

Appendix 1. Diagnosis of Urinary Tract Infection – Top Ten Myths

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For further reading consider:

1. Trautner BW, Grigoryan L, Petersen NJ, et al. Effectiveness of an Antimicrobial Stewardship Approach for Urinary Catheter-Associated Asymptomatic Bacteriuria. *JAMA Intern Med.* 2015;175(7): 1120-1127.
2. Kalra R, Kraemer RR. Urinary catheterization -- when good intentions go awry: a teachable moment. *JAMA Intern Med.* 2014;174(10): 1547-1548.

The diagnosis of UTI is not a laboratory defined diagnosis. The diagnosis should be based on clinical symptoms combined with supportive laboratory information, if obtained.

Myth 1: The urine is cloudy and smells bad. My patient has a UTI.

Truth 1: Urine color and clarity or odor should not be used alone to diagnose or start antibiotic therapy in any patient population.

- a. Visual inspection of urine clarity is not helpful in diagnosing UTI in women.²⁹
 - a. 100 female patients at a university hospital had their urine tested by reading newsprint through the sample. The sensitivity, specificity, and positive and negative predictive values were 13.3%, 96.5%, 40.0%, and 86.3% respectively.
- b. *Foul smelling urine is an unreliable indicator of infection in catheterized patients*, and usually dependent on a patients hydration status and concentration of urea in the urine.^{11,31}

Myth 2: The urine has bacteria present. My patient has a UTI. Also see Myth 8.

Truth 2: The presence of bacteria in the urine on microscopic examination without UTI symptoms is NOT recommended for the diagnosis of UTI due to the possibility of contamination and asymptomatic bacteriuria³⁵

- a. UTI is not a laboratory defined diagnosis. Diagnosis should be based on clinical symptoms. The bacterial thresholds (below) should usually be present in patients with a UTI; however, the absence of bacteria does not rule out UTI in patients with clinical symptoms.
- b. In patients *without* an indwelling catheter the following cutoffs should define significant bacteriuria³⁶
 - i. $\geq 10^5$ CFU/mL of ≤ 2 species of microorganisms in voided culture
 - ii. $\geq 10^2$ CFU/mL of any number of microorganisms in a straight cath culture
- c. In patients *with* an indwelling catheter, $\geq 10^3$ CFU/mL of any organism(s) should define significant bacteriuria³⁶ since this is predictive of higher colony counts of 10 to the fifth within 48 hours¹²⁸

Myth 3: My patient's urine sample has >5 squamous epithelial cells per low powered field and the culture is positive. Because the culture is positive, I can disregard the epithelial cell count and treat the UTI.

Truth 3: A good specimen has less than 5 epithelial cells per low power field on UA. Poor specimens should be considered for recollection or straight catheterization should be performed.

Myth 4: The urine has positive leukocyte esterase. My patient has a UTI and needs antibiotics.

Truth 4: Urine leukocyte esterase **should not be used alone** to diagnosis or start antimicrobial therapy in any patient population.

- a. A dipstick leukocyte esterase test has high sensitivity and specificity for the presence of quantitative pyuria, 80-90% and 95-98%, respectively; **however** a positive leukocyte esterase

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alone is NOT recommended for diagnosis of UTI.^{32,33} Pyuria or bacteriuria alone is not an indication for antimicrobial therapy

- b. On rare occasions, a negative leukocyte esterase in the presence of UTI symptoms may still prompt a urine culture if clinically suspected^{32,33} but especially prompt a search for urethritis, vaginitis, or sexually transmitted infection.

Myth 5: My patient has pyuria. They must have a UTI.

Truth 5: Quantitative urine WBC **should not be used alone** to diagnosis or start antimicrobial therapy in any patient population

- a. In neutropenic or leukopenic patients, the WBC count may be artificially low and reflex culture may not occur. The microbiology lab should be contacted and an order for urine culture ordered if urinary symptoms are present and urinary source of infection is suspected.
- b. Borderline WBC counts of 6-10 may reflect the patient's state of hydration. Patients with oliguria or anuria (dialysis) usually have some degree of pyuria.
- c. Non-infectious conditions, such as sexually transmitted infections or non-infectious cystitis may give pyuria.

Myth 6: The urine has nitrates present. My patient has a UTI.

