



Myths Surrounding UTI Diagnosis

Michael Tichy, Pharm.D.

PGY1 Pharmacy Resident

UW Medicine

mtichy@uw.edu

Disclosure

- I have no financial relationships or conflicts of interest to disclose.



Learning Objectives

- Distinguish factors that determine a urinary tract infection (UTI) from asymptomatic bacteriuria (ASB)
- Provide data to debunk myths around diagnosing UTI



"Can You Feel It": Epidemiology of ASB and Diagnosis of ASB vs. UTI



Case 1

- A 68 YOF comes to the ED from a nursing home with acute mental status changes
- Hx: COPD, former smoker (1 PPD x 30 years)
- As part of her work up, her provider orders a UA with reflex to microscopy and culture
- Grows *P. mirabilis* with the following sensitivity



UCx results

Antibiotic	Sensitivity	MIC (mcg/mL)
Ampicillin	S	≤8
Ampicillin/Sulbactam	S	≤8
Aztreonam	S	≤1
Cefazolin	S	≤16
Ceftriaxone	S	≤0.25
Ciprofloxacin	S	0.25
Gentamicin	S	≤4
Levofloxacin	S	0.5
Nitrofurantoin	R	-
Piperacillin/Tazobactam	S	≤2
Trimethoprim/Sulfamethoxazole	S	≤2/38



Diagnosing UTI

- No “agreed upon” criteria
- Clinical
 - Fever >38 degrees C
 - Suprapubic tenderness
 - Costovertebral angle pain/tenderness
 - Urgency
 - Frequency
 - Dysuria
 - Gross hematuria
- Microbiological
 - ≤2 species of bacteria
 - At least one species has $\geq 10^5$ CFU/mL



Case 1, Part 2

- A **70 YOF** returns to the ED for the 12th time in 2 years, but **now with fever, altered mental status and hypotension** and a 2 day history of urinary retention
- Hx: COPD, former smoker (1 PPD x 30 years), **12 ED/inpatient stays in the past 2 years.**
- As part of her work up, her provider orders a BCx and a UA + with reflex to microscopy and culture
- Grows *P. mirabilis* with the following sensitivity



Antibiotic	Sensitivity	MIC (mcg/mL)
Ampicillin	R	≥32
Ampicillin/Sulbactam	R	≥32
Aztreonam	R	≥16
Cefazolin	R	≥32
Cefepime	R	≥16
Cefotetan	R	≥64
Ceftazidime	R	≥16
Ceftriaxone	R	≥4
Ciprofloxacin	R	≥4
Ertapenem	R	≥2
Gentamicin	R	≥16
Levofloxacin	R	≥4
Meropenem	R	≥4
Nitrofurantoin	R	-
Piperacillin/Tazobactam	R	≥128
Trimethoprim/Sulfamethoxazole	R	≥4/76



Epidemiology of ASB

- Prevalence in women
 - 1% to 5% in premenopausal
 - 2.8% to 8.6% in postmenopausal
- Prevalence in men
 - Rare in young healthy men
 - 3.6-19% in men > 70 years old in the community
- Quality of sample

Nicolle LE. Infect Dis Clin North Am. 2003;17:367-94.

Lipsky BA. Ann Intern Med. 1989;110(2):138-50.

Nicolle LE. Clin Geriatr Med. 2016;32:523-38.



Epidemiology of Catheterized ASB

- Approximate risk = 3% per day of catheterization
 - 60% of patients after 30 days
 - 93% of patients after 90 days
- Other studies place the 30-day rate at close to 100%
- These patients regularly develop new ASBs
 - One new ASB per 1.8 patient weeks



Definition of ASB

- Absence of signs/symptoms of a UTI
- For men
 - A single urine culture with $\geq 10^5$ CFU/mL
- For women
 - A UCx with $\geq 10^5$ CFU/mL with a 2nd UCx in 2 weeks growing the same organism at $\geq 10^5$ CFU/mL



"Up and Outta Here": Rapid Fire Myth Debunking



Statistics Crash Course

- Sensitivity
 - Have disease -> **Will test be positive?**
- Positive Predictive Value (PPV)
 - Test is positive -> **But do I have the disease?**
- Specificity
 - Don't have disease -> **Will test be negative?**
- Negative Predictive Value (NPV)
 - Test is negative -> **Do I NOT have the disease?**



Appearance/Smell of Urine does NOT Indicate Bacteriuria

Bacteriuria			
Odor	Positive	Negative	Total
Yes	15	13	28
No	17	52	69
Total	32	65	97

Sensitivity = 46.9%

Specificity = 80%

PPV = 53.6%

NPV = 75.4%

Other causes

- DM
- Starvation
- Dehydration
- Food
- Medications



Pyuria/Leukocyte Esterase/Nitrites are indicative of UTI



FluVaxAmine PharmD

@KaseyPharmD

Follow



UA shows UTI.

