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Research Article

Stenotrophomonas maltophilia Infections in Geriatric Patients

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ABSTRACT

We present *Stenotrophomonas maltophilia* infections in 317 hospitalized patients in a large health network over a 3-year period. The majority of patients were elderly. Most infections were polymicrobial: respiratory 95.2%, wound 91%, urinary 80.8% and blood 64.3%. Younger patients were small in number and were more common in those with otitis externa, infections from injection drug use and those with line infections. Most deaths were in patients with terminal conditions and polymicrobial infections and mortality could not be directly attributed to *Stenotrophomonas maltophilia*. None of the sputum, bronchial, urinary or wound culture positive patients had positive blood cultures. Only blood (14/317) or ear (7/317) culture positive patients had significant numbers of younger individuals with only 3 out of 14 over age 50 in blood culture positive patients and 1/7 in those with otitis externa. Those with bacteremia included patients with injection drug use, chronic pain syndromes and vascular catheter infections. 94% of urinary infections, 91.7% wound infections and 85.8% respiratory isolates were in those above age 50. Overwhelming majority of urinary infections were in males with drainage devices present in 75%. Recurrent infections were uncommon. Respiratory specimens were frequently associated with tracheostomies and endotracheal tubes. Most wound infections were in chronic lower extremity ulcers. Prior carbapenem use was not significant in this study. Isolates from all sites were over 98% susceptible to Trimethoprim/sulphamethoxazole.

Limitations: The study group only had 1 organ transplant and 2 cystic fibrosis patients and no burn wound infections.

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Introduction

Stenotrophomonas maltophilia is a gram-negative bacillus known for inherent resistance to antibiotics, biofilm formation, association with carbapenem use, cystic fibrosis, hospital-acquired infections, burn wounds and immunocompromised [1-13]. In our study of 317 isolates, the majority were elderly (Table 1) except ear infections and infections in injection drug users and line infections. Most infections were polymicrobial (Table 2). The wound infections were mostly chronic lower extremity infections. There was a clear association with Foley and suprapubic catheters, urinary stents, tracheostomies and endotracheal tubes. Very few patients received prior carbapenems. The attributable mortality was low in our study (Tables 3 & 4) in contrast to prior reports

with rates as high as 37.5% [14, 15]. Such overestimates are probably due to inadequate attention given to polymicrobial infections and serious underlying conditions (Tables 5 & 6) that contributed to deaths that were not adequately assessed.

Methods

We retrospectively studied 317 infections and clinical presentation of patients with laboratory reported *Stenotrophomonas maltophilia* positive cultures admitted to our health network during the 30 months ending in December 2018. The age of patients ranged from 1-98 (Table 1). The specimens were respiratory (105,62M/43F), wound (84,38M/46F), urinary (52,39M/13F), blood (14,7M/7F) and other sites. MALDI-TOF MS (matrix assisted laser desorption ionization-time of flight mass

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spectrometry) was used by the laboratory to identify the isolates. The charts were manually studied for the clinical presentation, sites of infections, prior antibiotic use, antibiotic susceptibilities and mortality.

Table 1: Age of *Stenotrophomonas maltophilia* patients.

Site of infection	Total	Age range	Percentage over age 50
Sputum	107	3-94	85.8%
Wound	84	14-98	91.7%
Urine	52	43-98	94.2%
Blood*	14	1-87	21.4%

*vascular catheter infections 4/14, chronic pain syndrome 3/14, injection drug use 2/14.

Results

I Wound Infections [16]

Seventy six out of 84 (91%) infections were polymicrobial (Table 2). All except 7/84 (8.3%) were over 50 years old (Table 1). The majority (48/84) 57% were lower extremity wounds. Predominant comorbid conditions included diabetes mellitus (29), chronic non-healing lower extremity ulcers (23), morbid obesity (12), chronic kidney disease (8) and peripheral vascular disease (6). None had positive blood cultures. The most common prior antibiotics were cephalexin 12, vancomycin 6, ciprofloxacin 6, amoxicillin/clavulanate 6, doxycycline 5, cefazolin 5 and ceftriaxone 3. Only 1 had received meropenem. The most common mixed infections included methicillin susceptible *Staphylococcus aureus* 22, methicillin resistant *Staphylococcus aureus* 7, group B *Streptococcus* 9, *Escherichia coli* 7, *Enterobacter cloacae* 7, *Klebsiella oxytoca* 6, *Pseudomonas aeruginosa* 5, and mixed skin bacteria 14. Most isolates were trimethoprim / sulphamethoxazole (TMP/SMX) susceptible (98.8%), with levofloxacin 97.6%, ticarcillin /clavulanate 53.6% and ceftazidime 46.4%.

Table 2: Polymicrobial infections.

