

Original Research Article

STENOTROPHOMONAS MALTOPHILIA AS AN EMERGING MULTIDRUG-RESISTANT NOSOCOMIAL PATHOGEN IN INTENSIVE CARE UNITS: A RETROSPECTIVE STUDY FROM A TERTIARY CARE CENTRE IN NORTH INDIA

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ABSTRACT

Background: *Stenotrophomonas maltophilia* is an inherently multidrug-resistant, non-fermenting Gram-negative bacillus that is increasingly associated with healthcare-related infections, particularly in critically ill patients.

Objectives: To investigate the epidemiology, clinical distribution, antibiotic susceptibility patterns, and minimum inhibitory concentration (MIC) profiles of *S. maltophilia* isolates obtained from ICU patients over a four-year duration.

Materials and Methods: A retrospective laboratory-based investigation was performed from January 2022 to December 2025 at a tertiary care teaching hospital. All clinical samples from the ICU that tested positive for *S. maltophilia* were included. The VITEK 2 Compact system was used to find the bacteria and assess its susceptibility to antibiotics, including finding the minimum inhibitory concentration (MIC). We followed the CLSI 2025 standards to figure out susceptibility.

Results: Out of 3843 Gram-negative isolates, 2031 were non-fermenters. Of those, 70 (3.4%) were *S. maltophilia*. Respiratory samples made up 55.71% of the isolates, and blood samples made up 31.42%. The majority of those afflicted were elderly individuals (≥ 61 years), making up 47.14%. Minocycline had the highest susceptibility (97.14%), followed by levofloxacin (91.42%) and trimethoprim-sulfamethoxazole (84.28%). The CLSI-defined susceptible ranges for minocycline and levofloxacin were well within the MIC_{50/90} values.

Conclusion: *Stenotrophomonas maltophilia* is a newly discovered pathogen that is resistant to several drugs and is mostly seen in ICU patients who are older and have chronic renal disease or ventilator-associated pneumonia. To stop more resistance from developing and enhance therapeutic outcomes, we need to do MIC-based susceptibility surveillance, rational antibiotic stewardship, and tight infection control procedures right away.

Keywords: Infectious diseases, Emerging pathogen, Antimicrobial Resistance

INTRODUCTION

Stenotrophomonas maltophilia is a Gram-negative bacillus that moves, lives in the air, does not ferment, and does not produce oxidase. It has become a major

opportunistic infection in hospitals around the world (1,2). It used to be called *Pseudomonas maltophilia* and then *Stenotrophomonas maltophilia*. Now, it is acknowledged as one of the most important non-fermenters in hospitals (3).

Currently, *S. maltophilia* is acknowledged as the third most prevalent non-fermenting Gram-negative bacillus responsible for healthcare-associated infections, behind *Pseudomonas aeruginosa* and *Acinetobacter* species^(3,4). It has been associated with several infections, including ventilator-associated pneumonia, bacteremia, urinary tract infections, meningitis, and endocarditis, particularly in immunocompromised and critically ill patients^(2,4).

It is hard to treat *S. maltophilia* infections because it is naturally resistant to several antimicrobial drugs, like carbapenems, aminoglycosides, and most β -lactams^(2,5). This resistance is caused by β -lactamases encoded in chromosomes, multidrug efflux pumps, a less permeable outer membrane, and the production of biofilms^(5,6). Resistance may sometimes emerge during therapy, complicating treatment and leading to suboptimal clinical results^(4,7).

Because *S. maltophilia* isolates are becoming more common in ICUs and there aren't many ways to treat them, local epidemiological data, MIC-based susceptibility testing, and clinical correlation are all important for guiding empirical antimicrobial therapy and antimicrobial stewardship programs^(4,8).

MATERIALS AND METHODS

Study Design and Setting

This is a retrospective study that was carried out over a four-year period (January 2022-December 2025) in the microbiology laboratory of a tertiary care teaching hospital in North India. Only isolates from ICU patients were included.

Inclusion Criteria

One clinically significant *S. maltophilia* isolate per patient

Isolates from ICU clinical samples

Exclusion Criteria

Duplicate isolates from the same patient

Non-ICU isolates

Microbiological Processing

All isolates were processed by standard microbiological procedures. Identification and antimicrobial susceptibility testing were done using the VITEK 2 Compact system (bioMérieux, India). MIC values were noted for all tested agents.

Antimicrobials Tested

Minocycline

Levofloxacin

Trimethoprim-sulfamethoxazole (TMP-SMX)

Ceftazidime (MIC generated but not interpreted)

Interpretation of Susceptibility Testing

Results of susceptibility testing were interpreted using CLSI 2025 guidelines.

RESULTS

Isolation Frequency

A total of 3843 Gram-negative bacilli were isolated during the study period, of which 2031 (52.8%) were non-fermenters. Seventy isolates (3.4% of non-fermenters) were identified as *S. maltophilia*.

Table 1: Sample-wise Distribution

Sample Type	Number (n=70)	Percentage (%)
ET aspirate	25	35.71
Blood	22	31.42
Sputum	8	11.42
Pleural fluid	6	8.57
Pus	4	5.71
Urine	4	5.71
CSF	1	1.42

Respiratory samples accounted for 55.71% of isolates.

