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Original Research

Stenotrophomonas Maltophilia Infection in Cancer Patients Undergoing Major Surgery in A Tertiary Cancer Centre

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Background: We aim to study the impact of postoperative *Stenotrophomonas maltophilia* infections among cancer patients undergoing major surgery.

Methods: Ambispective, observational study. Study period from 1st November 2019 to 31st March 2024. The study population included patients with a definite diagnosis of cancer who underwent a major surgical procedure in a single, dedicated surgical unit and developed postoperative infection which showed a documented growth of *Stenotrophomonas maltophilia*. Clinical and laboratory parameters were collected and data represented as median values, percentages and range.

Results: Nine patients were identified to have *Stenotrophomonas maltophilia* infection in the postoperative period among a total of 2506 patients. Co-morbid illnesses were noted in 33.3% patients; all were nosocomial infections. Fever was a manifestation in 77.8% patients, 44.4% had leukocytosis. Of all samples, 33.3% were respiratory ones. Co-infection was noted in 44.4% patients. Sensitivity to trimethoprim-sulphamethoxazole was seen in 44.4% and to levofloxacin in 66.7% isolates. Mortality rate was 11.1%.

Conclusion: *Stenotrophomonas maltophilia* causes uncommon but clinically significant infections among cancer patients in the postoperative period.

Introduction

Stenotrophomonas maltophilia is a multi-drug resistant gram-negative bacillus and it acts as an opportunistic pathogen. Such infections are usually encountered in hospitalized patients and often result in high incidence of morbidity and mortality. The bacillus has inherent resistance to several antibiotics like carbapenems and the indiscriminate use of antibiotics may potentially make it a prominent nosocomial infection. The predisposing factors for S. maltophilia infection include in-dwelling central venous catheters, urinary catheters, mechanical ventilation, a post-surgical period, cancer, an intensive care unit (ICU) setting, use of immunosuppressive drugs and neutropenia. It can cause a wide array of manifestations ranging from pneumonia, bacteremia and sepsis, urinary tract infections, peritonitis, wound infections, cholangitis, arthritis, meningitis and endocarditis. The existing literature about this uncommon pathogen and its implication in patients undergoing major cancer surgery is limited world-wide and non-existent from our region. Our results will be a useful guide with respect to the clinical significance of this pathogen in the context described.

The aim of the study was to describe the impact of *Stenotrophomonas maltophilia* infection in the postoperative period of patients undergoing major cancer surgery. The primary objective was to estimate the clinical outcomes in terms of in-hospital morbidity and mortality associated with *Stenotrophomonas maltophilia* infection and the secondary objective was to report about the antibiotic sensitivity profile of these infections besides describing the clinical profile of the patients who had those infections.

Materials and Methods

An ambispective, observational study was done in the surgical oncology unit of a tertiary care cancer centre in North-East India during the study period from 1st November 2019 to 31st March 2024. The study population included patients with a definite diagnosis of cancer who underwent a major surgical procedure in a single, dedicated surgical unit and developed postoperative infection which showed a documented growth of *Stenotrophomonas maltophilia*. All the microbiological samples were processed by standard procedures including inoculation in blood agar and MacConkey agar plates incubated overnight at 37 degrees centigrade and all the plates were examined for visible growth (Figure 1 and 2).

Figure 1. Stetenotrophomonas in Blood Agar.

Figure 2. Stenotrophomonas in MacConkey.

The colonies were identified as per standard microbiological procedures (Figure 3).

Figure 3. Stenotrophomonas under 100x Magnification Showing Gram Negative Bacilli Pattern.

The samples of blood culture were processed in BACT/ALERT 3D (bioMérieux). The final identification of the organisms was identified using a fully automated system, VITEK 2 (bioMérieux).The antibiotic sensitivity profile was done using the same system. For data collection, microbiological and clinical data variables obtained from review of EMR and physical case records. Variables to be studied include: age, sex, co-morbidity, primary malignancy, surgery performed, presence of fever, number of days of ICU and hospital stay, outcomes including whether recovered or succumbed, specimen types, presence of co-infection, blood parameters including total leucocytic count (TLC) and differential leucocytic count (DLC) and antibiotic sensitivity profile. The results were presented with the use of median values, percentages and range. The study was approved by the Institutional Ethical Committee (IEC).

Results

Atotal of 9 patients were found to have *Stenotrophomonas maltophilia* infection in the postoperative period among the 2506 patients undergoing major oncologic surgeries in the surgical unit concerned. The median age of the patients was 54 years (range 23 to 77 years). There were five male patients and four females. Three patients had co-morbid illnesses (33.3%), other than cancer. Seven patients (77.8%) were those who had major surgery for gastrointestinal and pancreatic cancers. All nine patients had the infection while they were hospitalized. Fever was a manifestation in 77.8% patients (Table 1).

