Resistances in Aeromonas Species from the SENTRY Global Surveillance

J. D. Turnidge[1], J. M. Bell[1] , R. N. Jones[2], and H. Sader[2]

[1]Women's and Children's Hospital, Adelaide, Australia; [2]The Jones Group/JMI Laboratories, North Liberty, IA

Jan Bell
Women's and Children's Hospital
72 King William Road
North Adelaide, SA, Australia
Facsimile: (61-8) 8161 6051
email: bellj@mail.wch.sa.gov.au

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Introduction

Aeromonas spp. are uncommon pathogens often causing severe illness. Although they harbour specific β-lactamases, resistance to many other drugs should be low as their reservoir is environmental. We examined the resistance patterns of all *Aeromonas* spp. isolated in the SENTRY surveillance program over 5 years (1997 - 2001).

Methods

Isolates

All *Aeromonas* isolated from blood, lower respiratory tract, skin/soft tissue, urine and feces. A total of 57 laboratories from 24 countries contributed strains.

Susceptibility testing

All isolates were tested by broth microdilution using custom made panels (TREK™ Diagnostic Systems), according to NCCLS standards,[1] to over 25 antimicrobials. Strains were defined as resistant if the MIC exceeded NCCLS *Enterobacteriaceae* breakpoints for 'susceptible'[2]

Multi-resistant *Aeromonas* spp. were defined as those strains demonstrating resistance to 4 or more of the following agents: cefoxitin, ceftriaxone, ceftazidime, cefepime, ciprofloxacin, gentamicin, tetracycline, meropenem or trimethoprim/sulphamethoxazole.

Results

- A total of 258 strains were collected during the study period. Blood isolates accounted for 50% of all isolates (Figure 1)
- Over 87% of all species were either *Aeromonas hydrophila* (n=149), *A. caviae* (n=40) or *A. sobria* (n=37) (Figure 2)
- Resistance rates for the different species and regions are shown in Table 1
- Significant variation in resistance patterns were noted among species and by region
- Nalidixic acid resistance was high (49%) for *A. sobria* however no ciprofloxacin resistance was detected
- Multi-drug resistant strains were common (17%) in Latin American isolates (Figure 3). One strain of *S. salmonicida* from Venezuela was resistant to all drugs tested. It had a cefepime MIC of 16 mg/L
- Only 2% of isolates were meropenem resistant
- Ceftriaxone-resistant strains were resistant to ceftazidime and had elevated MICs to cefepime and aztreonam. Their meropenem MICs were not elevated

Figure 1.
Source of Isolates

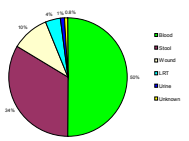


Figure 2.
Species Distribution by Region

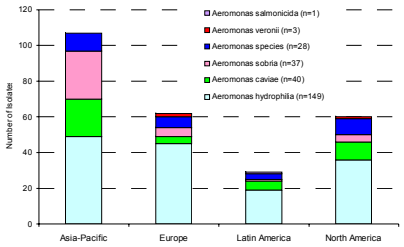
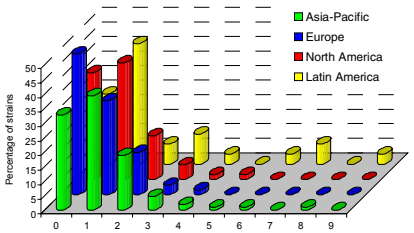


Figure 3.
Number of Resistances by Region



Results (Continued)

- There was a statistical association between tetracycline and trimethoprim/sulpha resistance (Table 3), and between ciprofloxacin and gentamicin resistance (Table 4)

