12-2022

Evaluation of Piperacillin/Tazobactam Utilization in Suspected Urinary Tract Infections at a Community Hospital

Adam P. Yagodinski

Jamie Gaul PharmD, BCPS

Dana Lorber PharmD, BCPS

Alissa Keillor PharmD

Evaluation of Piperacillin/Tazobactam Utilization in Suspected Urinary Tract Infections at a Community Hospital

Adam P. Yagodinski, PharmD Candidate[1]; Jamie Gaul, PharmD, BCPS[2]; Dana L. Lorber, PharmD, BCPS[2]; Alissa Keillor, PharmD, BCPS[2]

1. Ohio Northern University Raabe College of Pharmacy, Ada, Ohio 2. Parkview Regional Medical Center, Fort Wayne, Indiana

OBJECTIVE

- Evaluate and characterize the utilization of piperacillin/tazobactam in patients with a suspected urinary tract infection (UTI) at a community hospital in Fort Wayne, Indiana

BACKGROUND

Antimicrobial stewardship is an effort that focuses on appropriate utilization of antibiotics, especially those with a broad spectrum. Piperacillin/tazobactam is a commonly utilized broad spectrum agent that has coverage of many gram negatives (including *Pseudomonas aeruginosa*), gram positives, and anaerobic organisms.[1] It is used empirically for a wide range of infections from skin and soft tissue infections to nosocomial pneumonia. Many times, it is utilized inappropriately due to wrong indication, dose, and/or duration. The following table briefly highlights some published evaluations that have been performed in the past on piperacillin/tazobactam utilization.

Authors	Year	Results
Mekdad et al.[2]	2020	Appropriate use in 55% of cases
Shah et al.[1]	2013	Appropriate use in 71.5% of cases and 86% of inappropriate use was due to wrong empiric indication
Raveh et al.[3]	2006	Appropriate use in ~90% of cases
Antoine et al.[4]	2006	Appropriate use in 71% of cases

These studies contained a wide range of locations, patients, and specific focuses, but they all included an evaluation of how piperacillin/tazobactam was utilized. Use of this agent in UTIs was a small part of these analyses. The present medication use evaluation (MUE) of piperacillin/tazobactam was specifically aimed at evaluating the empiric use for UTIs.

METHODS

- Institutional review board exempt, single center, retrospective MUE
- Data were collected from April 1, 2020 to March 31, 2022 from adult patients (≥ 18 years old) who received piperacillin/tazobactam for a suspected UTI
  - Inclusion
    - UTI ICD-10 diagnosis code during encounter
    - Received ≥ 2 doses of piperacillin/tazobactam
  - Exclusion
    - Received piperacillin/tazobactam for diagnosis other than UTI
    - Presenting from a facility other than a Skilled Nursing Facility (SNF) or community (home)
    - Received ≥ 2 independent courses of piperacillin/tazobactam during same admission
- A random number generator in Microsoft Excel was used to select a subset of qualifying patients for the chart review

- **Electronic collection:** age, sex, vitals, admission source, presence of bacteremia, antibiotics in last 90 days, infectious disease (ID) consults, department of piperacillin/tazobactam initiation, urinalysis results, and urine culture results.

- For culture results, "no culture" meant that there was either no culture during admission or there was culture data, but it was from an outlying facility or alternative encounter

- **Manual collection:** presence of resistance to ≥ 2 antibiotics in any prior cultures within the preceding year, presence of documented classic UTI symptoms (e.g flank pain, urinary frequency, urgency, dysuria), antibiotic allergies and reported reaction, chronic catheter at time of admission, relevant pharmacy dosing consults, and categorizing urinalysis (UA) results into "likely" for UTI if urine white blood cell (WBC) count was ≥ 10 cells per mm^3 and "less likely" if WBC < 10 cells per mm^3
- Descriptive statistics were utilized to analyze the data

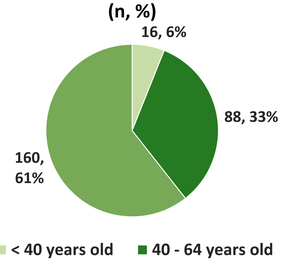
RESULTS

- There were 10,528 patients in the initial electronic collection of patients who received piperacillin/tazobactam. A total of 8,965 patients were excluded based on exclusion criteria.
- A total of 1,563 patients remained. A subset of 300 patients were randomly selected from this group.
- During manual data collection, 36 patients were found to have received ≥ 2 independent courses of piperacillin/tazobactam during their admission. These patients were then excluded leaving a final study population of 264 patients.