Characteristic category	Characteristics	No of patients/ Value
Median age		54 years(range 23 to 77 years)
Sex	Male	5
	Female	4
Co-morbidity	Diabetes mellitus	1
	Hypertension	1
	Idiopathic thrombocytopenic purpura	1

	Others	0
Primary malignancy	Esophageal cancer	3
	Pancreatic cancer	2
	Colon cancer	1
	Rectal cancer	1
	Breast cancer	2
Surgery performed	Esophagectomy	3
	Whipple's surgery	1
	Extended right hemicolectomy	1
	Low anterior resection	1
	Modified radical mastectomy	2
	Distal pancreaticosplenectomy and en bloc left nephrectomy andduodenojejunal flexure resection	1
Hospitalized patient	Yes	9
	No	0
Fever	Yes	7
	No	2
Median ICU stay		4 days(range 0 to 31 days)
Median hospital stay		15 days(range 0 to 42 days)
Outcome	Recovered	8
	Succumbed	1
Risk factors	In-dwelling central venous catheter	5
	Urinary catheter	8
	Mechanical ventilation	5
	ICU stay > 1 day	5

Table 1. Clinical Characteristics of the Patients.

We noted that 44.4% patients had leukocytosis and one patient (11.1%) had leucopenia. The specimens that yielded *Stenotrophomonas maltophilia* included wound swabs, blood samples, abdominal fluid (from drainage tube), pleural fluid (from pleural effusion) and tracheal swab and secretions. We found that 33.3% of positive samples were pertaining to the respiratory system (Table 2).

Test	Test categories	Value/ number of patients/ Percentage
Total leucocytic count (TLC)	Median total count	10,630 cells/mm^3 (range 1,850 to 33,710 cells/ mm^3)
	Leukocytosis	4
	Leukopenia	1
Differential leucocytic count (DLC)	Neutrophilia	8
	Eosinophilia	1
Specimen type		
Wound swab	Wound swab	2
Blood	Blood	2
Abdominal fluid	Abdominal (drain) fluid	2
Pleural fluid	Pleural fluid	1
Tracheal swab/ secretion	Tracheal swab/ secretion	2
Antibiotic sensitivity		
Levofloxacin		66.70%
Trimethoprim-sulphamethoxazole		44.40%

Table 2. Laboratory Parameters of the Patients.

It was found that the bacillus was sensitive to the antibiotic levofloxacin in 66.7% samples and it was sensitive to the antibiotic trimethoprim and sulphamethoxazole in 44.4% samples. Co-infection was noted in 44.4% of patients and these included Pseudomonas aeruginosa, Acinetobacter baumannii, Klebsiella pneumoniae and Enterococcus faecalis VRE (Vancomycin Resistant Enterococcus) (Table 3).

Surgery	Surgical complication	Specimen that yielded S. maltophilia	Co-infection	Sample yielding co-infection
Minimally invasive McKeown's esophagectomy	Pneumonia	Tracheal swab	Pseudomonas aeruginosa	Pus from neck wound
Minimally invasive McKeown's esophagectomy	Pleural effusion	Pleural fluid	Enterococcus faecalis VRE, Pseudomonas aeruginosa	Abdominal drain fluid
Whipple's pancreaticoduodenectomy	Pancreatojejunostomy anastomosis leak	Blood	None	None
Distal pancreaticosplenectomy with en bloc resection of duodenojejunal flexure and left nephrectomy	Peripancreatic collection	Abdominal fluid	None	None
Extended right hemicolectomy	Surgical site infection (SSI)	Blood	None	None
Low anterior resection	Anastomotic leak	Abdominal fluid	Acinetobacter baumannii, Klebsiella oneumoniae	Pus from abdominaldrain fluid
Modified radical mastectomy + thoraco-abdominal flap	Surgical site infection (SSI)	Wound swab	None	None
Modified radical mastectomy	Surgical site infection (SSI)	Wound swab	None	None
Minimally invasive McKeown's esophagectomy	Anastomotic leak in the neck	Tracheal secretion	Acinetobacter baumannii	Chest drain fluid

Table 3. Type of Surgical Morbidity Associated with the Infections and Co-infections.

Out of the nine patients in the study, 88.9% of them recovered with appropriate antibiotics. The patients had a median period of intensive care unit (ICU) stay of 4 days (range 0 to 31 days) and a median period of hospital stay of 15 days (range 0 to 42 days). Every patient did have surgical morbidity and one patient succumbed to sepsis (11.1% mortality).