Table 1. Resistance in *Aeromonas* spp. - a Global Perspective

		Number (%) of isolates resistant by species										Number (%) of isolates resistant by region									
Antimicrobial Agent	MIC (mg/L)	*A. hydrophilia* (n=149)		*A. caviae* (n=40)		*A. sobria* (n=37)		*Aeromonas* sp (n=28)		*A. veronii* (n=3)		Asia-Pacific (n=107)		Europe (n=62)		Latin America (n=29)		N. America (n=60)		Global (n=258)	
Amoxicillin/clavulanate	>8	137	(91.9)	31	(77.5)	31	(83.8)	28	(100)	2		95	(88.8)	53	(85.5)	28	(96.6)	54	(90.0)	230	(89.1)
Ticarcillin/clavulanate	>16	100	(67.1)	24	(60.0)	26	(70.3)	22	(78.6)	1		64	(59.8)	39	(62.9)	26	(89.7)	45	(75.0)	174	(67.4)
Piperacillin/tazobactam	>16	39	(26.2)	8	(20.0)	14	(37.8)	6	(21.4)	1		22	(20.6)	23	(37.1)	8	(27.6)	16	(26.7)	69	(26.7)
Cefoxitin	>8	60	(40.3)	16	(40.0)	6	(16.2)	15	(53.6)	0		46	(43.0)	18	(29.0)	13	(44.8)	21	(35.0)	98	(38.0)
Ceftriaxone	>8	7	(4.7)	6	(15.0)	0		4	(14.3)	0		5	(4.7)	2	(3.2)	6	(20.7)	5	(8.3)	18	(7.0)
Ceftazidime	>8	5	(3.4)	4	(10.0)	0		4	(14.3)	0		5	(4.7)	1	(1.6)	4	(13.8)	4	(6.7)	14	(5.4)
Cefepime	>8	0		2	(5.0)	0		0		0		1	(0.9)	0		2	(6.9)	0		3	(1.2)
Aztreonam	>8	2	(1.3)	2	(5.0)	0		1	(3.6)	0		1	(0.9)	1	(1.6)	3	(10.3)	1	(1.7)	6	(2.3)
Meropenem	>4	0		0		2	(5.4)	3	(10.7)	0		4	(3.7)	0		1	(3.4)	1	(1.7)	6	(2.3)
Gentamicin	>4	3	(2.0)	1	(2.5)	2	(5.4)	2	(7.1)	0		3	(2.8)	1	(1.6)	3	(10.3)	2	(3.3)	9	(3.5)
Nalidixic acid	>16	36	(24.2)	7	(17.5)	18	(48.6)	6	(21.4)	1		31	(29.0)	22	(35.5)	8	(27.6)	8	(13.3)	69	(26.7)
Ciprofloxacin	>1	2	(1.3)	2	(5.0)	0		1	(3.6)	0		1	(0.9)	1	(1.6)	3	(10.3)	1	(1.7)	6	(2.3)
Tetracycline	>4	29	(19.5)	9	(22.5)	17	(45.9)	8	(28.6)	1		39	(36.4)	12	(19.4)	10	(34.5)	4	(6.7)	65	(25.2)
Trimethoprim/sulpha	>1	23	(15.4)	3	(7.5)	9	(24.3)	6	(21.4)	1		20	(18.7)	8	(12.9)	10	(34.5)	5	(8.3)	43	(16.7)
Polymixin B	>8	28	(35.0)	0		6	(23.1)	2	(15.4)	2		30	(38.5)	2	(5.1)	2	(20.0)	2	(9.5)	36	(24.3)

Table 2.
Tetracycline vs Trimeth/sulphamethoxazole

		Tetracycline			
		≤4	8	≥8	Total
Sulpha/ trimeth	≤1	180	8	27	215
	2	13	7	23	43
	Total	193	7	50	258

Table 3. Ciprofloxacin vs Gentamicin

		Ciprofloxacin			
		≤1	2	≥4	Total
GEN	≤4	247	1	1	249
	8	4	0	0	4
	≥16	1	0	4	5
	Total	252	1	5	258

Acknowledgments

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References

1 NCCLS. Methods for Dilution Antimicrobial Susceptibility Testing for Bacteria That Grow Aerobically, 4th Ed. Approved Standard M7-A4. National Committee for Clinical Laboratory Standards, Wayne, Pa

2 NCCLS. Performance standards for Antimicrobial Susceptibility Testing; 12th Informational Supplement. M100-S12. NCCLS 20012 Wayne, Pa

Conclusions

- **Resistance patterns among *Aeromonas* species showed considerable variation**
- **Regional differences in resistance levels were also evident**
- **High frequencies of TET and SXT resistance suggest significant environmental selection pressure**
- **Possible extended-spectrum and metallo-β-lactamases were noted**