Truth 6: Urine nitrates **should not be used alone** to diagnosis or start antimicrobial therapy in any patient population.

- a. Urine nitrate has a high true-positive rate for bacteriuria, but bacteriuria, as noted above in Myth 2, does not define a clinically significant UTI. Diagnosis of UTI should be considered in a patient with elevated urine nitrate in the presence of clinical signs and symptoms of UTI.^{32,35}
- b. A negative leukocyte esterase AND a negative urine nitrate largely rule out infection in pregnant women, elderly patients, family medicine, and urology patients.³⁴ Alternative diagnosis should be thoroughly investigated in this scenario.
- c. In an analysis of the negative predictive value for pathogenic bacteria using the combined nitrite and leukocyte esterase dipstick analysis, the combination of a negative leukocyte esterase and negative nitrite test demonstrated an NPV of 88% (CI: 84%-92%).
- d. If both leukocyte esterase AND nitrite analyses are positive, the sensitivity for bacteriuria was 48% (CI: 41%-55%), and specificity was 93% (CI: 90%-95%).¹²⁹ See Myth 2

Myth 7: All findings of bacteria in a catheterized urine sample should be diagnosed as a UTI.

Truth 7: Virtually 100% of patients with an indwelling Foley catheter are colonized within 2 weeks of placement with 2-5 organisms. Colony counts of a catheter may define bacteriuria but must be taken in a clinical context for making a diagnosis of UTI.

- a. 98% of chronically catheterized patients had bacteriuria and 77% were polymicrobial. The mean interval between new episodes of bacteriuria was 1.8 weeks.⁴⁸
- b. Bacteriuria and pyuria in chronically catheterized patients should **only** be treated in the presence of signs and **symptoms of infection** (e.g. fever, leukocytosis, suprapubic pain and tenderness. Dysuria is obviously unassessable). Pyuria or bacteriuria alone is not an indication for antimicrobial therapy.
- c. Patients with intermittent or condom catheters are at lower risk for UTI and should be considered in the same risk category as those with no indwelling catheter.⁴⁰
- d. While antibiotics may delay the onset of bacteriuria in catheterized patients, this strategy ultimately selects for resistant microorganisms. Prophylactic anti-infectives are not recommended for patients with chronic catheters, but may be considered for short-term use by urology specialists

Myth 8: Bacteriuria results in urinary tract infections and should be treated with antibiotics.

Truth 8: Bacteriuria does NOT establish a diagnosis of a UTI and does NOT necessarily require initiation of antimicrobial therapy for asymptomatic bacteriuria.

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- a. The prevalence of bacteriuria in elderly institutionalized patient *without* indwelling catheters varies from 25-50% for women and 15-49% for men and increases with age.⁵ Bacteriuria and pyuria in the elderly is, to a large degree, an expected finding.
- b. Symptomatic UTI is substantially less common than asymptomatic bacteriuria.
- c. Asymptomatic bacteriuria has not been associated with long-term negative outcomes, such as pyelonephritis, sepsis, renal failure or hypertension.⁴⁷
- d. The overuse of antibiotics leads to antibiotic resistance and potential side effects.^{16,17,19}
- e. Pyuria, leukocyte esterase, or nitrate, individually, accompanying asymptomatic bacteriuria are NOT necessarily an indication for antimicrobial treatment in the general population.¹¹ Some exceptions include: pregnancy²¹ and patients with urinary tract stenting⁵⁷
- f. Recent evidence suggests that in younger women with true recurrent UTI, that bacteriuria may be “protective” for future UTI with more pathogenic organisms.¹³⁰

Myth 9: Falls and acute altered mental status changes in the elderly patient are usually caused by UTI.

