

Evaluating Resistance Patterns of LVAD-Related Pseudomonas Infections

Kelly A. Russo, MD, Jeffrey Alexis, MD, Christine Hay, MD, Samia Lopa, PhD, Lu Wang, MA, Rodolfo Alpizar-Rivas, MD
Department of Medicine, Division of Infectious Diseases, University of Rochester Medical Center

Background

Despite notable benefit of left ventricular assist devices (LVADs) as bridging or destination therapy for patients with end-stage heart failure, device-related infections occur in up to 39% of implanted patients. *Pseudomonas aeruginosa* is a common causative organism, and frequently develops resistance to commonly used antibiotics, limiting treatment options.

Study Aims

1. To determine and compare the incidence of acquired resistance (AR) of *P. aeruginosa* to four identified antibiotics: cefepime, piperacillin-tazobactam, meropenem & ciprofloxacin.
2. To determine and compare the median time to development of AR across the aforementioned antibiotics.

Methods

This single-center retrospective cohort study involved all patients with LVAD-associated *P. aeruginosa* infections between 2011-2023 treated with cefepime, piperacillin-tazobactam, meropenem, or ciprofloxacin (n = 37).

Each antibiotic course (n = 117) was associated with a pre- and post-antibiotic sensitivity. AR was defined as culture-proven, newly-developed resistance to the utilized antibiotic.

The incidence and cumulative proportion of AR were estimated using Poisson regression and Kaplan-Meier curve analysis, respectively. A marginal proportional hazards model was used to analyze time to AR between different antibiotic groups.

Results

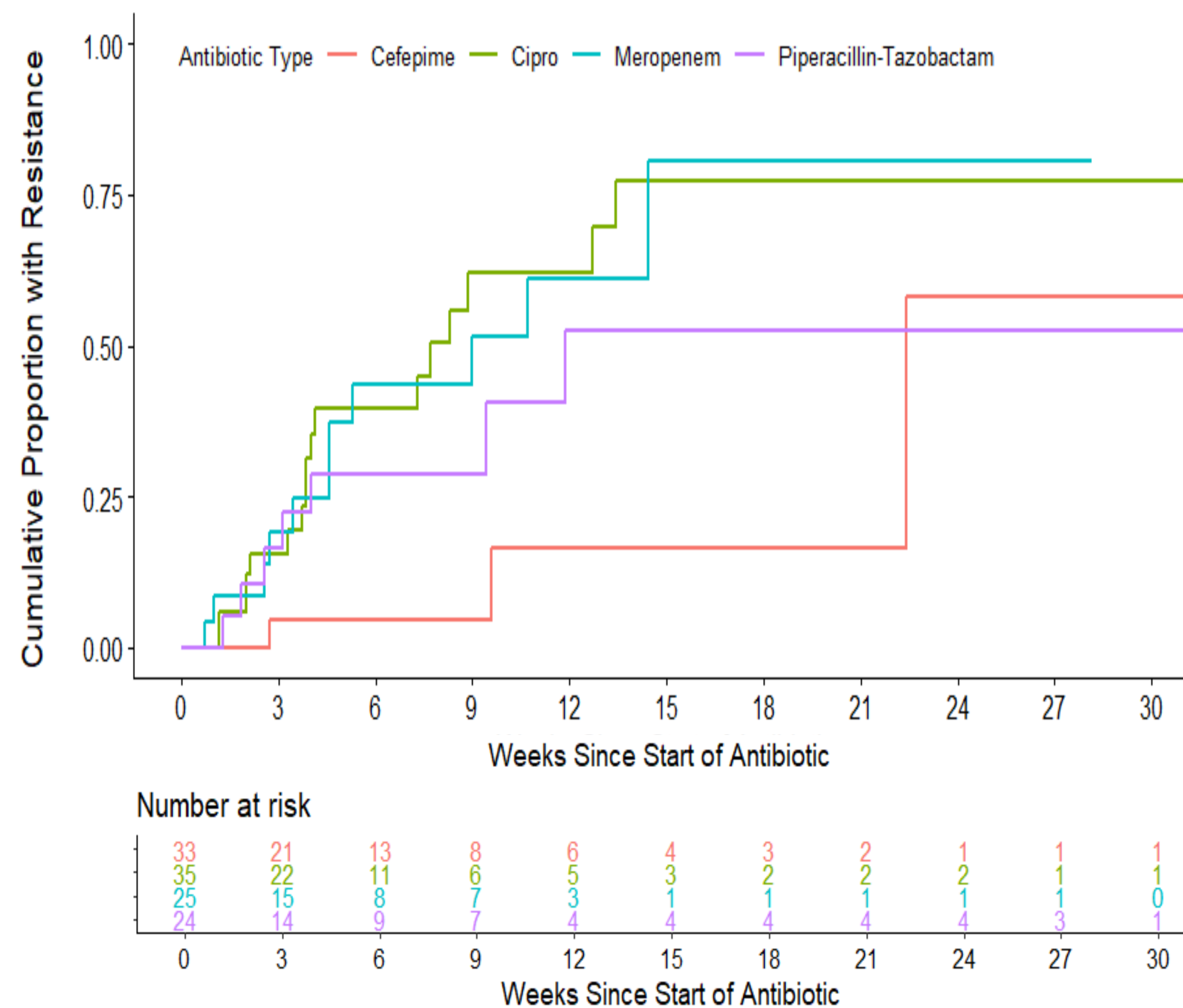


Figure 1. Kaplan Meyer curve demonstrating cumulative proportion of acquired resistance. Resistance occurs less frequently and later with cefepime (p = 0.02).



	Incidence rate (per 100 person weeks)	Confidence interval (95%)
Overall	3.9	(2.4, 6.4)
Cefepime	0.8	(0.2, 3.3)
Piperacillin-Tazobactam	3.6	(1.8, 8.0)
Meropenem	7.6	(4.1, 14.5)
Ciprofloxacin	6.4	(3.4, 12.5)

Table 1. Incidence rates of AR for cefepime, piperacillin-tazobactam, meropenem & ciprofloxacin per 100 person-weeks. Cefepime has the lowest incidence rate of AR.

	Cox proportional hazard ratio	P value
Ciprofloxacin vs. Cefepime	6.7 [1.9-22.9]	0.003
Meropenem vs. Cefepime	5.8 [1.6-21.1]	0.01
Piperacillin vs. Cefepime	3.5 [0.9-14.0]	0.07

Table 2. Hazard ratio comparing incidence of AR between antibiotic types (ref cefepime). Cefepime had a statistically significantly lower hazard ratio of AR when compared to ciprofloxacin and meropenem.

	Median time to development of AR (weeks)	Comparison of median time (ref ciprofloxacin)
Cefepime	22.4	2.91
Piperacillin-Tazobactam	11.9	1.55
Meropenem	9.0	1.17
Ciprofloxacin	7.7	1.00

Table 3. Median time to development of AR for cefepime, piperacillin-tazobactam, meropenem & ciprofloxacin with comparison between antibiotics. The median time to development of AR is longest with cefepime.

Conclusions

This study shows that patients with LVAD-associated *P. aeruginosa* infections had the lowest incidence of AR on cefepime (Table 1). The risk of developing resistance substantially increases with other antibiotics when compared to cefepime (Table 2). This study also showed that patients can remain on cefepime for a longer duration prior to developing acquired resistance (Figure 1, Table 3).