Antimicrobial Susceptibility Profiles of Bacterial Isolates from Bloodstream Infections of Transplant Recipient Patients

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SENTRY ANTIMICROBIAL SURVEILLANCE

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ABSTRACT

Background:

Transplant recipient patients (TRP) are at increased risk for bloodstream infections (BSI), and the increased use of broad spectrum antimicrobials as prophylactic agents in this specific population may exert an effect over susceptibility (S) rates of BSI pathogens. We analyzed S profiles of BSI isolates from two distinct groups: TRP and non-TRP.

Methods:

From 1997-2006, a total of 21,401 isolates were collected from BSI as part of the SENTRY Program in Latin America (LA). A total of 1% of all BSI isolates (n=204) were recovered from TRP. S testing by broth microdilution method was undertaken according to CLSI guidelines.

Results:

E. coli (EC) and *S. aureus* (SA) were the most frequently isolated pathogens, respectively, from TRP (18.6%) and non-TRP (21.8%) followed by (TRP/non-TRP): SA (16.6%)/EC(17.7%), CoNS (11.2%/12.8%), *K. pneumoniae* (KP; 10.7%/8.8%), and *P. aeruginosa* (9.8%/7.0%). 62.7% of TRP BSI were caused by Gram-negative bacilli (GNB). Decreased S rates were noticed for EC and KP for almost all antimicrobial agents tested among TRP in comparison to non-TRP. ESBL-producing EC and KP isolates were also more frequently observed among TRP, as shown in the table:

	MIC_{50}/%S			
	BSI-*E. coli*		BSI-*K. pneumoniae*	
Antimicrobial agents	TRP	non-TRP	TRP	non-TRP
Cefepime	≤0.12/92.1	≤0.12/94.7	0.25/68.2	≤0.12/73.0
Ceftazidime	≤1/89.5	≤1/94.0	1/59.1	≤1/64.7
Ceftriaxone	≤0.25/89.5	≤0.25/92.0	≤0.25/54.5	≤0.25/60.0
Amikacin	≤4/100.0	2/95.6	≤4/81.8	2/69.2
Ciprofloxacin	0.06/73.7	≤0.03/80.0	≤0.03/81.8	0.06/81.5
Imipenem	0.12/100.0	0.12/100.0	0.25/100.0	0.25/99.8
Piperacillin/tazobactam	2/92.1	2/93.3	4/68.2	4/69.2
ESBL producing (%)	13.2	10.3	50.0	46.6

Conclusions:

GNB still represent an important etiology of BSI among TRP in LA. Decreased S rates to most agents were observed among EC and KP collected from TRP in comparison to those of non-TRP. Moreover, when EC and KP were identified as the cause of BSI in TRP, these isolates had a higher prevalence of the ESBL phenotype than those isolated from non-TRP.

INTRODUCTION

Bloodstream infections (BSIs) are a major cause of morbidity and mortality in transplant recipient patients (TRP). Patient characteristics, administration of immunosuppressive drugs, and antimicrobial prescription practices have a significant impact on infectious complications among TRP. Moreover, in immunosuppressed hosts, colonizing organisms may cause local infections and further disseminate through the bloodstream.

The prophylactic use of broad spectrum antimicrobial agents in this group of patients may adversely affect the antimicrobial susceptibility patterns of these BSI pathogens. In the current study, we analyzed susceptibility profiles of BSI isolates collected from two distinct epidemiological groups: TRP and non-TRP, as part of the SENTRY Antimicrobial Surveillance Program in Latin America (1997-2006).

MATERIALS AND METHODS

Bacterial strains: A total of 21,401 consecutive, non-duplicate isolates were collected from BSI of patients hospitalized in Latin American (LA) medical centers in the 1997-2006 period. The medical centers were located in Argentina, Brazil, Chile, Colombia, Mexico and Uruguay. Overall, 1% of all BSI isolates (n=204) were recovered from TRP. All isolates were identified at the participating institution by routine methodologies in use at each laboratory. Upon receipt at the monitoring laboratory (JMI Laboratories, North Liberty, IA, USA), isolates were subcultured to ensure viability and purity. Confirmation of species identification was performed with the Vitek system (bioMerieux Vitek, Hazelwood, MO) or conventional methods, as required.

