Appendix 1. Diagnosis of Urinary Tract Infection – Top Ten Myths
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For further reading consider:

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 bacteriuria 35

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 bacteriuria 36

   i. ≥ 10^{5} CFU/mL of ≤ 2 species of microorganisms in voided culture

   ii. ≥ 10^{2} CFU/mL of any number of microorganisms in a straight cath culture

c. In patients with an indwelling catheter, ≥10^{3} CFU/mL of any organism(s) should define significant bacteriuria 36 since this is predictive of higher colony counts of 10 to the fifth within 48 hours 128

**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
alone is NOT recommended for diagnosis of UTI.\textsuperscript{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\textsuperscript{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.\textsuperscript{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.\textsuperscript{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%).\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.
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. 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.16

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 stenting.

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, while searching for other causes of confusion.131,132

  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.50

  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.53,44

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.56

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 valuable.

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.
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