Truth 9: Altered mental status and falls in the elderly are caused by many factors. Other signs and symptoms of UTI, especially dysuria (when able to assess) should be present to make the diagnosis of UTI in non-catheterized patients. Symptoms of active infection in a catheterized patient are obviously more difficult to assess.³⁹

- a. Elderly patients with acute mental status changes accompanied by bacteriuria and pyuria *without clinical instability or other signs or symptoms of UTI* can reasonably be observed for resolution of confusion for 24–48 hours without antibiotics^{131,132}, while searching for other causes of confusion.
 - 1. In all elderly patients, acute mental status change and functional decline are non-specific clinical manifestations of several circumstances, including, but not limited to dehydration, hypoxia, and poly-pharmacy adverse reactions. Diagnosis of UTI should be correlated with others signs of systemic inflammation,
- b. In the non-catheterized patient, acute changes in mental status was associated with *bacteriuria plus pyuria* in patients with *clinically suspected* UTI.³⁰
 - 1. However, these two findings are also frequently demonstrated in elderly patients with asymptomatic bacteriuria and attribution of altered mental status to bacteriuria can result in failure to identify the true cause.^{25,26,133} Falls without localizing urinary symptoms were not associated with bacteriuria or pyuria.^{43,44}
- c. Elderly patients, especially those with dementia or indwelling Foley catheters, have high rates of bacteriuria and may NOT have UTI symptoms⁵. Diagnosis of infection/sepsis of a urinary source with simple bacteriuria is not recommended unless other infectious sources have been excluded and patients meet urine criteria suspicious for infection. Diagnosis of UTI in the catheterized patient should always be a diagnosis of exclusion by investigating other causes for altered mental status in the absence of localized urinary tract findings.³⁶

Myth 10: The presence of yeast or candida in the urine, especially in patients with indwelling urinary catheters, indicates a candida UTI and needs to be treated.

- a. The occurrence of candiduria in the catheterized patient is common, especially in the ICU and most often reflects colonization or asymptomatic infection. Treatment of candida in the urine should only occur in rare situations, such as clear signs and symptoms of infection and no alternative source of infection
- b. Treatment of asymptomatic candiduria in non-neutropenic catheterized patients has *usually not* been shown to be valuable¹³⁴
- c. “Treatment” of candiduria should first include replacement/removal of urinary tract instruments.
- d. Except in selected highest risk transplant recipients, or immuno-compromised hosts who are receiving steroids, or clinical scenarios for patients at high risk of systemic candidiasis, candiduria has a low incidence of systemic complications, and conservative observation is usually indicated.
- e. Isolation of candida in the urine of non- catheterized patients should second raise concerns about vaginal or external contamination. If a reliable specimen is repeatedly obtained with yeast, and the patient is symptomatic, consideration of anti-fungal therapy may be warranted.

