Int.J.Curr.Microbiol.App.Sci (2022) *11*(03): 211-217

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 11 Number 03 (2022)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2022.1103.025

Prevalence of *Stenotrophomonas maltophilia* in Cancer Patients at a tertiary care hospital

Gaurav Salunke* and Sanjay Biswas

Department of Microbiology, Tata Memorial Hospital, Homi Bhabha National Institute, Mumbai, Maharashtra, India

**Corresponding author*

Keywords

S. maltophilia, Levofloxacin, Cotrimoxazole, Ceftazidime, Minocycline

Article Info

Received:
10 February 2022
Accepted:
25 February 2022
Available Online:
10 March 2022

A B S T R A C T

S. maltophilia is an environmental bacterium, which poses an upcoming threat to Immune suppressed individuals globally. An emerging resistance to Cotrimoxazole (drug of choice), is a serious concern in clinical practice. The aim of the study was to determine the prevalence of *S. maltophilia* in cancer patients at a tertiary care hospital. This retrospective study was conducted from microbiological data collected from January 2020 to December 2021. Routine antimicrobial susceptibility testing to Cotrimoxazole, Levofloxacin, Ceftazidime and Minocycline was also performed. A total of 181 isolates of *S maltophilia* were studied. 64.4% were males and in all individuals with more than 45 years of age were most affected. It was most susceptible to Minocycline (96.7 %) and least susceptible to Cotrimoxazole (61.9%). *S. maltophilia* is an emerging global opportunistic pathogen in cancer patients with limited treatment options.

Introduction

Stenotrophomonas maltophilia (*S. maltophilia)* is a catalase positive, oxidase negative, gram-negative bacilli, that produces acid from maltose but not lactose (hence the name *"maltophilia"*). It is known to be pervasive in almost any aquatic or humid environment and on plants (Adegoke *et al.*, 2017) The organism tends to colonize the toilets, water coolers, medical equipment, respiratory tract patients, intravascular catheters and ulcers (Brooke, 2012; Guyot *et al.*, 2013). Although it is not considered to be a highly virulent pathogen, *S. maltophilia* is associated with various types of hospital-acquired and community-acquired infections like endocarditis, wound infections, cellulitis, bacteremia, urinary tract infections, pneumonia and rarely meningitis. (Adegoke *et al.*, 2017; Crum *et al.*, 2002; Senol, 2004). Chronic diseases, immunodeficiency state, extended use of antibiotic, prolonged hospital stay, renal failure, and catheterization pose important risk for acquiring

these infections[5]. Treatment of *S. maltophilia* infections is also challenging due to resistance across many antibiotic groups, most commonly most common of β-lactam antibiotics, fluoroquinolones and aminoglycosides (CLSI; Gajdács and Urbán, 2019; Watson *et al.,* 2018).

Cotrimoxazole was considered the drug of choice for the treatment of *S. maltophilia* infection, but strains resistant to this agent have been increasingly reported. For this reason, World Health Organization has also labeled it as one of the most concerning multidrug-resistant (MDR), nosocomial pathogens worldwide (Gajdács, 2019; Spengler *et al.,* 2017).

The aim of this study was to determine the prevalence of infections caused by *S. maltophilia* at a tertiary-care cancer hospital, to assess the resistance trends associated with this pathogen and to compare our findings with results of other studies from the international literature.

Materials and Methods

The study was conducted in the Department of Microbiology at Tata Memorial Hospital, Mumbai. A two year (January 2020 to December 2021) retrospective analysis of *Stenotrophomonas maltophilia* isolated from patient samples received in the laboratory was done.

To collect the data, the Institutional laboratory information system records were searched for the designated time period. Only if *S maltophilia* was isolated in significant colony count, then it was included in the study. The samples isolates were considered separate if *S maltophilia* were detected from the same patient but from a different anatomical site.

No more than 1 isolate from the same site, in the same patient was included in the study. Collection of data confined to demographic characteristics (age, sex, sample type and diagnosis) was also considered in the study. The study was absolved from ethics review by the institutional review board, and informed consent was nonobligatory as data anonymity was maintained.