Discussion

Stenotrophomonas maltophilia is recognized as an emerging gram-negative multi-drug resistant organism (MDRO) and an opportunistic pathogen. It is mostly described in a hospital-acquired scenario, when the patient is immunocompromised. Even though it mostly causes respiratory infections, it has the ability to present with a wide spectrum of manifestations including pneumonia and acute exacerbations of chronic obstructive pulmonary disease (COPD), bacteremia and sepsis, urinary tract infections, peritonitis, wound infections, cholangitis, cellulitis and myositis, osteomyelitis and arthritis, eye infections, meningitis and endocarditis. The predisposing factors for S. maltophilia infection include in-dwelling central venous catheters, urinary catheters, mechanical ventilation, a post-surgical period, cancer, an intensive care unit (ICU) setting, use of immunosuppressive drugs and neutropenia [1-6]. We studied a population of patients who underwent major surgery for cancer and had several of such risk factors. Cancer itself has been described as a predisposing condition and the implications of infection by this organism has been

described recently in the available literature. Cancer patients may be immunocompromised due to the debilitating disease per se or the use of chemotherapeutic agents. A major surgery also has its effect on the immune system, especially during the well-recognized phase of perioperative catabolism [7]. In our study, the median duration of ICU stay was 4 (range 0 to 31 days). Five patients had in-dwelling central venous catheters and a same number had mechanical ventilator support (55.6%).

Stenotrophomonas maltophilia was first isolated in 1943 as Bacterium bookeri and was subsequently named Pseudomonas maltophilia, then Xanthomonas maltophilia and eventually, the present nomenclature [8, 9]. The organism is often isolated from aqueous-associated sources like water-treatment and distribution sources, sinkholes, tap water, contaminated chlorhexidine-cetrimide antiseptic solutions, irrigating solutions, hand-washing soaps etc. It has a special ability to adhere to plastic and produce biofilms, such as in intravenous cannulae and catheters, nebulizers and prosthesis [5] [10-14].

Stenotrophomonas maltophilia has intrinsic resistance to carbapenems and prior history of use of these agents is implicated in selection pressure for this pathogen [15-20]. Trimethoprim-sulfamethoxazole has been often viewed as the antimicrobial agent of choice, but resistance has increasingly been reported [21-24]. In our study, only 44.4% of the isolates were sensitive to this antibiotic. The susceptibility to alternative antimicrobial agents is often explored [25-28]. Sensitivity to levofloxacin was seen in 66.7% of isolates in our study. In certain situations, combination therapy or alternative routes of drug administration such as in aerosol form for pulmonary infections may be considered [29].

The crude mortality rate for patients with infection with this pathogen has been reported within the range of 14 to 69%. In our series, one patient succumbed to the infection (11.1%). A systematic review has highlighted that a significantly higher mortality occurs in patients treated with an initially inappropriate antibiotic, 61% as opposed to 30%. And, up to 37.5% of mortality was found to be attributable to *Stenotrophomonas maltophilia* infections. [30] From our series, we can note that outcomes of S. maltophilia infections have been varied, with two patients who had skin wound infections having a clinically non-significant course even with multi-drug resistance to the pathogen, whereas those with abdominal and thoracic cavity infections or bloodstream infections, especially in the presence of an adverse risk factor or an underlying serious surgical complication, having a significant clinical course. This re-iterates the fact that clinicians should not underestimate the clinical significance of these infections. In conclusion, *Stenotrophomonas maltophilia* infections, even though unusual, causes serious clinical manifestations with high morbidity and mortality rates and requires pinpoint antimicrobial therapy in view of several resistance patterns. These are opportunistic hospital-acquired infections which occur in patients with one or more adverse risk factors. Such risk factors become very prominent for patients being treated for cancer. The judicious use of currently available antimicrobial agents known as Antimicrobial Stewardship with pro-active hospital infection control policies will go a long way in curbing this menace.

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Competing interests

None

Author contributions

Author contributions: Both authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Amrita Talukdar and Gaurav Das. The first draft of the manuscript was written by Amrita Talukdar and Gaurav Das. Both authors read and approved the final manuscript.

Data availability

The datasets generated during and analysed during the current study are available with the corresponding author on reasonable request and are not available publicly as per the permissions obtained from Institutional Ethics Committee (IEC).

Ethics Approval

This study was performed in line with the principles of the Declaration of Helsinki and the Indian Good Clinical Practice. Approval was granted by the Institutional Ethics Committee.

Consent to participate

Waiver of consent was obtained from the Institutional Ethics Committee by virtue of this being a retrospective and observational study using de-identified patient information and variables already present in the hospital information system.

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