Gender Distribution

- Male: 49 (70%)
- Female: 21 (30%)

Table 2: Age-wise Distribution

Age Group (years)	Number	Percentage (%)
0-15	3	4.28
16-30	9	12.85
31-45	9	12.85
46-60	16	22.85
≥61	33	47.14

Table 3: Antimicrobial Susceptibility Pattern

Antimicrobial	Sensitive (n)	Sensitivity (%)
Minocycline	68	97.14
Levofloxacin	64	91.42
TMP-SMX	59	84.28

Table 4: MIC Distribution

Antimicrobial	MIC Range ($\mu\text{g/mL}$)	MIC ₅₀	MIC ₉₀
Minocycline	<0.5 – 4	1	2
Levofloxacin	0.5 – 2	1	2
TMP-SMX	<20 – 160	38	76

Annual Trend of Isolation

A progressive increase in the isolation of *S. maltophilia* was noticed from 2022 to 2025, signifying its increasing relevance as an ICU-associated pathogen.

DISCUSSION

The present study highlights the growing significance of *Stenotrophomonas maltophilia* as a notable multidrug-resistant nosocomial pathogen in intensive care units, primarily affecting elderly patients with various underlying comorbidities. Consistent with prior research, the present study indicates that most *S. maltophilia* isolates were derived from respiratory and blood specimens, thereby reaffirming the pathogen's strong correlation with ventilator-associated pneumonia and bacteremia in critically ill patients^(5,10,12). One of the most relevant clinical findings in the current study was that patients with underlying chronic kidney disease (CKD) were disproportionately affected, followed by those with ventilator-associated pneumonia. Chronic kidney disease (CKD) is a significant risk factor for *S. maltophilia* infection due to its correlation with recurrent hospitalisations, frequent exposure to broad-spectrum antibiotics, the utilisation of indwelling vascular access devices, and immunological suppression resulting from uremia^(1,14,15). Individuals with chronic kidney disease (CKD) are especially vulnerable to bacteremia induced by *S. maltophilia*, and the prognosis is frequently unfavourable due to the limited availability of effective antimicrobial drugs and the modified pharmacokinetics of antibiotics^(1,15).

Ventilator-associated pneumonia was the second most common clinical presentation among our isolates, as shown by the vast number of isolates collected from endotracheal aspirates and other respiratory sources. The ability of *S. maltophilia* to build biofilms on ventilator circuits, endotracheal tubes, and respiratory equipment is a key element in its persistence and virulence in mechanically ventilated patients^(11,16). This phenomenon has also been documented in multicentric studies, indicating that respiratory tract infections constituted approximately half of all *S. maltophilia* infections in

ICUs^(12,17). In keeping with global trends, our *S. maltophilia* isolates exhibited significant intrinsic resistance, retaining susceptibility solely to minocycline, levofloxacin, and trimethoprim-sulfamethoxazole^(5,6,12). MIC tests indicated that the MIC₅₀ and MIC₉₀ values for minocycline and levofloxacin fell within the susceptibility ranges established by CLSI, confirming their efficacy as therapeutic drugs in our setting.

Trimethoprim-sulfamethoxazole, once considered the preferred medication, exhibited varied MIC distribution, emphasising the significance of MIC-based reporting over categorical susceptibility reporting^(4,8). Ceftazidime has historically been employed for the treatment of *S. maltophilia* infections; however, its clinical efficacy has diminished due to the inherent resistance given by the inducible L2 serine β -lactamase^(6,18). The CLSI 2025 guidelines do not include interpretive breakpoints for ceftazidime against *S. maltophilia*, indicating a weak link between in vitro susceptibility and clinical efficacy. In the present investigation, ceftazidime MIC values were acquired by an automated system; however, they were excluded from susceptibility testing due to the absence of validated interpretive breakpoints, rendering ceftazidime an unreliable treatment option. The emergence of *S. maltophilia* is significantly associated with the widespread utilisation of broad-spectrum antibiotics, especially carbapenems, which exert selective pressure on intrinsically resistant bacteria^(4,12). MIC-based susceptibility reporting aids antibiotic stewardship by enabling tailored therapy and prompt de-escalation. *S. maltophilia* is known to thrive in moist hospital environments, such as ventilator circuits, humidifiers, and water systems. Therefore, strict adherence to hand hygiene practices, ventilator bundles, environmental surveillance, and timely removal of invasive devices is required^(7,11,17).

Limitations

- Study at a single center
- Study in the past
- No analysis of molecular resistance
- No data on clinical outcomes or deaths

CONCLUSION

Stenotrophomonas maltophilia is an emerging multidrug-resistant nosocomial pathogen of increasing clinical significance in intensive care units. In the present investigation, infections predominantly occurred in older, critically sick patients with pre-existing chronic renal disease, followed by those with ventilator-associated pneumonia (VAP), highlighting the significant correlation of this pathogen with severe underlying comorbidities and invasive supportive treatment.

The high number of respiratory and bloodstream isolates shows that the organism can live in an ICU and cause serious infections in people who have been in the hospital for a long time, have intrusive devices, and have already been exposed to broad-spectrum antimicrobials. Minocycline and levofloxacin exhibited exceptional in vitro activity with favourable MIC distributions, but trimethoprim-sulfamethoxazole demonstrated inconsistent susceptibility, underscoring the significance of MIC-based reporting. Without verified CLSI breakpoints and clinical efficacy, ceftazidime should not be regarded as a dependable treatment for *S. maltophilia* infections. Early identification, meticulous clinical correlation—particularly in individuals with chronic renal disease and ventilator-associated pneumonia—and the judicious use of antimicrobials are crucial for enhancing outcomes.

To stop *S. maltophilia* from spreading and showing up more in intensive care units, we need to keep an eye on it, have good antimicrobial stewardship programs, and follow stringent infection control rules.

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