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Pseudomonas aeruginosa Non-susceptibility to Common Antibiotics by Source in USA Hospitals in 2015-2016: A Multicenter Study

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Abstract

Background: We evaluated the non-susceptibility of commonly used antibiotics used to treat *Pseudomonas aeruginosa* (PSA) infections by source in the inpatient setting.

Methods: We analyzed an inpatient dataset from July 2015 to June 2016 in an electronic research database of Becton Dickinson & Company from 348 USA hospitals. All non-duplicate PSA isolates (first isolate of a species per 30 day period) from respiratory, blood, wound, or urine were identified as non-susceptible if intermediate or resistant to ciprofloxacin or levofloxacin, ceftazidime, cefepime, meropenem, imipenem or meropenem, or piperacillin/ tazobactam (PIP/TAZ).

Results: The non-susceptible rates across all 4 sources were 32.8% (14,383/43,904), 19.8% (5,791/29,239), 19.5% (7,842/40,154), 20.5% (5,948/28,983), and 13.7% (5,429/39,621) for ciprofloxacin/ levofloxacin, ceftazidime, cefepime, meropenem, and PIP/TAZ, respectively. Respiratory source had significantly higher non-susceptible rates than other sources for each of the 5 antibiotics, ranging from 19.4% to 38.2% (all p<0.01) (see Table 2).

Conclusions: Across all 4 sources in the inpatient population, 1 in 3 PSA isolates was non-susceptible to ciprofloxacin or levofloxacin and 1 in 5 to ceftazidime, cefepime, or meropenem. Respiratory source had the highest rates of non-susceptibility for all of these common antibiotics, which are considered the cornerstone of PSA therapy. These findings highlight the importance of antibiotic choice and source of infection when choosing anti-pseudomonal therapy.

Background

Each year in the United States, at least 2 million people acquire serious infections with bacteria that are resistant to one or more of the antibiotics designed to treat those infections.[1] *Pseudomonas aeruginosa* is a common cause of healthcare-associated infections with some isolates resistant to multiple antibiotics.

Purpose

We evaluated the non-susceptibility of commonly used antibiotics used to treat *Pseudomonas aeruginosa* (PSA) infections by source in the inpatient setting.

Methods

- *Pseudomonas* isolates from 348 hospitals reporting data from July 2015 to June 2016 from the Becton Dickinson electronic data research database were analyzed.
- All non-duplicate PSA isolates (first isolate of a species per 30 day period) from respiratory, blood, skin, or urine were identified as non-susceptible if intermediate or resistant to ciprofloxacin or levofloxacin, ceftazidime, cefepime, ceftazidime or cefepime, meropenem, imipenem or meropenem, or piperacillin/ tazobactam (PIP/TAZ).
- Isolates were categorized as inpatient by the specimen collection time for the following two settings combined:
  1) Admission: within 3 days of an inpatient admission and no previous admission within 14 days;
  2) Hospital-onset: 3 days or more post-admission or within 14 days of discharge.

Results

- The non-susceptible rates from 348 acute care facilities (Table 1) across all 4 sources were 32.8% (14,383/43,904), 19.8% (5,791/29,239), 19.5% (7,842/40,154), 22.0% (9,693/44,154), 20.5% (5,948/28,983), 22.2% (7,947/35,829), and 13.7% (5,429/39,621) for ciprofloxacin/levofloxacin, ceftazidime, cefepime, ceftazidime or cefepime, meropenem, imipenem or meropenem, and PIP/TAZ, respectively (Table 2).
- Differences were noted within admission and hospital-onset settings across sources (see Table 2).
- Respiratory source had significantly higher non-susceptible rates than other sources for each of the 5 antibiotics, ranging from 19.4% to 38.2% (all p<0.01) (see Table 2).

Conclusion

- Across all 4 sources in the inpatient population, 1 in 3 PSA isolates was non-susceptible to ciprofloxacin or levofloxacin and 1 in 5 to ceftazidime, cefepime, ceftazidime or cefepime, meropenem or imipenem, or meropenem.
- Respiratory source had the highest rates of non-susceptibility for all of these common antibiotics which are considered the cornerstone of PSA therapy. These findings highlight the importance of antibiotic choice and source of infection when choosing anti-pseudomonal therapy.

Limitations

- These data were collected from the laboratory information system feeds provided by participating hospitals and relied on interpretive results reported at each facility.
- These data were collected and analyzed from the perspective of unique non-duplicate collected cultures and not from the perspective of unique patients. The goal was to understand the volume and frequency of these organisms that were seen at the level of the hospital/microbiology laboratory across a large number of geographical diverse institutions.

