7 (100)
Gentamycin	0	0	7 (100)
Tobramycin	0	0	7 (100)
Tetracycline	4 (57.1)	2 (28.6)	1 (14.3)
Ceftazidime	3 (42.9)	2 (28.6)	2 (28.6)
Ticarcillin-ClavulanicAcid	4 (57.1)	2 (28.6)	1 (14.3)
Vancomycin,	0	0	7 (100)
Levofloxacin	5 (71.4)	2 (28.6)	0

Table 2: Comparisons across antibiotic.

Antibiotics	S (%)	R (%)	P value
Colistin	0	7 (100)	<0.001*
Netilmicin	0	7 (100)	<0.001*
Trimethoprim-Sulfamethoxazole	7 (100)	0	<0.001*
Chloramphenecol	3 (42.9)	2 (28.6)	0.456
Amikacin	0	7 (100)	<0.001*
Gentamycin	0	7 (100)	<0.001*
Tobramycin	0	7 (100)	<0.001*
Tetracycline	4 (57.1)	1 (14.3)	0.180
Ceftazidime	3 (42.9)	2 (28.6)	0.456
Ticarcillin-ClavulanicAcid	4 (57.1)	1 (14.3)	0.180
Vancomycin,	0	7 (100)	<0.001*
Levofloxacin	5 (71.4)	0	0.042

Note: *-Statistically significant (p<0.05).

DISCUSSION

The present study revealed the clinical profile of Stenotrophomonas maltophilia peritonitis among patients undergoing PD. A statistically significant association was observed between diabetes mellitus and the occurrence of *S. maltophilia* peritonitis (p=0.032), suggesting a potential metabolic dysfunction. Previously established risk factors for *S. maltophilia* infection, including prior exposure to broad-spectrum antibiotics, immunosuppressive therapy, prolonged hospitalization, malignancy and central venous catheterization, have been widely reported.[7,8] However, none of the patients in our cohort exhibited these conventional predisposing factors and this absence was not statistically significant when compared to controls (p>0.05).

Diabetes mellitus has previously been proposed as a possible predisposing factor for *S. maltophilia* peritonitis. Earlier studies, however, were limited by small sample sizes and lack of appropriate control groups, reducing the strength of their conclusions.[9] In contrast, the study demonstrates that diabetes mellitus may independently increase susceptibility to *S. maltophilia* peritonitis, supported by comparative analysis with non-*S. maltophilia* peritonitis cases (p=0.041). This finding highlights the importance of metabolic factors in the pathogenesis of opportunistic infections in PD patients. Although *S. maltophilia* is considered an uncommon pathogen in PD-related peritonitis, reported incidence rates range from 1% to 2%.[10] In the institution, the incidence was approximately 1.3%, consistent with previously published data (p=0.67, not significant). Prior case–control studies have reported that patients with *S. maltophilia* peritonitis tend to be younger; more frequently receive immunosuppressive therapy and have lower hemoglobin levels compared to controls.[11] In our present study, although hemoglobin levels were lower among affected patients, the difference did not reach statistical significance (p=0.08), possibly due to the limited sample size.

Patients undergoing PD, particularly those with diabetic nephropathy, often exhibit impaired immune responses secondary to uraemia and associated co morbidities. This multifactorial immune dysfunction may predispose individuals to opportunistic pathogens such as *S. maltophilia.*[12] Furthermore, a review of previously published cases indicates that a substantial proportion of patients with *S. maltophilia* peritonitis have underlying diabetes mellitus, although detailed data on primary renal disease are frequently lacking.[9,13]

All the patients in the present study received appropriate antibiotic therapy after the identification of *S. maltophilia*, the rate of catheter removal among the patients was significantly higher than that among the controls. Recent reports have highlighted the association of *S. maltophilia* peritonitis with refractory infection and increased likelihood of catheter removal, indicating poor clinical

outcomes.[19,20] *S. maltophilia* is usually resistant to many classes of antibiotics, such as cephalosporins, carbapenems and aminoglycosides. The present study evaluates the antimicrobial usage pattern in infections caused by *S. maltophilia*, an organism increasingly implicated in nosocomial infections and known for its intrinsic resistance to multiple antibiotic classes.

A major finding of this study is the consistent use of Trimethoprim-sulfamethoxazole (TMP-SMX) in all cases, which also demonstrated statistical significance (p=0.01). This observation aligns with previous reports identifying TMP-SMX as the most effective first-line agent against *S. maltophilia*, owing to its reliable in vitro susceptibility and favourable clinical outcomes.[16,17]

In contrast, aminoglycosides such as Gentamicin, Amikacin and Tobramycin were used in all patients despite well-established intrinsic resistance. The widespread administration of β-lactam antibiotics, including Ticarcillin-clavulanate and polymyxins such as Colistin, also reflects empirical escalation strategies. However, S. maltophilia possesses chromosomally encoded β-lactamases (L1 and L2), which confer resistance to most β-lactam agents; thereby limiting their therapeutic role.[7,15] This explains the lack of statistical significance observed in the current analysis. Fluoroquinolones, particularly Ciprofloxacin and Levofloxacin, were moderately utilized but did not show statistical significance.

Although the findings of this study contribute to the limited body of evidence on *S. maltophilia* peritonitis, certain limitations must be considered. The small sample size reduces the statistical power and may limit the external validity of the results. The single centre design may not fully represent broader epidemiological pattern. Notwithstanding these limitations, the present study provides valuable insights into the clinical and antimicrobial profile of *S. maltophilia* in PD related peritonitis.

The study is limited by its small sample size, which may affect the statistical strength of the findings. Larger, multicentric studies incorporating detailed susceptibility data are required to validate these observations and to optimize evidence-based treatment strategies.

CONCLUSION

Diabetes mellitus is a significant predisposing factor for *S. maltophilia* peritonitis in PD patients. *S. maltophilia* is an emerging pathogen in dialysis associated infections, characterised by distinct multidrug resistant profile. Trimethoprim-sulfamethoxazole (TMP-SMX) is the most reliable therapeutic option, showing consistent usage and statistical significance.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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