The prevalence and outcome of Stenotrophomonas maltophilia bacteraemia over a 5 year period at tertiary care in Saudi Arabia

Ali Amer Al Shehri (1)
Bader Ibrahim Asiri (2)
Khalid Mousa Asiri (3)
Mohammad Abdullah Albakkar (3)
Salmah Muidh Ali Alharbi (4)
Saeed Saad Alqahtani (3)
Sultan Ahmad Alkahtani (5)
Yahya Mohammed Aloosh (3)

(1) Infectious Disease and Internal Medicine Consultant
(2) Internal Medicine Senior Registrar
(3) Internal Medicine Registrar
(4) ORL-HNS resident
(5) Chief of Microbiology, Pathology Department, AFHSR

Corresponding author:
Ali Amer Al Shehri
Infectious Disease and Internal Medicine Consultant
Email: aaas1400@hotmail.com

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Abstract

Objective: To identify bacteraemia of Stenotrophomonas maltophilia, susceptibilities, and which antibiotic was used.

Methods: A record-based retrospective study was conducted on those who were admitted to Armed Forces Hospital Southern Region – Khamis Mushet, Saudi Arabia, during the period from January 2017 until January 2021 and who had positive blood culture for Stenotrophomonas maltophilia during admission.

Results: We collected data from 34 patients with mean age of 65.4 years old (SD=19.9). Moreover, we found that 73.5 % of the patients were males. Intubation was reported among 61.8 % of the patients with mean duration of 12.6 days. Moreover, tracheostomy was reported in 35.3 % of the patients with mean duration of 52.5 days. Single antibiotic regimen was applied in 67.6 % of cases while two-antibiotics regimen was applied in 32.4 % of them. Ceftazidime was used in 55.9 % of the patients, levofloxacin was used only in 23.5 % of the patients and trimeth/sulfa was used in 41.2 % of the patients. According to susceptibility tests, ceftazidime showed the highest level of resistance (27.3 %) and trimeth/sulfa showed the highest level of sensitivity

Conclusion: We found that our drug of choice is trimeth/Sulfa when considering treatment of positive patients with S. maltophilia. Stenotrophomonas incidence is common in patients with comorbidities than the normal population.

Keywords:
Stenotrophomonas maltophilia bacteraemia, prevalence, outcome

Conclusion

Stenotrophomonas maltophilia (S. maltophilia) is one of the Gram-negative bacilli, nonfermenting group that is universal in nature with a higher estimation in aquatic environments and on plants [1]. Stenotrophomonas maltophilia is catalase positive and oxidase negative bacteria, and it uses maltose to produce acid, so named "maltophilia" [2,3]. Stenotrophomonas maltophilia can survive on abiotic sides in clinical settings because of its charged cell wall surface and biofilm production. This includes central venous catheters, nebulizers, disinfectant and hand-washing solutions, circuits of ventilators, solutions for haemodialysis, endoscopes, tap water, and showerheads) [4–6]. This bacterium is often responsible for nosocomial infections, particularly in intensive care units (ICUs) [7–9]. Before the 1980s, there have been few details of the isolation of this microorganism in the context of human infections [10].

In the case of S. maltophilia bacteraemia, they usually comes from colonized/infected lungs, a CVC-infection or the gastrointestinal tract. Risk factors for bacteraemia include many and different items such as long hospitalization period, mechanical ventilation, admission to the intensive care unit (ICU), severe neutropenia and/or mucositis, many original diseases (haematological malignancy), corticosteroid therapy, cytotoxic chemotherapy or radiotherapy, recent surgical intervention, receiving broad-spectrum antibiotics, total parenteral nutrition (TPN), besides history of identified S. maltophilia colonization [11–13]. S. maltophilia is a significant factor in morbidity and mortality, with the associated mortality of bacteraemia thought to be around 20–70% [9,14].

The management of S. maltophilia bacteraemia is challenging due to the bacteria's widespread intrinsic and induced antimicrobial resistance [15]. Various molecular mechanisms of resistance have been known and incorporate ß-lactamase production against ß-lactam antibiotics, multidrug efflux pumps, the plasmid-encoded gene against quinolones, and the presence of class 1 integrons, known to be responsible for resistance to TMP/SMX [15].

Methodology

A record-based retrospective study was conducted by exploring all records of adult patients who were admitted to Armed Forces Hospital Southern Region – Khamis Mushet, Saudi Arabia, during the period from January 2017 until January 2021. A total of 34 adult patients were included. They had positive blood culture for Stenotrophomonas maltophilia during admission to the hospital, were aged 14 years or more and have complete data on records. Patients' records were reviewed for patients' bio-demographic characteristics, when blood culture was positive and the susceptibilities, which antibiotic was used and when blood culture was negative. The study was done after ethical approval.