Processing of Microbial Sample

Patient samples were collected aseptically and sent to the Microbiology laboratory. On receipt, the specimens were immediately cultured on Blood agar, Mac Conkey agar and Chocolate agar, followed by incubation for 24 – 48 hours at 37 ° C. For bacterial identification of *S maltophilia* and susceptibility testing to Cotrimoxazole, Levofloxacin and Minocycline, VITEK 2 Compact ID/AST (bioMérieux, Marcy-l'Étoile, France) was used. Susceptibility to Ceftazidime was determined by Disk diffusion test (30 mcg Ceftazidime disc) on conventional Mueller–Hinton (MH) agar, using the Kirby Bauer Technique; as per the guidelines set by to the Clinical and Laboratory Standards Institute (CLSI).

Statistical Analysis

Data for statistical analyses was prepared using Microsoft Excel 2013 (Microsoft Corp, Redmond, Washington). SPSS software version 24 (IBM SPSS Statistics for Windows 24.0; IBM Corp Armonk, New York) was used to perform the statistical analyses.

Results and Discussion

A total of 181 *S maltophilia* isolates were identified (67 in 2020, 114 in 2021) from various samples between 2020 and 2021. The affected patients presented with a definite male preeminence (female-to-male ratio: 0.35; 64.64 % male).

This trend was constant across 2020 and 2021. The median age of the affected patients was 53 years (range: 1 - 96 years). The age distribution of the patients in 2020 & 2021 is shown in graph 1. In the two years, 28.18% of *S. maltophilia* were isolated in the age group of 55- 64 years, followed by 45 – 54 years (22.65 %) and 65 – 74 years (13.81 %).

Abdominal Drain fluid and Bile were the most common samples type (28.73%), followed by Broncho Alveolar Lavage (BAL) and sputum (27.07%) and pleural fluid (16.02 %), Table 1. The largest amount of isolates originated from the Gastrointestinal cancer unit (30.94 %), followed by Thoracic Cancer unit (19.34 %) and Head Neck Cancer unit (12.71%).

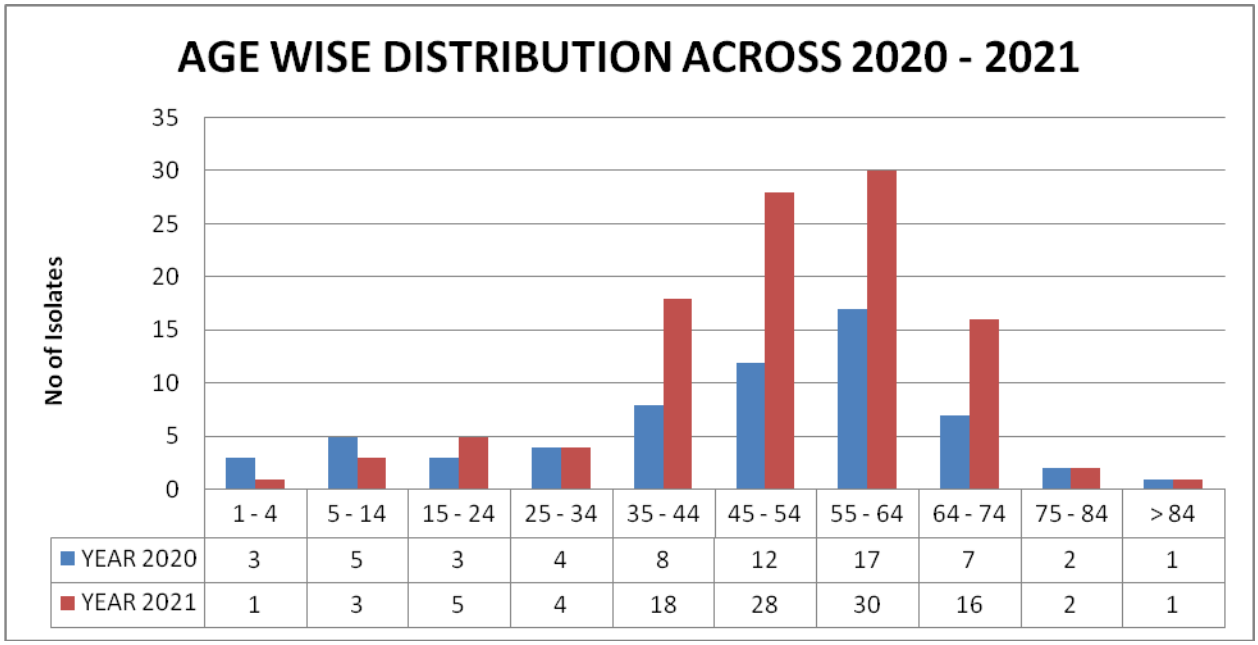
Graph 2, shows that during the 02 -year period, 96.7 % of *S maltophilia* were susceptible to Minocycline, 87.3% were sensitive to Levofloxacin, 68.5 % were sensitive to Ceftazidime and 61.9 % were susceptible to Cotrimoxazole. The sensitivity has been fairly consistent across the two years. Over the last decade, *S maltophilia* has become an eminent candidate in the race of MDR, nosocomial pathogens. Although its numbers may be infrequent, the organism causes significant mortality/ morbidity in certain patient populations, particularly in individuals who are severely debilitated or immune suppressed (Adegoke *et al.,* 2017; Crum *et al.,* 2002). Similar to others studies, Teo *et al.,* 2006 we also found a numerical increase in *S. maltophilia* infections in our institute (67 in 2020, 114 in 2021).

