Characteristics Associated with Inappropriate Antibiotic Prescribing in Patients with Asymptomatic Bacteriuria (ASB)

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ABSTRACT

Background: Antibiotic treatment of asymptomatic bacteriuria (ASB) is considered inappropriate, does not improve patient outcomes, and may lead to adverse events such as antibiotic resistance and *Clostridioides difficile* infection. Previous stewardship interventions have focused on reducing unnecessary urine culture collection in individuals without urinary symptoms; however, further interventions to reduce inappropriate prescribing in ASB are warranted. This study sought to identify characteristics associated with treatment of ASB in order to implement future stewardship interventions.

Materials/methods: This two-center, retrospective cohort study included unique emergency department or inpatient adults with consecutive non-duplicate monomicrobial urine isolates of Enterobacterales or *Pseudomonas aeruginosa* collected between 8/2013 and 1/2014 from two academic hospitals in Boston, Massachusetts. Patients with ASB (without chart-documented urinary-specific symptoms) were identified through chart review and stratified into two groups: those treated with empiric urinary tract infection (UTI) antibiotics and those untreated. Logistic regression analyses were performed to identify variables independently associated with antibiotic treatment of ASB.

Results: During the study, 255 patients were determined to have ASB and a majority (80.8%) were treated with empiric UTI antibiotics. Most patients were female (71.4%) and elderly (mean age 70 years). The most common organisms isolated were *Escherichia coli* (59.2%), *Klebsiella* spp. (23.1%), and *P. aeruginosa* (9.8%). The presence of isolated fever (OR, 7.83 [95% confidence interval, 1.51, 144.20]); p = 0.05), urinalysis positive for pyuria (>10 white blood cells) (OR, 2.52 [95% CI, 1.15, 5.54]; p = 0.02), and *Klebsiella* spp. urine isolate (OR, 2.99 [95% CI, 1.19, 8.60]; p = 0.02) were independently associated with treatment.

Conclusions: A large proportion of ASB patients were treated with antibiotics despite clinical practice guidelines recommending against this practice. Isolated fever, pyuria, and *Klebsiella* spp. culture were all significantly associated with the treatment of ASB; targeted review of these patients by stewardship programs may help to reduce inappropriate ASB treatment within these institutions.

BACKGROUND

- Bacteriuria is the presence of bacteria in the urine while ASB is bacteriuria in the absence of any urinary specific symptoms.
- Current guidelines from the Infectious Diseases Society of America (IDSA) recommend against screening and treatment of most ASB cases.
- Previous stewardship interventions have focused on decreasing frequency of urine cultures and increasing provider education on the issues related to treating ASB but additional work needs to be done to reduce unnecessary prescriptions in ASB patients.

OBJECTIVE

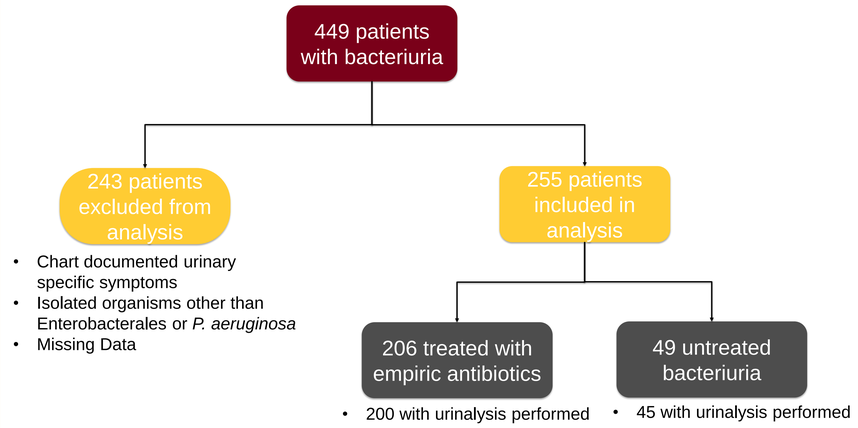
- Identify patient risk factors independently associated with antibiotic treatment of ASB for a future stewardship intervention.

METHODS

- Retrospective cohort study including 255 unique adult ASB patients with monomicrobial urine isolates collected between 8/2013 and 1/2014 from two hospitals in Boston, MA
  - Stratified into two groups: those treated with empiric UTI antibiotics (n = 206) and those untreated (n = 49)
- Patient data were collected from electronic medical records using a standardized form
- Rstudio was used for all statistical analysis.
  - Fisher's exact for binary data
  - Welsh's two sample t-test for continuous numerical data
  - Kruskal-Wallis test discrete numerical data
- Univariate and multivariate logistic regression analyses were conducted to identify independent risk factors for antibiotic treatment of ASB

METHODS

Figure 1. Study design



RESULTS

Table 1. Comparison of patient characteristics by treatment of empiric antibiotics for a UTI