Table 1: Patients' baseline characteristics

		Count	Column N %
Gender	Male	25	73.5%
	Female	9	26.5%
DM	Yes	24	70.6%
	No	10	29.4%
HTN	Yes	25	73.5%
	No	9	26.5%
IHD	Yes	7	20.6%
	No	27	79.4%
Malignancy	Yes	1	2.9%
	No	33	97.1%
immunosuppressive dis.	Yes	1	2.9%
	No	33	97.1%
CRD	Yes	18	52.9%
	No	16	47.1 %

Results

In this study, we collected data from 34 patients with mean age of 65.4 years old (SD=19.9). Moreover, we found that 73.5 % of the patients were males. The most prevalent medical condition among patients was hypertension (73.5 %) followed by diabetes mellitus (70.6 %) and chronic respiratory disease (52.9 %) (Table 1).

Among patients, we found that 70.6 % of the patients needed central line with mean duration of 21.5 days. Intubation was reported among 61.8 % of the patients with mean duration of 12.6 days. Moreover, tracheostomy was reported in 35.3 % of the patients with mean duration of 52.5 days. Furthermore, 52.9 % of the patients had end-stage renal failure (ESRD) and needed hemodialysis while no patients were ESRD on CAPD. Moreover, 73.5 % of patients were admitted to the ICU and 8.8 % of them needed surgical intervention while bed sores were reported in 26.5 % of them (Table 2). Single antibiotic regimen was applied in 67.6 % of cases while two- antibiotics regimen was applied in 32.4 % of them. Three antibiotics were found to be used among patients including ceftazidime (used in 55.9 % of the patients), levofloxacin (used only in 23.5 % of the patients) and timeth/sulfa which was used in 41.2 % of the patients. According to susceptibility tests, ceftazidime showed the highest level of resistance (27.3 %) and trimeth/sulfa showed the highest level of sensitivity (Table 3).

Table 2: The general characteristics of patients during the period of admission

		Count	Column N %
Central line	Yes	24	70.6%
	No	10	29.4%
Duration of central line (days)	Mean (SD)	21.5	8.87
Intubation	Yes	21	61.8%
	No	13	38.2%
Duration of intubation (days)	Mean (SD)	12.6	4.83
Tracheostomy	Yes	12	35.3%
	No	22	64.7%
Duration of tracheostomy (days)	Mean (SD)	52.5	57.64
ESRD on HD	Yes	18	52.9%
	No	16	47.1%
ESRD ON CAPD	Yes	0	0.0%
	No	34	100.0%
ICU admission.	Yes	25	73.5%
	No	9	26.5%
Surgical procedure	Yes	3	8.8%
	No	31	91.2%
Bed sores	Yes	9	26.5%
	No	25	73.5%

Table 3: Characteristics of used antibiotics			
Single antibiotic	Yes	23	67.6%
	No	11	32.4%
Combined antibiotic	Yes	11	32.4%
	No	23	67.6%
Ceftazidime	Yes	19	55.9%
	No	15	44.1%
Levofloxacin	Yes	8	23.5%
	No	26	76.5%
Trimeth/Sulfa	Yes	14	41.2%
	No	20	58.8%
Susceptibility to ceftazidime	Sensitive	20	60.6%
	Intermediate	4	12.1%
	Resistant	9	27.3%
Susceptibility to levofloxacin	Sensitive	25	83.3%
	Intermediate	4	13.3%
	Resistant	1	3.3%
Susceptibility to trimeth/Sulfa	Sensitive	30	90.9%
	Intermediate	0	0.0%
	Resistant	3	9.1%

Moreover, we found that the mean duration of admission for the patients was 93.3 days with standard deviation (86.6 days). Furthermore, we found that the mean period between positive and negative culture result was 16.4 days (SD=11.7). We found no significant difference between single or combined antiobiotic on time between – ve and + ve results or duration of hospitalization. The only significant difference was found between using or not using Trimeth/Sulfa where the using of Trimeth/Sulfa had significant impact on reducing the time needed for having negative results (Table 4).

Table 4: The difference between the use of different antibiotic medication on time between -ve and + ve tests and duration of hospitalization					
		Time between -ve and + ve results		Duration of admission	
		Mean	P-value	Mean	P-value
Single antibiotic	Yes	15.06	0.460	93.77	0.963
	No	18.78		92.27	
Ceftazidime	Yes	16.88	0.798	89.39	0.783
	No	15.56		97.93	
Levofloxacin	Yes	15.83	0.869	108.62	0.573
	No	16.58		88.36	
Trimeth/Sulfa	Yes	11.75	0.03*	77.79	0.023*
	No	18.59		104.68	

According to Table 5, we found that having ESRD on HD or being admitted to ICU did not have significant impact on resistance to antibiotics. Considering resistance to any type of antibiotics, we found that patients who were admitted to ICU showed a slightly higher percentage of resistance to antibiotics (56 % compared with 33.3 % of those who were not admitted to ICU). Higher resistance rate among patients who were admitted to ICU was against ceftazidime (29.2 %) while the high sensitivity was found for trimeth/Sulfa.

Table 5: The impact of admission to ICU or having EDRD on HD on the sensitivity of used antibiotics.