In agreement with the results of other studies, also found that most of the affected patients in our study were in the age group of 35 – 74 years (81.22 %), with an observed male dominance in the patient population. This can be explained by the fact that, males tend to be more involved in activities in the outdoors/aquatic environments, thus putting them at higher risk of contracting *S. maltophilia*. (Guyot *et al.,* 2013) Aging is accompanied by the decline in function of lymphoid and non-lymphoid tissues involved in the host immune response; which explains why 45.38% of the isolates in patients with more than 55 years of age. Very little is known on how a patient acquires *S. maltophilia.* The mucosal surfaces of the respiratory tract; the lower gastrointestinal tract and oral cavity may act as reservoirs for the organism. (Looney *et al.,* 2009; Aitken *et al.,* 2020) Treatment in cancer patients involves extensive and prolonged surgery, resulting in disruption of anatomic barriers, and chemotherapy/ Radiation related neutropenia. (Metan *et al.,* 2006) In view of neutropenia, these patients are subjected to prolonged antibiotics prophylactically and empirically. (Ko *et al.,* 2019) This induces emergence of ESBL-positive strains and to counter them Carbapenem group of drugs are started.

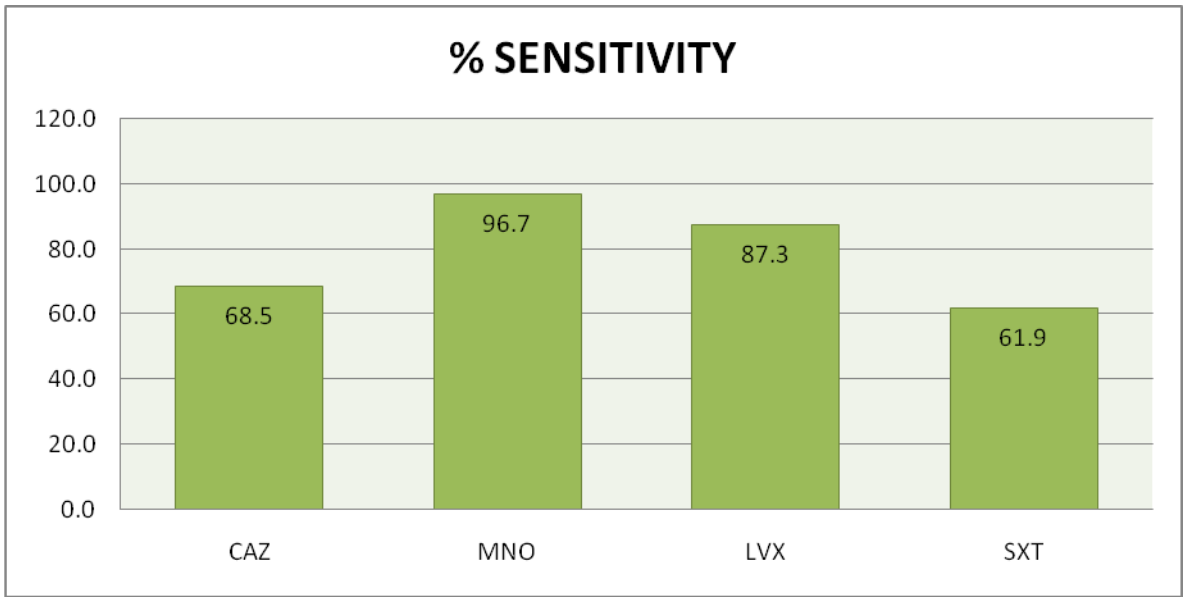
Table.1 Specimen wise distribution of isolates *of S. maltophilia*

Specimen type	Number of isolates	%
Abdominal fluid/ Drain/ Bile	52	28.73
Broncho-alveolar lavage/ Sputum	49	27.07
Pleural fluid	29	16.02
Blood	19	10.50
Urine	10	5.52
Abscess/ Aspirate/ Pus	8	4.42
Wound	7	3.87
Tissue	6	3.31
Cerebrospinal fluid	1	0.55
Total	**181**	

Graph.1 Age wise distribution of isolates *of S. maltophilia* across 2020 – 2021



Graph.2 Antibiotic sensitivity profile in *S. maltophilia*