Last reviewed/ revised: 10/2015

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1. Foley A, French L. Urine clarity inaccurate to rule out urinary tract infection in women. *Journal of the American Board of Family Medicine : JABFM*. Jul-Aug 2011;24(4):474-475.
2. Nicolle LE. The chronic indwelling catheter and urinary infection in long-term-care facility residents. *Infection control and hospital epidemiology : the official journal of the Society of Hospital Epidemiologists of America*. May 2001;22(5):316-321.
3. Nicolle LE, Bradley S, Colgan R, Rice JC, Schaeffer A, Hooton TM. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America*. Mar 1 2005;40(5):643-654.
4. Van Nostrand JD, Junkins AD, Bartholdi RK. Poor predictive ability of urinalysis and microscopic examination to detect urinary tract infection. *American journal of clinical pathology*. May 2000;113(5):709-713.
5. Stone ND, Ashraf MS, Calder J, et al. Surveillance definitions of infections in long-term care facilities: revisiting the McGeer criteria. *Infection control and hospital epidemiology : the official journal of the Society of Hospital Epidemiologists of America*. Oct 2012;33(10):965-977.
6. Tambyah PA, Maki DG. The relationship between pyuria and infection in patients with indwelling urinary catheters: a prospective study of 761 patients. *Archives of internal medicine*. Mar 13 2000;160(5):673-677.
7. Pappas PG. Laboratory in the diagnosis and management of urinary tract infections. *The Medical clinics of North America*. Mar 1991;75(2):313-325.
8. Bent S, Saint S. The optimal use of diagnostic testing in women with acute uncomplicated cystitis. *The American journal of medicine*. Jul 8 2002;113 Suppl 1A:20S-28S.
9. Deville WL, Yzermans JC, van Duijn NP, Bezemer PD, van der Windt DA, Bouter LM. The urine dipstick test useful to rule out infections. A meta-analysis of the accuracy. *BMC urology*. Jun 2 2004;4:4.
10. Sundvall PD, Gunnarsson RK. Evaluation of dipstick analysis among elderly residents to detect bacteriuria: a cross-sectional study in 32 nursing homes. *BMC geriatrics*. 2009;9:32.
11. Warren JW, Tenney JH, Hoopes JM, Muncie HL, Anthony WC. A prospective microbiologic study of bacteriuria in patients with chronic indwelling urethral catheters. *The Journal of infectious diseases*. Dec 1982;146(6):719-723.
12. Loeb M, Bentley DW, Bradley S, et al. Development of minimum criteria for the initiation of antibiotics in residents of long-term-care facilities: results of a consensus conference. *Infection control and hospital epidemiology : the official journal of the Society of Hospital Epidemiologists of America*. Feb 2001;22(2):120-124.
13. Nicolle LE. Urinary tract infections in long-term-care facilities. *Infection control and hospital epidemiology : the official journal of the Society of Hospital Epidemiologists of America*. Mar 2001;22(3):167-175.
14. Nicolle LE. Asymptomatic bacteriuria in the elderly. *Infectious disease clinics of North America*. Sep 1997;11(3):647-662.
15. Frank U, Kleissle EM, Daschner FD, et al. Multicentre study of antimicrobial resistance and antibiotic consumption among 6,780 patients with bloodstream infections. *European journal of clinical microbiology & infectious diseases : official publication of the European Society of Clinical Microbiology*. Dec 2006;25(12):815-817.
16. Tacconelli E, De Angelis G, Cataldo MA, Pozzi E, Cauda R. Does antibiotic exposure increase the risk of methicillin-resistant *Staphylococcus aureus* (MRSA) isolation? A systematic review and meta-analysis. *The Journal of antimicrobial chemotherapy*. Jan 2008;61(1):26-38.
17. Burke JP. Antibiotic resistance--squeezing the balloon? *JAMA : the journal of the American Medical Association*. Oct 14 1998;280(14):1270-1271.
18. ACOG Practice Bulletin No. 91: Treatment of urinary tract infections in nonpregnant women. *Obstetrics and gynecology*. Mar 2008;111(3):785-794.
19. Paick SH, Park HK, Oh SJ, Kim HH. Characteristics of bacterial colonization and urinary tract infection after indwelling of double-J ureteral stent. *Urology*. Aug 2003;62(2):214-217.
20. Cai T, Mazzoli S, Mondaini N, et al. The role of asymptomatic bacteriuria in young women with recurrent urinary tract infections: to treat or not to treat? *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America*. Sep 2012;55(6):771-777.

Last reviewed/revised: 10/2015

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21. Tambyah PA, Maki DG. Catheter-associated urinary tract infection is rarely symptomatic: a prospective study of 1,497 catheterized patients. *Archives of internal medicine*. Mar 13 2000;160(5):678-682.
22. Beveridge LA, Davey PG, Phillips G, McMurdo ME. Optimal management of urinary tract infections in older people. *Clinical interventions in aging*. 2011;6:173-180.
23. Nicolle LE. Asymptomatic bacteriuria in institutionalized elderly people: evidence and practice. *CMAJ*. Aug 8 2000;163(3):285-286.
24. Juthani-Mehta M, Quagliarello V, Perrelli E, Towle V, Van Ness PH, Tinetti M. Clinical features to identify urinary tract infection in nursing home residents: a cohort study. *Journal of the American Geriatrics Society*. Jun 2009;57(6):963-970.
25. Drinka PJ, Crnich CJ. Diagnostic accuracy of criteria for urinary tract infection in a cohort of nursing home residents. *Journal of the American Geriatrics Society*. Feb 2008;56(2):376-377; author reply 378.
26. Nicolle LE. Urinary tract infections in the elderly. *Clin. Geriatr. Med*. Aug 2009;25(3):423-436.
27. Nicolle LE. Symptomatic urinary tract infection in nursing home residents. *Journal of the American Geriatrics Society*. Jun 2009;57(6):1113-1114.
28. Kauffman CA, Vazquez JA, Sobel JD, et al. Prospective multicenter surveillance study of funguria in hospitalized patients. The National Institute for Allergy and Infectious Diseases (NIAID) Mycoses Study Group. *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America*. Jan 2000;30(1):14-18.

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Last Revised: 10/2015