Antimicrobial Resistance Profile of *Aeromonas hydrophila* and *Aeromonas caviae* Isolated from Clinical and Environment Sources

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Introduction

Aeromonads are ubiquitous in aquatic environments and the genus consists of 36 species. *Aeromonas hydrophila and A. caviae* are commonly involved in causing human infections such as gastroenteritis, severe skin and soft tissue infection and bacteraemia [1]. Aeromonads are known to exhibit intrinsic and acquired antimicrobial resistance. Increasing usage of antimicrobials in humans, food fish and ornamental aquaculture can accelerate the development of antimicrobial resistance in this emerging human pathogen.

Objectives

Investigate the antimicrobial resistance patterns of *A. hydrophila* and *A. caviae* from clinical [2,3] and non-clinical sources [4,5,6] based on Minimum Inhibitory Concentrations.

Methods

Isolation and identification [2-6] → Microscan NM44 plates → Interpretation

	Humans	Aquatic environments	Food fish
A. hydrophila (n=36)	26	10	0
A. caviae (n=70)	40	13	17

Inoculum preparation: Prompt Inoculation System D

Incubation: 35°C 20 hours

CLSI guideline M45-A3 2015

Results – Antimicrobial resistance profiles

Species	Number of strains	Imipenem	Doripenem	Meropenem	Trimethoprim/ Sulfamethoxazole	Cefotaxime	Ceftazidime	Cefepime	Aztreonam
A.hydrophila	Clinical (n=26)	76.9%	30.8%	19.2%	38.5%	11.5%	7.7%	3.8%	3.8%
	Non-clinical (n=10)	70.0%	50.0%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%
A.caviae	Clinical (n=40)	10.0%	7.5%	5.0%	22.5%	15.0%	7.5%	5.0%	2.5%
	Non-clinical (n=30)	16.7%	16.7%	16.7%	3.0%	0.0%	0.0%	0.0%	0.0%

Discussion

- Regardless of isolation source, *A. hydrophila* (3.8% to 76.9%) exhibited higher antimicrobial resistance rate than *A. caviae* (2.5% to 22.5%).
- *A. hydrophila* clinical strains had a higher resistance rate than that of non-clinical strains towards imipenem (76.9% vs 70%) and meropenem (19.2% vs 10%) but in the opposite observation for doripenem (30.8% vs 50%).
- In contrast, *A. caviae* non-clinical strains, primarily those from tank water of ornamental fish, exhibited a higher resistance rate compared to clinical strains for imipenem (16.7% vs 10%), doripenem (16.7% vs 7.5%) and meropenem (16.7% vs 5%). None of the *A. caviae* from food fish exhibited resistance to the antimicrobials tested.
- Among imipenem-resistant strains of both species, 83.3% (30/36) strains showed resistance with a MIC $\geq$ 8 µg/*mL which is two times above the CLSI* breakpoint ($\geq$ 4µg/*mL)*. Multidrug resistance was observed in clinical strains, in three *A. hydrophila* (urine, tissue and peritoneal fluid) and one *A. caviae* (stool).

Conclusion

Our findings highlight that monotherapy of imipenem should be used with caution when treating human *Aeromonas* infection. Continued monitoring of dissemination of AMR *Aeromonas* in their potential habitats is important, to aid measures in limiting the spread of antimicrobial resistance between humans, food fish and ornamental aquaculture.

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References

[1] Chen PL, Lamy B, Ko WC.. Front Microbiol. 2016;7:793. doi: 10.3389/fmicb.2016.00793.
[2] SD Puthucheary, Puah SM, Chua KH.. PLoS One 2012.7(2);e30205. doi: 10.1371/journal.pone.0030205.
[3] Khor WC, Puah SM, Koh TH , Tan JAMA, Puthucheary SD, Chua KH.. Microbial Drug Resistance 2018;24(4):469-478, doi: 10.1089/mdr.2017.0083
[4] Khor WC, Puah SM, Tan JA, Puthucheary SD, Chua KH. Plos One 2015;10(12):e0145933. doi: 10.1371/journal.pone.0145933.
[5] Cheok YY, Puah SM, Chua KH and Tan JAMA. Acta Vet Hung. 2020;68(2):130-139.
[6] Lau TVV, Puah SM, Hon CKK, Ching FF, Tan JAMAT, Puthucheary SD, Lee PC, Chua KH.. Aquaculture Res. https://doi.org/10.1111/are.14739
[7] CLSI. Methods for antimicrobial dilution and disk susceptibility testing of infrequently isolated or fastidious bacteria. 3rd ed. CLSI guideline M45. Wayne, PA: Clinical and laboratory Standard Institute;2015