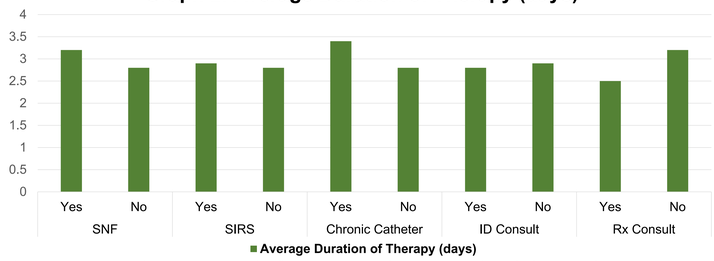
Table 1: Demographics	
Characteristics	**# of patients (n = 264)**
Female (%)	141 (53.4)
Admission Source: SNF[1] (%)	13 (4.9)
Antibiotics in last 90 days[2] (%)	140 (53)
Resistant culture in prior year[3] (%)	55 (20.8)
Chronic catheter (%)	27 (10.2)
Documented UTI Symptoms (%)	107 (40.5)
Meets SIRS criteria[4] (%)	132 (50)

1. SNF: skilled nursing facility. 2. Inpatient or outpatient antibiotics 3. Organism resistant to ≥ 2 antibiotics in prior year. 4. SIRS: systemic inflammatory response syndrome

Graph 1: Patients By Age (n, %)



Graph 2: Average Duration of Therapy (days)



Graph 2: Average duration of piperacillin/tazobactam for different patient variables SNF: skilled nursing facility. SIRS: systemic inflammatory response syndrome (criteria). ID: infectious disease. Rx: pharmacy

Table 2: Urine Culture Results (n = 264)					
	Number of Patients, n (%)	**Presenting from SNF**	**Meets SIRS criteria**	**Antibiotics in past 90 days**	**Resistant cultures in prior year**
Escherichia coli	48 (18.1)	2	25	20	7
Proteus spp.[1]	9 (3.4)	1	4	4	4
Klebsiella spp.[2]	18 (6.8)	1	11	9	5
ESBL E. coli [3]	3 (1.1)	0	1	2	1
P. aeruginosa [4]	6 (2.3)	0	2	4	1
Multiple Organisms	35 (13.3)	4	21	24	10
Other gram negatives	10 (3.8)	1	5	6	2
Gram positives	9 (3.4)	2	7	4	2
Candida spp.[5]	5 (1.9)	0	3	4	1
No Culture	61 (23.1)	1	23	35	11
No Significant Growth	60 (22.7)	1	30	28	11
Total (%)	**264 (100)**	**13 (4.9)**	**132 (50)**	**140 (53)**	**55 (20.8)**

1. ***Proteus*** **species. 2.** ***Klebsiella*** **species. 3. extended-spectrum beta-lactamase producing** ***Escherichia coli*** **4.** ***Pseudomonas aeruginosa.*** **5.** ***Candida*** **species**

RESULTS

- The initial data collection screened for all ESBL producing organisms. Only three were present and all three were in E. coli organisms.