The whole cycle itself, further creates more pronounced selection pressure, feeding the rise of organisms like *S maltophilia*. (Benkő *et al.*, 2016) From our results, we have noted an increase in the isolation rate of *S maltophilia* from gastrointestinal samples and respiratory samples. Our patients sometimes present late to seek therapy, whereby the cancer is at an advanced stage, with metastases and obstruction as the likely presentation. The presence of any obstruction in itself favors the growth of organisms like *S maltophilia*. (Singhal *et al.*, 2017)

Antibacterial therapy for *S. maltophilia* infections can be challenging. Antibiotics commonly used for

empirical treatment of documented infections by other *Gram*-negative organisms in febrile neutropenia; do not act against *S. maltophilia*. It is inherently resistant to β-lactams (presence of zinc-containing penicillinase, L1 and Cephalosporinase, L2), (Avison *et al.,* 2001) Amioglycosides (aminoglycoside acetyl-transferase) (Li *et al.,* 2003) and quinolones (efflux pumps). (Zhang *et al.,* 2001) Spontaneous mutations in outer-membrane proteins (OMP) are also known to occur. (Nicodemo and Paez, 2007) In the past, Cotrimoxazole exhibited the most reliable in vitro activity against *S. maltophilia;* hence it was tipped to be the drug of choice. Other drugs like Levofloxacin, Ceftazidime or Minocycline would serve as potential alternatives to Cotrimoxazole. (Chang *et al.,* 2015) But today of great concern is the burgeoning resistance to these antibiotics. Resistance to Cotrimoxazole varies globally, from 27% in Spain and 10 – 15% in Turkey (Europe) to more than 25% in Taiwan and 30% - 48% in China (Asia). A study by Masgala *et al.,* (2010) has reported 24% resistance to Ceftazidime in isolates of *S. maltophilia.*Few reports from Eastern Europe have reported 8.9 % resistance towards Levofloxacin (Brooke, 2014; Gajdács and Urbán, 2019)