		ESRD on HD				ICU adm.			
		Yes		No		Yes		No	
		Count	Column N %	Count	Column N %	Count	Column N %	Count	Column N %
Any type of resistance	No	9	50.0%	8	50.0%	11	44.0%	6	66.7%
	Yes	9	50.0%	8	50.0%	14	56.0%	3	33.3%
	P-value	1.000				0.244			
Susceptibility to ceftazidime	Sensitive	9	50.0%	11	73.3%	14	58.3%	6	66.7%
	Intermediate	3	16.7%	1	6.7%	3	12.5%	1	11.1%
	Resistant	6	33.3%	3	20.0%	7	29.2%	2	22.2%
	P-value	0.378				0.904			
Susceptibility to levofloxacin	Sensitive	15	100.0%	10	66.7%	17	77.3%	8	100.0%
	Intermediate	0	0.0%	4	26.7%	4	18.2%	0	0.0%
	Resistant	0	0.0%	1	6.7%	1	4.5%	0	0.0%
	P-value	0.05*				0.336			
Susceptibility to trimeth/Sulfa	Sensitive	16	88.9%	14	93.3%	22	91.7%	8	88.9%
	Intermediate	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Resistant	2	11.1%	1	6.7%	2	8.3%	1	11.1%
	P-value	0.658				0.805			

Discussion

S. maltophilia bacteraemia is considered one of the relatively rare conditions, however it is a life-threating infection, that could cause high significant mortality. In this study, we collected data from 34 patients who were positive for S. maltophilia bacteraemia. We found that the main comorbidities associated with infection were hypertension and diabetes mellitus. However, some previous studies showed that the infection is associated with surgical intervention and heavily immunosuppressed patients [1–4]; only 2.9 % of our patients were immunosuppressed. Moreover, our study showed that most complications of the infection were the using of central line followed by intubation, and ESRD using HD.

There are not many antimicrobial options for treatment of the infections due to S. maltophilia because of the extensive resistance to most antibiotics related with this infection including β-lactam antibiotics, cephalosporins, macrolides, aminoglycosides, and carbapenems [16,17]. The results of this study showed that trimeth/Sulfa showed the highest level of susceptibility against S. maltophilia while Ceftazidime showed the highest level of resistance. In a previous study conducted by Rajkumari N et al., the authors showed that maximum resistance was found in co-trimoxazole (68.7%) in S. maltophilia [9]. According to study of Wang et al., trimeth/Sulfa is recognized as the drug of choice in treatment of this infection [18]. Moreover, study of the Chung et al., showed that resistance against trimeth/Sulfa is different cross different regions but mostly lower than 10 % [19]. In a previous study, the global surveillance data in the period between 1997-2012 showed that this bacteria continues to be highly sensitive to trimeth/sulfa [15]. In the study of Ebara et al., the retrospective epidemiological characterization of two medical hospitals was accomplished: the related susceptibility rates of S. maltophilia were 87.5% for trimeth/sulfa and 75.5% for levofloxacin [20]. In a retrospective, single-centre study in Japan, covering eight years, Hotta el al. recognized fifty-four cases of clinically related S. maltophilia bacteraemia, with trimeth/sulfa resistance levels around 18.0% and 100.0% minocycline susceptibility [21].

One of the most effective antibiotics among β-lactam drugs against S. maltophilia is ceftazidime as well as ticarcillin/clavulanate. However, many previous studies including our study found that the resistance rates of ceftazidime is more than 30 % with a decrease in the susceptibility with ceftazidime from 47-75 % during the period between 1997 and 1999 to 30.5-36.8 % during the period between 2009-2012 [22–24]. Novel fluoroquinolones display improved potency against S. maltophilia than ceftazidime or ticarcillin/clavulanate and have become sensible alternatives. However, a comparison of data from worldwide SENTRY studies exposes a reduction in sensitivity of S. maltophilia to levofloxacin, from 83.4% during the period 2003–2008 [23] to 77.3% in 2011 [25]. Low susceptibility rates ranging from 64–69.6% have also been reported in Canada [26], China [27,28], and Korea [19]. Few multi-center studies have investigated the efficacy of fluoroquinolones against S. maltophilia in patients with UTIs. In a SMART study conducted in the Asia-Pacific region, isolates of S. maltophilia from patients with UTIs showed exceptionally high rates of resistance to levofloxacin (33.3%) [29].

Among healthcare settings which are considered high-risk infection settings, Intensive care unit (ICU) is considered an epicentre of infections. Patients who are admitted to ICU are known to be vulnerable to infections as they are exposed to different invasive procedures including intubation, vascular access, mechanical ventilation as well as need for some drugs including sedatives and muscle relaxants which also increase the risk for infections [30]. In our analysis, we found that admission to ICU did not significantly affect the sensitivity of the antibiotics. However, the literature review reported many studies which showed that most patients admitted to ICU showed high resistance to antibiotics [31–33]. Moreover, our results showed that trimeth/Sulfa still has the highest level of sensitivity against S. maltophilia among ICU patients.

In conclusion, we found that our drug of choice is trimeth/Sulfa when considering treatment of positive patients with S. maltophilia. Stenotrophomonas incidence is common in patients with comorbidities than in the normal population.

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