Site of infection	Total	Percentage of Polymicrobial infections
Sputum	107	95.2%
Wound	84	91%
Urine	52	80.8%
Blood	14	64.3%

II Urinary Infections [17]

All *S. maltophilia* urinary infections were in older patients in the present study. The youngest was 43. Only 3 patients were below 50. (94.2% over age 50). The majority were males (75%). Most infections were polymicrobial 42/52 (80.8%) with 60% gram negative (Table 7). Significant co-morbidities were present in 94.2%. Drainage devices were present in 75%; suprapubic catheter 13, Foley catheter 20, nephrostomy tube 4, intermittent catheterization 1, condom catheter 1. Recurrent or persistent infections were uncommon (4%). None had positive blood cultures for *S. maltophilia*. The attributable mortality was not significant, with no deaths in close proximity to the culture date (Table 4). Prior carbapenem exposure did not play a role. The majority were susceptible to TMP/SMX (98%) with levofloxacin 87%, ceftazidime 76% and ticarcillin/ clavulanate 69%.

Table 3: Deaths during the 3-year study period.

Culture source	Total deaths	Deaths within 3 months of culture date	Death possibly associated with <i>S. maltophilia</i>
Blood	1/14	1 (advanced pulmonary sarcoidosis on palliative care)	0
Sputum / bronchial	31/107	18 (majority polymicrobial with more invasive bacteria)	6
Urine	10/52	2 (see Table 4)	0
Wound	12/84	6 (majority polymicrobial with more invasive bacteria)	1

Table 4: Deaths in patients with urinary isolates during the study period.

Age	Sex	Underlying conditions	Time to death from culture date	Organisms in culture
91	M	COPD, CKD, BPH	2 years	<i>S. maltophilia</i> , <i>Enterococcus</i> sp.
85	M	Dementia, CHF, BPH, COPD, CDI	7 months	<i>S. maltophilia</i> , <i>Escherichia coli</i> , <i>Proteus mirabilis</i>
94	F	Dementia, CHF, CKD, bilateral hydronephrosis	2 years	<i>S. maltophilia</i>
79	M	Lung Cancer, COPD, DM2, AF	9 months	<i>S. maltophilia</i> , <i>Candida</i> sp.
82	M	High grade prostate cancer, AKI, palliative cystectomy, nephrostomy, post-operative respiratory failure	2 months	<i>S. maltophilia</i> , <i>Acinetobacter baumannii</i>
72	F	Metastatic vaginal cancer, CDI, bilateral hydronephrosis, common bile duct obstruction. <i>Proteus</i> bacteremia	1 year	<i>S. maltophilia</i> , <i>Candida</i> sp.
72	M	Colon cancer, cerebro-vascular accident	10 months	<i>S. maltophilia</i> , <i>Enterococcus faecalis</i> , <i>Achromobacter</i> sp.
94	M	BPH, urinary infection	7 months	<i>S. maltophilia</i> , <i>Pseudomonas aeruginosa</i> , coagulase negative <i>Staphylococcus</i>
61	F	Metastatic carcinoma of the appendix	6 months	<i>S. maltophilia</i> , <i>Klebsiella oxytoca</i>
88	M	<i>Pseudomonas</i> pneumonia, empyema, acute respiratory failure, end stage renal disease	16 days (palliative care)	<i>S. maltophilia</i> , <i>E coli</i> , <i>P aeruginosa</i>

COPD: Chronic Obstructive Pulmonary Disease; CKD: Chronic Kidney Disease; BPH: Benign Prostatic Hypertrophy; CHF: Congestive Heart Failure; CDI: *Clostridioides Difficile* Infection; DM2: Diabetes Mellitus Type 2; AF: Atrial Fibrillation; AKI: Acute Kidney Injury.

Table 5: Organisms in polymicrobial infections of deceased *S. maltophilia* sputum culture positive patients.

<i>Pseudomonas aeruginosa</i>	10
methicillin susceptible <i>Staphylococcus aureus</i>	1
methicillin resistant <i>Staphylococcus aureus</i>	2
<i>Haemophilus influenzae</i>	1
<i>Enterobacter cloacae</i>	3
<i>Escherichia coli</i>	1
<i>Achromobacter xylosoxidans</i>	2
Mixed bacterial growth and yeasts (<i>Candida albicans</i> +/- <i>C. glabrata</i>)	4
Mixed oral bacteria	7
<i>Aspergillus fumigatus</i>	1
<i>Mycobacterium avium</i>	1
<i>Klebsiella pneumoniae</i>	1
<i>Acinetobacter bereziniae</i>	1
<i>Moraxella catarrhalis</i>	1

III Respiratory Infections

Majority were polymicrobial 100/105 (95.2%) (Table 2). Most were elderly 89/105 above age 50 (Table 1). Majority had significant co-morbidities (Table 6). Deaths were in patients with advanced cancer, terminal chronic obstructive lung disease and terminal amyotrophic lateral sclerosis and muscular dystrophy. Some were on hospice care. Only one patient (1/33) who died had a monomicrobial sputum culture for *Stenotrophomonas maltophilia*. Foreign body associations included 15 with tracheostomies 40 intubated with endotracheal tubes. None had positive blood cultures. Susceptibilities were: TMP/SMX 100%, Levofloxacin 98% and ceftazidime or ticarcillin/clavulanic acid approximately 25%.