	ASB treated n = 206	ASB untreated n = 49	p value
Age, mean (SD)	69.9 (16.4)	70.7 (18.0)	0.77
Female, n (%)	147 (71.4)	35 (71.4)	1.00
Presenting location, n (%)			
Home	130 (63.4)	33 (67.3)	0.62
Skilled nursing facility/long-term care facility	31 (15.1)	9 (18.4)	0.66
Outside hospital	43 (21.0)	7 (14.3)	0.42
Rehab	1 (0.5)	0 (0.0)	1.00
In-patient, n (%)	109 (52.9)	26 (53.1)	1.00
ICU patient, n (%)	68 (33.0)	14 (28.6)	0.61
Length of ICU stay, median (IQR)	4.0 (5.0)	2.0 (9.0)	0.42
APACHE II score median (IQR)	10.0 (6.75)	9.0 (5.00)	0.62
Length of stay median (IQR)	5.5 (9.0)	4.0 (7.0)	0.96
Prior to culture	0.0 (2.0)	0.0 (2.0)	0.69
Comorbidities, n (%)			
Hypertension	147 (71.4)	29 (59.2)	0.12
Hyperlipidemia	80 (38.8)	18 (36.7)	0.87
Diabetes mellitus	73 (35.4)	15 (30.6)	0.62
Hematological/oncological conditions	65 (31.6)	14 (28.6)	0.73
Coronary artery disease	54 (26.2)	12 (24.5)	0.86
Heart failure	46 (22.3)	12 (24.5)	0.71
Atrial fibrillation	46 (22.3)	9 (18.4)	0.70
Chronic kidney disease	38 (18.4)	5 (10.2)	0.21
Anemia	31 (15.0)	7 (14.3)	1.00
Immunosuppression	32 (15.5)	6 (12.2)	0.66
Asthma	22 (10.7)	9 (18.4)	0.15
Chronic obstructive pulmonary disease	27 (13.1)	3 (6.1)	0.22

RESULTS

Table 2. Comparison of patient symptoms and bacteriuria characteristics

	ASB treated n = 206	ASB untreated n = 49	p value
Organism isolated, n (%)			
Escherichia coli	120 (58.0)	31 (63.3)	0.63
Klebsiella spp.	52 (25.1)	7 (14.3)	0.13
Pseudomonas aeruginosa	18 (8.7)	7 (14.3)	0.28
Proteus spp.	10 (4.8)	3(6.1)	0.72
Urinalysis results, n (%)			
Positive pyuria (>10 white blood cells)	161 (80.5)	26 (57.8)	<0.01
Positive nitrates	103 (51.5)	16 (35.6)	0.05
Positive casts	44 (22.0)	13 (28.9)	0.33
History of UTI, n (%)	42 (20.4)	6 (12.2)	0.23
Non-urinary specific symptoms, n (%)			
Confusion or altered mental status	35 (17.0)	4 (8.2)	0.18
Fever	29 (14.1)	1 (2.0)	0.01
Complicating factors, n (%)			
Ureteral stent	3 (1.5)	1 (2.0)	0.58
Neurogenic bladder	5 (2.4)	0 (0.0)	0.59
Urinary catheter status, n (%)			
Presence of urinary catheter[a]	52 (25.2)	9 (18.4)	0.36
Urinary catheter removed[b]	12 (5.8)	4 (8.2)	0.52

[a]In place for >2 days and in place at the time of the positive urine culture
[b]In place for >2 days and removed prior to the positive urine culture

Table 3. Logistic regression analyses for the risk factors for empiric antibiotic treatment of ASB

	Univariate Model		Multivariate Model	
	Odds Ratio (95% CI)	p value	Odds Ratio (95% CI)	p value
Comorbidities				
Asthma	0.53 (0.23-1.29)	0.14	0.63 (0.24-1.78)	0.37
Chronic obstructive pulmonary disease	2.31 (0.77-9.98)	0.18	1.81 (0.51-8.83)	0.40
Chronic kidney disease	1.99 (0.80-6.04)	0.17	1.73 (0.57-6.55)	0.37
Hypertension	1.72 (0.89-3.26)	0.10	2.05 (0.94-4.50)	0.07
Recurrent Infection	4.88 (0.97-88.71)	0.13	4.56 (0.74-88.63)	0.16
History of leukemia	0.11 (0.01-1.22)	0.08	0.15 (0.01-4.29)	0.21
Non-urinary specific symptoms				
Confused /altered mental status	2.30 (0.86-8.00)	0.13	1.55 (0.53-5.69)	0.46
Fever	7.86 (1.62-141.90)	0.05	**7.83 (1.51-144.20)**	**0.05**
History of UTI	1.84 (0.78-5.06)	0.20	1.20 (0.45-3.63)	0.73
Urinalysis results				
Positive pyuria	2.79 (1.38-5.56)	<0.01	**2.52 (1.15-5.54)**	**0.02**
Positive nitrates	1.89 (0.98-3.76)	0.06	1.65 (0.78-3.55)	0.19
Isolate				
Klebsiella spp.	0.79 (0.90-5.18)	0.11	**2.99 (1.19-8.60)**	**0.03**

CONCLUSIONS

- Independent risk factors for antibiotic treatment of ASB among this patient cohort (n = 255) included: (1) an isolated fever, (2) urinalysis results positive for pyuria, and (3) a urine isolate of *Klebsiella* spp.
- The next step is to develop an institution-specific tool to flag the highest risk patients for antibiotic prescription for review by the stewardship team.

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