

Catheter-Associated Urinary Tract Infections: If You Hear Hoofbeats...

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ANNALS CASE

“A 90-year-old man with a history of benign prostatic hypertrophy and a chronic indwelling catheter presented to the emergency department [ED] with 2 days of “dark” urine, suprapubic pain, and decreased oral intake. He denied dysuria, fevers, or chills. The patient’s physical examination revealed mild suprapubic tenderness and a discolored Foley catheter bag. Serum laboratory test results were unremarkable. His urinalysis revealed a specific gravity of 1.015, and per high-power field, greater than 50 WBCs, 3 to 5 RBCs, many bacteria, and a pH of 8.0. Subsequent urine culture grew *Escherichia coli*. Diagnosis: Purple urine bag syndrome.”¹

They say that purple is the color of royalty and that, millennia ago, rare purple dye from sea snails was worth its weight in gold. Why? Because it took thousands of snails and countless man-hours of milking snail glands to come up with just 1 g of pure dye.² Imagine what those people would’ve said if they’d seen this patient and his urine....

To be fair, though, purple urine bag syndrome is a rare condition in which all the stars have to align to concoct this liquid purple gold: indwelling urinary catheter, alkaline urine, and bacteria with just the right kind of enzyme.¹ It naturally makes sense, then, that this phenomenon tends to happen most commonly in elderly patients with chronic indwelling Foleys.³ Now, although this case’s teaching

point that the purple color was a uniquely obvious indicator of a catheter-associated urinary tract infection (CAUTI), abnormally colored urine isn’t the only clue to the diagnosis. Let’s go over some practical things to guide your approach when evaluating someone for CAUTI.

LAYING THE GROUND RULES: THE 3 C’S

When it comes to defining CAUTIs, suffice it to say that several prominent international societies and experts define it as a combination of history, physical exam result, and urinary tests, otherwise known as “the 3 C’s”⁴⁻⁶:

1. Catheter (duh): The patient has an indwelling urethral or suprapubic catheter for greater than 2 days and the patient has that indwelling catheter at presentation or had it removed 1 day before, or the patient performs intermittent catheterization.
2. Change in Condition: New or worsening signs and symptoms (Figure).
3. Culture: A urine culture from catheterized or midstream catch that grows greater than 10^3 colony-forming units/mL (Infectious Diseases Society of America guideline⁴) or greater than 10^5 colony-forming units/mL (Centers for Disease Control and Prevention [CDC] guideline⁵) of greater than 1 bacteria.

Now, before you get yourself into a tizzy about the impracticalities of getting urine culture results and counting days of “indwelling-ness” in the ED, let’s start with a simple, structured approach to evaluating a patient for a CAUTI in the ED.

THE 5 W’S: WHO, WHAT, WHEN, WHERE, WHY Who Put In the Catheter and How?

Seems silly to ask, but as we’ll discuss in a few paragraphs, if you end up diagnosing a CAUTI for your patient, you may need to replace the catheter. If that’s the case, you’d probably like to know if 5 nurses and 2 emergency providers failed last time, ultimately requiring the urologist to come in

Patients With Indwelling Catheter

Fever
 Rigors
 Altered mental status
 Malaise
 Lethargy
 Flank or suprapubic pain
 Costovertebral angle tenderness
 Acute hematuria
 Pelvic discomfort

Patients With Recently Removed Catheter <48 h

Dysuria
 Urgency
 Frequency
 Suprapubic pain or tenderness

Patients With Neurogenic Bladder

Increased spasticity
 Autonomic dysreflexia
 Incontinence
 General discomfort

Figure. CAUTI signs and symptoms.⁴

to use a cystoscope and serial dilators. Save yourself the frustration and find out if you are likely going to need help.

What Is New or Different?

Sniffing out sepsis is second nature to us, so we won't belabor the importance of systemic symptoms and presence of abnormal vital signs. Also, when you look at the accompanying [Figure](#), that all of these signs and symptoms suggest a urinary tract infection (UTI) shouldn't surprise you. Put another way, imagine your patient without the Foley; if it sounds like a UTI and looks like a UTI, then he or she probably has a UTI (mind-blowing, we know).

One important thing to note, though, is not just the presence of these signs or symptoms but also any worsening from baseline. New daytime urinary incontinence in a patient receiving intermittent catheterization who was previously dry, or a patient who is now experiencing suprapubic pain that is different from baseline bladder spasms, should alert you to a possible CAUTI. Also, red flags should be waving in your brain with patients who have spinal cord pathology and neurogenic bladders because CAUTIs can present with nonurologic complaints such as increased spasticity, autonomic dysreflexia, lethargy, or even just malaise.⁷

When Did the Catheter Get Placed?