During this study, it was observed that 31.8% of the isolates were resistant to Cotrimoxazole, 31.5% resistant to Ceftazidime, 12.7 % resistant to Levofloxacin and 3.3% resistant to Minocycline. Resistance was also more commonly seen amongst the isolates recovered from respiratory and gastrointestinal samples. The resistance rates to Cotrimoxazole, Ceftazidime and Levofloxacin among the *S. maltophilia* isolates, reported in our study were considerable higher than the global rates. Even more surprising was the 3.3% resistance to Minocycline, which is a newer finding. This can be explained by the fact that an advanced stage of the disease, extensive surgery, chemotherapy and neutropenia together has prompted extensive use of Carbapenems in these patients. This has created antibiotic selection pressure, resulting in selection of mutations and evolution of efflux pumps and altered ribosomal binding sites, (Roberts, 2011) thus rendering the antibiotics ineffective.

Clinicians should be apprised of the fact that breakthrough infections by *S. maltophilia* are increasing and may occur during the course of broad-spectrum antibiotics, especially following prolonged use of Carbapenem. Taking note of increased resistance against Cotrimoxazole; Levofloxacin, Ceftazidime or Minocycline alone or in combination may be considered as substitute options.

Acknowledgement

The authors would like to thank Shamita Binod and Virendra Jaiswar for the excellent laboratory assistance during the routine diagnostic work

Statements and Declarations

Funding

The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Competing Interests

The authors have no relevant financial or non-financial interests to disclose

Author Contributions

All authors contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript. The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

References

Adegoke A A, Stenström T A, Okoh A I. *Stenotrophomonas maltophilia* as an emerging ubiquitous pathogen: looking beyond contemporary antibiotic therapy.

Front Microbiol. 2017;8:2276

Aitken S L, Sahasrabhojane P V, Kontoyiannis D P, Savidge T C, Arias C A, Ajami N J, *et al.*, Alterations of the Oral Microbiome and Cumulative Carbapenem Exposure are Associated with *Stenotrophomonas maltophilia* Infection in Patients With Acute Myeloid Leukemia Receiving Chemotherapy. *Clin Infect Dis* (2020) 72(9):1507–13

Avison M B, Higgins C S, von Heldreich C J, *et al.*, Plasmid location and molecular heterogeneity of the L1 and L2 beta-lactamase genes of *Stenotrophomonas maltophilia*. Antimicrob Agents Chemother 2001; 45:413.

Benkő R, Matuz M, Hajdú E. *et al.*, [Antibiotic use in the Hungarian hospitals in the last two decades (1996-2015)]. *OrvHetil*. 2016;157(46):1839–1846

Brooke J S. New strategies against *Stenotrophomonas maltophilia*: a serious worldwide intrinsically drug-resistant opportunistic pathogen. *Expert Rev Anti Infect Ther*. 2014;12(1):1–4

Brooke, J. S. *Stenotrophomonas maltophilia*: an emerging global opportunistic pathogen ClinMicrobiol Rev, 25 (1) (2012), pp. 2-41

Chang Y T, Lin C Y, Chen Y H, Hsueh P R. Update on infections caused by *Stenotrophomonas maltophilia* with particular attention to resistance mechanisms and therapeutic options. Front Microbiol 2015; 6:893.

Clinical and Laboratory Standards Institute: Performance standards for antimicrobial susceptibility testing: 28th ed.. CLSI supplement M100.

Crum, N. F., G. C. Utz, M. R. Wallace. *Stenotrophomonas maltophilia* endocarditis. Scand J Infect Dis, 34 (12) (2002), pp. 925-927

Gajdács M, Urbán E. Epidemiological trends and resistance associated with *Stenotrophomonas maltophilia* bacteremia: a 10-year retrospective cohort study in a tertiary-care hospital in Hungary. *Diseases*. 2019;7(2):E41

Gajdács M. Extra deaths due to pandrug resistant bacteria: A survey of the literature. *Egészségfejlesztés*. 2019;60:31–36.