Table 1: Hospital characteristics

Category	Facility Distribution (n=348)
Region	
Northeast	9.5%
South	47.7%
Midwest	27.0%
West	15.8%
Urban/Rural	
Urban	75.9%
Rural	24.1%
Medical School Affiliation	
Major	12.9%
Limited	19.3%
Graduate	4.6%
No Affiliation	63.2%
Bed size	
<100	22.7%
100-300	40.2%
>300	37.1%

Figure 1: Distribution non-duplicate *P. aeruginosa* non-susceptible isolates by source

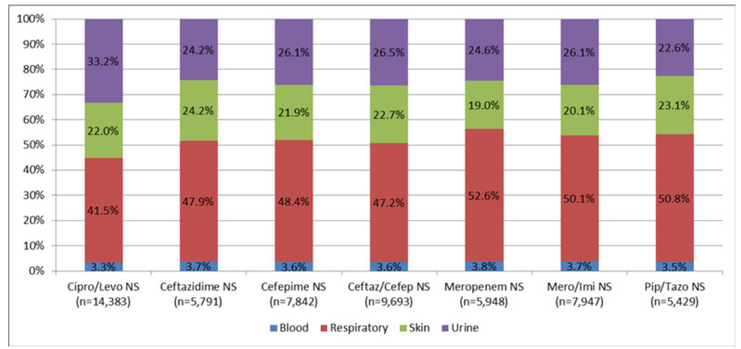

Table 2: Non-susceptible *P. aeruginosa* rates by pathogen, source and admission vs. hospital-associated setting

Source	Setting	Ciprofloxacin or Levofloxacin	Ceftazidime	Cefepime	Ceftazidime or Cefepime	Meropenem	Meropenem or Imipenem	Piperacillin/ Tazobactam
All sources	Admission Period	31.4% (5,701/18,181)	15.4% (1,856/12,090)	16.1% (2,624/16,319)	18.0% (3,286/18,303)	15.7% (1,796/11,460)	17.9% (2,609/14,553)	10.6% (1,750/16,485)
	Hospital-onset	33.8% (8,682/25,723)	22.9% (3,935/17,149)	21.9% (5,218/23,835)	24.8% (6,407/25,851)	23.7% (4,152/17,523)	25.1% (5,338/21,276)	15.9% (3,679/23,136)
	Subtotal	32.8% (14,383/43,904)	19.8% (5,791/29,239)	19.5% (7,842/40,154)	22.0% (9,693/44,154)	20.5% (5,948/28,983)	22.2% (7,947/35,829)	13.7% (5,429/39,621)
Blood	Admission Period	18.9% (138/730)	9.5% (45/472)	9.7% (65/671)	9.9% (74/744)	8.9% (40/447)	11.0% (63/573)	6.5% (44/678)
	Hospital-onset	24.5% (336/1,370)	18.8% (172/914)	16.6% (214/1,286)	19.8% (273/1,382)	19.2% (185/965)	20.7% (235/1135)	11.6% (145/1,255)
	Subtotal	22.6% (474/2,100)	15.7% (217/1,386)	14.3% (279/1,957)	16.3% (347/2,126)	15.9% (225/1,412)	17.4% (298/1,708)	9.8% (189/1,933)
Urine	Admission Period	34.8% (1,899/5,452)	12.3% (437/3,560)	14.7% (706/4,795)	15.9% (868/5,475)	13.8% (444/3,216)	16.4% (689/4,189)	8.1% (393/4,871)
	Hospital-onset	31.6%(2,877/9,092)	16.2% (967/5,986)	16.3% (1,342/8,255)	18.6% (1,698/9,109)	17.5% (1,019/5,834)	19.2% (1,388/7,233)	10.4% (836/8,065)
	Subtotal	32.8% (4,776/14,544)	14.7% (1,404/9,546)	15.7% (2,048/13,050)	17.6% (2,566/14,584)	16.2% (1,463/9,050)	18.2% (2,077/11,422)	9.5% (1,229/12,936)
Respiratory	Admission Period	35.7% (2,265/6,352)	19.9% (849/4,277)	21.4% (1,244/5,814)	23.7% (1,518/6,404)	22.1% (941/4,251)	24.3% (1,272/5,227)	14.7% (854/5,808)
	Hospital-onset	39.9% (3,702/9,277)	30.4% (1,922/6,329)	29.1% (2,551/8,758)	32.7% (3,057/9,356)	32.8% (2,187/6,665)	34.4% (2,706/7,866)	22.5% (1,905/8,449)
	Subtotal	38.2% (5,967/15,629)	26.1% (2,771/10,606)	26.0% (3,795/14,572)	29.0% (4,575/1,5760)	28.7% (3,128/10,916)	30.4% (3,978/13,093)	19.4% (2,759/14,257)
Skin	Admission Period	24.8% (1,399/5,647)	13.9% (525/3,781)	12.1% (609/5,039)	14.5% (826/5,680)	10.5% (371/3,546)	12.8% (585/4,564)	9.0% (459/5128)
	Hospital-onset	29.5% (1,767/5,984)	22.3% (874/3,920)	20.1% (1,111/5,536)	23.0% (1,379/6,004)	18.7% (761/4,059)	20.0% (1,009/5,042)	14.8% (793/5,367)
	Subtotal	27.2% (3,166/11,631)	18.2% (1,399/7,701)	16.3% (1,720/10,575)	18.9% (2,205/11,684)	14.9% (1,132/7,605)	16.6% (1,594/9,606)	11.9% (1,252/10,495)

References

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