Susceptibility testing: All isolates were susceptibility tested by broth microdilution methods as described by the Clinical and Laboratory Standards Institute (CLSI) guidelines. MIC panels were produced by TREK Diagnostics (Cleveland, OH). Results were interpreted according to CLSI document M100-S17 (2007) for all agents. Concurrent quality control was performed using the following organisms: *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853 and *Staphylococcus aureus* ATCC 29213. Isolates of *E. coli* and *Klebsiella pneumoniae* with increased MIC values (≥2 µg/ml) for ceftazidime and/or ceftriaxone and/or aztreonam were considered as extended-spectrum-ß-lactamase (ESBL)-producing phenotypes. Production of ESBL was confirmed by disk approximation tests and/or Etest (AB BIODISK, Solna, Sweden) for inhibition by clavulanic acid.

RESULTS

- Overall, the majority (62.7%) of bloodstream infection pathogens collected from TRP were represented by Gram-negative bacilli.

Table 1. Frequency of the main pathogens causing bloodstream infections in transplant recipient patients in Latin American medical centers, according to country of isolation (SENTRY Program, 1997 - 2006).

	No. of strains (%):						
Organism	Argentina	Brazil	Chile	Colombia	Mexico	Uruguay	Total
E. coli	13 (14.8)	12 (17.4)	5 (29.4)	1 (14.3)	7 (35.0)	-	38 (18.6)
S. aureus	15 (17.0)	12 (17.4)	3 (17.6)	2 (28.5)	1 (5.0)	1 (33.3)	34 (16.6)
CoNS	10 (11.3)	6 (8.7)	2 (11.8)	2 (28.5)	3 (15.0)	-	23 (11.3)
K. pneumoniae	11 (12.5)	8 (11.6)	-	1 (14.3)	1 (5.0)	1 (33.3)	22 (10.8)
P. aeruginosa	6 (6.8)	8 (11.6)	3 (17.6)	-	3 (15.0)	-	20 (9.8)
E. cloacae	7 (8.0)	1 (1.4)	1 (5.9)	1 (14.3)	1 (5.0)	-	11 (5.4)
A. baumannii	4 (4.6)	4 (5.8)	1 (5.9)	-	1 (5.0)	-	10 (4.9)
E. faecalis	4 (4.6)	2 (2.9)	-	-	-	-	6 (3.0)
S. maltophilia	3 (3.4)	3 (4.3)	-	-	-	-	6 (3.0)
Others[a]	15 (17.0)	13 (18.9)	2 (11.8)	-	3 (15.0)	1 (33.3)	34 (16.6)
Total	88	69	17	7	20	3	204

a. Includes *Acinetobacter* spp. (1); *A. lwoffii* (3); *B. cepacia* (1); *C. freundii* (1); *C. jeikeium* (1); *E. faecium* (1); Group A *Streptococcus* (1); Group B *Streptococcus* (2); *K. oxytoca* (2); *L. monocytogenes* (1); *M. morganii* (2); *P. mirabilis* (3); *S. enterica* (1); *S. marcescens* (4); *S. mitis* (1); *S. oralis* (1); *S. pneumoniae* (2); *S. sanguinis* (1).

- The most frequently isolated bacterial pathogens from TRP were *E. coli* (18.6%), *S. aureus* (16.6%), and *K. pneumoniae* (10.8%; Table 1).
- Decreased susceptibility rates were noted for *E. coli* and *K. pneumoniae* isolated from TRP for nearly all antimicrobial agents tested in comparison to those isolated from non-TRP (Table 2). ESBL-producing *E. coli* and *K. pneumoniae* isolates were also more frequently observed among TRP.
- The prevalence of carbapenem (imipenem, meropenem)-resistant *P. aeruginosa* and *Acinetobacter baumannii* was also higher among isolates from TRP in comparison to non-TRP (Table 2).
- Similar oxacillin resistance rates were observed among CoNS collected from TRP (78.3%) and non-TRP (77.3%; Table 2). In contrast, an increased frequency of oxacillin-resistant *S. aureus* (MRSA) was detected among non-TRP (35.0%) in comparison to TRP (26.5%).
- Vancomycin-resistant *Enterococcus* spp. were not detected among TRP (Table 3).
- Argentinean and Brazilian medical centers contributed the majority of isolates harboring resistant phenotypes (Table 3).