Gajdács, M., E. Urbán. Epidemiological trends and resistance associated with *Stenotrophomonas maltophilia* bacteremia: a 10-year retrospective cohort study in a tertiary-care hospital in HungaryDiseases, 7 (2) (2019), p. 41

Guyot, J. F. Turton, D. Garner. Outbreak of *Stenotrophomonas maltophilia* on an intensive care unit. J Hosp Infect, 85 (4) (2013), pp. 303-307

Ko J H, Kang C I, Cornejo-Juarez P, Yeh K M, Wang C H, Cho S Y, *et al.*,. Fluoroquinolones Versus Trimethoprim-Sulfamethoxazole for the Treatment of *Stenotrophomonas maltophilia* Infections: A Systematic Review and Meta-Analysis. *ClinMicrobiol Infect* (2019) 25(5):546–5

Li X Z, Zhang L, McKay G A, Poole K. Role of the acetyltransferase AAC(6')-Iz modifying enzyme in aminoglycoside resistance in *Stenotrophomonas maltophilia*. J AntimicrobChemother 2003; 51:803.

Looney W J, Narita M, Muhlemann K. *Stenotrophomonas maltophilia*: An Emerging Opportunist Human Pathogen. *Lancet Infect Dis* (2009) 9(5):312–23. doi: 10.1016/S1473-3099(09)70083-0

Masgala A, Galani I, Souli M, Giamarellou HCent. Discrepancies between various methods in susceptibility testing and epidemiological analysis of *Stenotrophomonas maltophilia* clinical isolates. Eur J Public Health. 2010 Jun; 18(2):119-23.

Metan G, Hayran M, Hascelik G, Uzun O. 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

Nicodemo A C, Paez J I. Antimicrobial therapy for *Stenotrophomonas maltophilia* infections. Eur J ClinMicrobiol Infect Dis. 2007

Apr;26(4):229-37

Roberts M C. 2011. Mechanisms of bacterial antibiotic resistance and lessons learned from environmental tetracycline-resistant bacteria. In *Antimicrobial Resistance in the Environment* (ed. Keen P, Montforts MHMM). Wiley, Hoboken, NJ

Senol, E. *Stenotrophomonas maltophilia*: the significance and role as a nosocomial pathogen. J Hosp Infect, 57 (1) (2004), pp. 1-7

Singhal L, Kaur P, Gautam V. *Stenotrophomonas maltophilia*: from trivial to grievous. *Indian J Med Microbiol*. 2017;35(4):469–479

Spengler G., Kincses A., Gajdacs M., Amaral L. New Roads Leading to Old Destinations: Efflux Pumps as Targets to Reverse Multidrug Resistance in Bacteria. *Molecules.* 2017;22 doi: 10.3390/molecules22030468

Teo W Y, Chan M Y, Lam C M, Chong C Y. Skin Manifestation of *Stenotrophomonas maltophilia* Infection–A Case Report and Review Article. *Ann Acad Med Singap* (2006) 35(12):897–900

Watson, L., J. Esterly, A. O. Jensen, M. Postelnick, A. Aguirre, M. McLaughlin. Sulfamethoxazole/trimethoprim versus fluoroquinolones for the treatment of *Stenotrophomonas maltophilia* bloodstream infections J Glob Antimicrob Resist, 12 (2018), pp. 104-106

Zhang L, Li X Z, Poole K. Fluoroquinolone susceptibilities of efflux-mediated multidrug-resistant *Pseudomonas aeruginosa*, *Stenotrophomonas maltophilia* and *Burkholderia cepacia*. J AntimicrobChemother 2001; 48:549.

How to cite this article:

Gaurav Salunke and Sanjay Biswas. 2022. Prevalence of *Stenotrophomonas maltophilia* in Cancer Patients at A Tertiary Care Hospital. *Int.J.Curr.Microbiol.App.Sci.* 11(03): 211-217.
doi: https://doi.org/10.20546/ijcmas.2022.1103.025