**Write a sad story
using only 3 words.**

7:26 PM - 7 Apr 2019



Pyuria/Leukocyte Esterase/Nitrites are NOT indicative of Bacteriuria

- Analysis of 32,998 UA + UCx at a single hospital in Turkey
 - Excluded contaminated or catheter samples

Test	Sensitivity(%)	Specificity (%)	PPV (%)	NPV (%)
Leukocyte Esterase	71.0	83.6	9.2	99.3
Nitrite	17.7	90.1	4.0	97.9
Pyuria	68.2	87.8	11.7	99.2

The **ABSENCE** of pyuria/leukocyte esterase/nitrites are predictive of **no bacteriuria**.



Association between Falls and Bacteriuria + Pyuria

	Positive	Negative	Total
Fall	9	36	45
No Fall	137	215	352
Total	146	251	397

Sensitivity = 6.16%

Specificity = 85.66%

PPV = 20.00%

NPV = 61.08%

Other causes

- Starvation
- Dehydration
- Medications
- Age

Falls are NOT associated with UTI in the elderly



AMS is associated with UTI in the elderly

- **Maybe**

- More likely to have bacteriuria + pyuria
- RR 1.38 (1.03-1.74)

- **But**

- It predicts bacteriuria + pyuria <40% of the time
- Add in dysuria +/- urine character changes and predicts bacteriuria + pyuria ~63% of the time



Summary

- Urine smell **does not correlate** with Bacteriuria
- The absence of a positive Nitrite, LE and/or Pyuria indicates no UTI
- Investigate other causes for falls before treatment
- Investigate other causes for AMS before treatment



References

- @KaseyPharmD. UA shows UTI. <https://twitter.com/KaseyPharmD/status/1115078462392369152>. Posted April 7, 2019.
- Centers for Disease Control and Prevention/ National Healthcare Safety Network. 2020 NHSN Urinary Tract Infection (UTI) Checklist . January 2020. Available from: <https://www.cdc.gov/nhsn/pdfs/checklists/uti-checklist-508.pdf>.
- Garibaldi RA, Mooney BR, Epstein BJ, Britt MR. An evaluation of daily bacteriologic monitoring to identify preventable episodes of catheter-associated urinary tract infection. *Infect Control*. 1982;3(6):466-70.
- Juthani-Mehta M, Quagliarello V, Perrelli E, et al. Clinical features to identify urinary tract infection in nursing home residents: a cohort study. *J Am Geriatr Soc*. 2009;57(6):963-70.
- Kayalp D, Dogan K, Ceylan G, et al. Can routine automated urinalysis reduce culture requests?. *Clin Biochem*. 2013;46(13-14):1285-9.
- Lipsky BA. Urinary tract infections in men. Epidemiology, pathophysiology, diagnosis, and treatment. *Ann Intern Med*. 1989;110(2):138-50.
- Midthun SJ, Paur R, Lindseth G. Urinary tract infections. Does the smell really tell?. *J Gerontol Nurs*. 2004;30(6):4-9.
- Nicolle LE. Asymptomatic bacteriuria: when to screen and when to treat. *Infect Dis Clin North Am*. 2003;17:367-94.
- Nicolle LE. Urinary tract infections in the older adult. *Clin Geriatr Med*. 2016;32:523-38.
- Nicolle LE, Gupta K, Bradley SF, et al. Clinical Practice Guideline for the Management of Asymptomatic Bacteriuria: 2019 Update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2019; 68(10):e83-110.
- Rowe TA, Juthani-mehta M. Diagnosis and management of urinary tract infection in older adults. *Infect Dis Clin North Am*. 2014;28(1):75-89.
- Rowe T, Towle V, Van ness PH, Juthani-mehta M. Lack of positive association between falls and bacteriuria plus pyuria in older nursing home residents. *J Am Geriatr Soc*. 2013;61(4):653-4.