Table 6: Co-morbidities in 107 *S. maltophilia* sputum positive patients.

Terminal cancer	10
End stage chronic obstructive lung disease	3
End stage amyotrophic lateral sclerosis	3
Ischemic bowel	2
End-stage muscular dystrophy	1
Anoxic brain injury	1
Tracheostomy	17
Endo-tracheal tube / ventilator	40
Polymicrobial growth in sputum culture	100

IV Blood Infections

There were 14 with positive blood cultures, 5 monomicrobial and 9 polymicrobial. The organisms in polymicrobial infections included *Enterobacter cloacae* x 4, *Klebsiella pneumoniae*, *Acinetobacter lwoffii*, *Pseudomonas putida*, *Delftia acidovorans*, *Chryseobacterium gleum*, *Chryseobacterium* sp., *Klebsiella oxytoca*, *Candida parapsilosis*, *Aerococcus* sp., *Staphylococcus haemolyticus* and *Peptoniphilus harei*. The ages of patients were younger (1, 23, 30, 30, 31, 39, 47, 47, 47, 48, 49, 63, 70, 87) with only 3 above age 50. In cases where the source was identified, infections were associated with vascular line infections (3), dialysis catheter infections (1), injection drug use (2) and chronic pain syndromes (3). All 14 patients had co-morbidities (advanced sarcoidosis,

non-healing abdominal wound, opioid dependence, pancytopenia, leg cellulitis, alcoholism, injection drug use, nephrotic syndrome, pyloric stenosis, septic arthritis, diabetic ketoacidosis with coma, Alzheimer’s dementia and respiratory failure).

V Other Infections

Seven patients had ear infections, 5 monomicrobial in contrast to polymicrobial predominance in other sites. Only one patient was elderly (age 74). Other patients were younger (ages 5, 9, 9, 13, 13, 33) with otitis externa associated with swimming. Co-morbidities were not reported for any patient in this group.

Discussion

Our study shows that *Stenotrophomonas maltophilia* is predominantly found in elderly patients (Table 1) with the exception of bacteremia and ear infections. It is significantly associated with foreign materials such as foley catheters, suprapubic catheters, urinary stents, tracheostomies and endotracheal tubes. Monomicrobial infections were uncommon (Table 2). *S. maltophilia* was almost always found in association with other organisms, most of which were more invasive (Tables 4, 5 & 7). Lack of invasiveness of the organism is seen by the absence of bacteremia in patients with urinary, respiratory and wound infections and absence of the organism in repeated blood cultures even with no treatment in some cases [18]. Majority of patients except those with ear infections had severe underlying diseases. Majority of urinary tract infections were in males due to higher number of male patients with drainage devices. The attributable mortality was low (Table 4) [18, 19].

Table 7: Organisms found in polymicrobial urinary infections.

<i>Enterococcus faecalis</i>	11
<i>Escherichia coli</i>	9
<i>Pseudomonas aeruginosa</i>	9
<i>Candida</i> sp.	7
Coagulase negative <i>Staphylococcus</i>	3
<i>Klebsiella oxytoca</i>	3
Methicillin susceptible <i>Staphylococcus aureus</i>	2
<i>Pseudomonas putida</i>	2
<i>Citrobacter koseri</i>	2
<i>Citrobacter freundii</i>	1
<i>Pantoea</i> sp.	1
<i>Achromobacter</i> sp.	1
Methicillin resistant <i>Staphylococcus aureus</i>	1
<i>Acinetobacter baumannii</i>	1
<i>Staphylococcus capri</i>	1
<i>Proteus mirabilis</i>	1
Mixed growth	5

The organism was highly susceptible to TMP/SMX with > 98% with a minimal inhibitory concentration less than 2/38. For those who cannot tolerate TMP/SMX, levofloxacin is the best alternative. Ceftazidime or ticarcillin/clavulanate could be used if susceptibilities are known. In our series, respiratory isolates had the highest resistance to these two drugs (approximately 25%), but over half were susceptible at other sites. Prior carbapenem use was not significant in our patients.

Conclusion

The majority of *Stenotrophomonas maltophilia* infected patients were elderly (Table 1). Most infections were polymicrobial (Table 2). Many patients had serious underlying co-morbidities (Tables 4 & 6). The overwhelming majority of urinary infections were in males (39/52). Association with foreign materials was frequent in urinary (75%) and respiratory infections (53.2%) (Table 6). Due to the association with serious underlying diseases and polymicrobial infections, only few deaths could be directly attributed to *S. maltophilia* (Tables 3, 4, 5 & 6). None of the patients with wound, urinary or respiratory isolates had a positive blood culture. Of 14 blood culture positive patients none had more than one positive culture. When the blood cultures were repeated, *Stenotrophomonas maltophilia* was not present with or without treatment. Prior carbapenem use did not play a significant role in our patients. The study limitations include low numbers of organ transplant (1) and cystic fibrosis (2) patients and no burn wound infections.

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Competing Interests

None.

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