Table 3: Risk of Resistant Organisms By Percentage								
	SNF n (%)		**Abx Last 90d n (%)**		**Hx of Resistance n (%)**		**Chronic Catheter n (%)**	
	Yes (n =13)	**No (n = 251)**	**Yes (n = 140)**	**No (n = 124)**	**Yes (n = 55)**	**No (n = 209)**	**Yes (n = 27)**	**No (n = 237)**
ESBL *E. coli*	0 (0)	3 (1.2)	2 (1.4)	1 (0.8)	1 (1.8)	2 (1.0)	1 (3.7)	2 (0.8)
P. aeruginosa	0 (0)	6 (2.4)	4 (2.9)	2 (1.6)	1 (1.8)	5 (2.4)	1 (3.7)	5 (2.1)
Multiple Organisms	4 (30.8)	31 (12.4)	24 (17.1)	11 (8.9)	10 (18.2)	25 (12.0)	10 (37)	25 (10.5)

ESBL E. coli: extended-spectrum beta-lactamase producing *Escherichia coli. P.* aeruginosa: *Pseudomonas* aeruginosa. SNF: skilled nursing facility. Abx: antibiotics. 90d: 90 days. Hx: history.

- Total of 55% of patients had either no significant growth, *E. coli*, Klebsiella species, Proteus species, or other gram negatives. An additional 13.3% grew multiple organisms
- Relevant pharmacy consults also yielded a shorter duration of therapy compared to those who did not receive such consults (2.5 vs 3.2 days)

DISCUSSION & CONCLUSIONS

- Patients with antibiotics in the last 90 days or chronic catheter were more likely to grow multiple cultures, *Pseudomonas* or ESBL *E. coli* compared to their counterparts
- Patients from SNF grew multiple organisms more often and those with a history of resistance grew more ESBL *E. coli* and multiple organisms than their counterparts
- Excluding the "no culture" group, 55% grew organisms which would have been susceptible to a narrower agent
- Including patients who grew multiple organisms, the percentage increases to 68% of cases where a narrower agent, like ceftriaxone, could have been used empirically
- Pharmacist consults were shown to shorten the duration of piperacillin/tazobactam by 0.7 days or 2 full doses
- This MUE is difficult to compare to other MUEs as it does not have matching parameters and it only focuses on its use in UTIs. Other MUEs reported a wide range from 55% to 90% of cases where piperacillin/tazobactam was appropriately used.
- An ID consult appeared to have little effect on duration of therapy compared to no ID consult (2.8 vs 2.9 days)
- **Limitations:**
  - Sixty one patients or 23.1% were labeled, "no culture," but could have had a culture prior to receiving piperacillin/tazobactam, but it was not collected during the study encounter
    - Gives false impression that no culture was collected to guide therapy
  - "Multiple organism" cultures were not further analyzed to discern what organisms grew
    - This occurred in 35 patients or 13.3% of the study population
- In conclusion, caution should be taken for patients with a suspected UTI who present from a SNF, have a chronic catheter, history of resistance in the prior year or have had any antibiotics in the past 90 days. Overall, 55 - 68% of these cases represented situations where either no treatment was merited, or ceftriaxone would have been an effective empiric agent. This MUE also reinforced the important role pharmacists play in antimicrobial stewardship.

REFERENCES

1. Shah PJ, Ryzner KL. Evaluating the appropriate use of piperacillin/tazobactam in a community health system: a retrospective chart review. P T. 2013 Aug;38(8):462-83.
2. Mekdad SS, AlSayed L. Prospective evaluating the appropriate use of piperacillin /tazobactam in a cardiac center of a tertiary care hospital. J Cardiothorac Surg. 2020 May 1;15(1):70.
3. Raveh D, Muallem-Zilcha E, Greenberg A, Wiener-Well Y, Schlesinger Y, Yinnon AM. Prospective drug utilization evaluation of three broad-spectrum antimicrobials: cefepime, piperacillin-tazobactam and meropenem. QJM. 2006 Jun;99(6):397-406.
4. Antoine TL, Curtis AB, Blumberg HM, Desilva K, Fransua M, Gould CV, et al. Knowledge, attitudes, and behaviors regarding piperacillin-tazobactam prescribing practices: results from a multicenter study. Infect Control Hosp Epidemiol. 2006 Nov;27(11):1274-7.

Disclosure

The authors of this presentation have the following to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation:
Adam P. Yagodinski: Nothing to disclose | Jamie Gaul: Nothing to disclose | Dana L. Lorber: Nothing to disclose | Alissa Keillor: Nothing to disclose