Table 2. Suceptibility profile of selected antimicrobial agents against pathogens collected from bloodstream infections in transplant recipient patients (TRP) and non-TRP from Latin American medical centers (SENTRY Program, 1997 - 2006).

Antimicrobial agents	MIC_{50}/%Susceptibility (no. tested)			
	E. coli		*K. pneumoniae*	
	TRP[a] (38)	non-TRP (3762)	TRP (22)	non-TRP (1868)
Cefepime	≤0.12/92.1	≤0.12/94.7	0.25/68.2	≤0.12/73.0
Ceftazidime	≤1/89.5	≤1/94.0	1/59.1	≤1/64.7
Ceftriaxone	≤0.25/89.5	≤0.25/92.0	≤0.25/54.5	≤0.25/60.0
Amikacin	≤4/100.0	2/95.6	≤4/81.8	2/69.2
Ciprofloxacin	0.06/73.7	≤0.03/80.0	≤0.03/81.8	0.06/81.5
Imipenem	0.12/100.0	0.12/100.0	0.25/100.0	0.25/99.8
Piperacilin/Tazobactam	2/92.1	2/93.3	4/68.2	4/69.2
ESBL producing (%)	13.2	10.3	50.0	46.6
	P. aeruginosa		*Acinetobacter baumannii*	
	TRP (20)	Non-TRP (1485)	TRP (10)	Non-TRP (729)
Cefepime	8/60.0	4/68.8	16/40.0	>16/31.8
Ceftazidime	4/55.0	4/65.1	>16/40.0	>16/26.3
Amikacin	4/65.0	4/74.8	4/60.0	>32/32.5
Ciprofloxacin	0.5/60.0	0.25/62.9	2/40.0	>2/28.5
Imipenem	1/75.0	1/76.2	0.5/60.0	1/83.8
Meropenem	1/70.0	1/77.6	0.25/50.0	2/81.7
Piperacilin/Tazobactam	16/55.0	16/59.8	16/50.0	>64/24.1
Imipenem resistance (%)	25.0	16.9	40.0	14.4
Meropenem resistance (%)	20.0	17.0	40.0	15.0
	S. aureus		CoNS	
	TRP (34)	Non-TRP (4641)	TRP (23)	Non-TRP (2729)
Oxacillin	0.5/73.5	0.5/65.0	>2/21.7	>2/22.7
Ciprofloxacin	0.25/76.5	0.5/66.0	>2/47.8	0.5/53.3
Clindamycin	≤0.25/76.5	≤0.25/69.0	>2/47.8	0.25/55.2
Linezolid	2/100.0	2/100.0	1/100.0	1/99.9
Rifampin	≤0.25/75.0	≤0.25/80.5	≤0.25/66.7	≤0.25/75.7
Vancomycin	1/100.0	1/100.0	1/100.0	1/100.0
Oxacillin resistance (%)	26.5	35.0	78.3	77.3

a. TRP: Transplant recipient patients.

Table 3. Number of isolates with selected resistance phenotypes collected from bloodstream infections in transplant recipient patients (TRP) in Latin American medical centers (SENTRY Program, 1997 - 2006).

	Country of isolation						
Resistance phenotype	Argentina	Brazil	Chile	Colombia	Mexico	Uruguay	Total
Methicillin-resistant *S. aureus*	5	3	1	-	-	-	9
Methicillin-resistant CoNS	6	6	2	2	2	-	18
Vancomycin-resistant *Enterococcus* spp.	-	-	-	-	-	-	0
Imipenem-resistant *P. aeruginosa*	2	3	-	-	-	-	5
Imipenem-resistant *Acinetobacter* spp.	3	2	-	-	-	-	5
ESBL-producing *K. pneumonia*	4	5	-	1	-	1	11
ESBL-producing *E. coli*	2	-	1	-	2	-	5

CONCLUSIONS

- Gram-negative bacilli represent an important etiology of BSI among TRP in the selected Latin American countries participating in the SENTRY Program.
- Isolates causing BSI in TRP generally exhibited lower susceptibility rates when compared to those from non-TRP patients.
- Further studies evaluating the antimicrobial susceptibility of isolates collected from TRP are necessary to better understand antimicrobial resistance trends of BSI pathogens in this population.

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