Sure, if you see yellow rock "candy" encasing the penis and catheter, you can safely assume that the catheter hasn't been changed in a long time. That being said, an important number to remember is 2 weeks, for 2 reasons: diagnosis and treatment. As soon as a catheter is placed, bacteria produce a biofilm that provides a protective environment within which it and other bacteria can flourish and grow. That biofilm creeps up the catheter into the bladder, effectively establishing bacteriuria within 2 weeks.⁸ So urine specimens collected through a catheter in place for more than 2 weeks are considered contaminated and may not accurately reflect bladder urine. Add this onto that: one study demonstrated that replacement of long-term catheters before antibiotic treatment for CAUTIs led to faster clinical improvement and lower rates of CAUTI recurrence.⁹ So in patients with suspected CAUTI who still need a catheter, Infectious Diseases Society of America guidelines recommend replacing catheters older than 2 weeks with a new one and then collecting urine specimens from that new catheter before administering empiric antibiotics.⁴

Where Is the Problem?

Seriously, look at the junk. We know it's awkward to do it in the hallway, where most of these patients end up, but walk them to a room, close the door, and put on a pair of gloves.

Beyond assessing for suprapubic fullness and tenderness and costovertebral tenderness, the most common pitfall lies in the genitourinary exam, specifically failing to consider alternate sources of pain and potential infection. The meatus and urethra should be inspected for any signs of meatal erosion, periurethral abscess, or urethral obliteration as a result of prolonged urethral catheterization. The color of the urine in the tubing and bag should also be assessed (hey, it's purple!). The testicles should be palpated for any signs of epididymo-orchitis, which can refer pain to the suprapubic area. Finally, consider the digital rectal exam to assess the prostate, although you should avoid it in men with recent prostate surgery and avoid an aggressive one in suspected acute prostatitis.

Why Do You Have a Catheter?

OK, maybe there's a better way to ask this question so that the patient won't stare at you like you're a doofus ("Um, because I can't pee?"). But this is probably the most important question to ask. As we mentioned, typical CAUTI treatment may involve catheter replacement. But, if you have a patient who has an indwelling catheter as a result of genitourinary trauma or a urologic procedure and you suspect a CAUTI, don't remove it! Premature removal

of a postoperative or trauma catheter can have severe consequences, like peritonitis, abscess, urinomas, fistulas, or strictures.¹⁰ Some of these operations aren't externally obvious, and heaven knows patients don't tell you things, so ask! If the patient is unreliable, then carefully look for signs of recent surgery on physical exam: lower midline incision, laparoscopic incisions, and the often overlooked perineal incision hiding under the scrotum. For any postoperative patient, be sure to call your urologist before touching that catheter.

WHAT ABOUT THE URINE?

Now that we're done talking with the patient, we can focus our attention on the liquid gold. Urine cultures as a criterion for defining CAUTI make sense, but unfortunately we don't have that luxury in the ED. Sure, previous urine culture results can help guide antibiotic selection if indicated, but even those are often hard to come by. So that leaves us with the good ol' urinalysis (dipstick and microscopic analysis).

A NEGATIVE URINALYSIS RESULT IS NEGATIVE? MIND-BLOWING!

What's the saying about urinalysis and chronic indwelling urinary catheters? Pyuria doesn't necessarily mean infection. However, although pyuria alone is an unreliable diagnostic marker for UTI in patients with a catheter,⁴ one study in the trauma ICU found that a urinalysis demonstrating absence of bacteria, negative leukocyte esterase result, negative nitrite result, and urine WBCs less than 10 per high-power field had a negative predictive value of 100%, effectively ruling out CAUTI.¹¹ Sadly, there are no studies that look specifically at the diagnostic accuracy of urinalysis for UTI in patients with an indwelling catheter who present to the ED (surprise, surprise).

WHEN TO PHONE A FRIEND

As we always say, it's easy to pick up the phone when you have a septic patient. But know that there are lots of reasons to call your friendly neighborhood urologist: presence of postoperative and trauma catheters, evidence of abscess formation anywhere along the genitourinary tract (eg, periurethral abscess, prostatic abscess, pyocystitis, pyonephrosis), or difficulty with catheter replacement. That being said, don't forget about your infectious disease friends, especially when dealing with patients with a history of multidrug-resistant organisms.

Patients with suspected CAUTI who are stable for discharge with outpatient antibiotics should have a follow-up appointment in 24 to 48 hours for definitive urine culture and antibiotic sensitivity results, as well as clinical assessment of response to empiric antibiotics.

ANTIBIOTICS? YOU'RE ON YOUR OWN!

Because of increasing antibiotic resistance and large variations in microbial prevalence, your choice of empiric antibiotics depends on your local antibiograms.¹² That being said, Infectious Diseases Society of America guidelines state that CAUTIs should be started with a 7-day course of antibiotics, tailoring the antibiotics according to sensitivities and if necessary extending duration according to clinical response.⁴ If the urinalysis result is negative and the patient does not have a history of resistant infections and has minor symptoms (no systemic signs or pain), then it is reasonable to hold off on empiric antibiotics until the urine culture results in 24 to 48 hours. There is consensus that in the absence of clinical symptoms or signs, bacteriuria or funguria should not be treated with antimicrobial therapy.⁴ That being said, there are specific situations in which treatment of asymptomatic bacteriuria is generally accepted, such as for pregnant women.⁴

COMMON SENSE IS COMMON SENSE!

If we take another look at this case, this patient fits the picture of a CAUTI: there was an indwelling catheter, the patient had new suprapubic pain and tenderness, along with abnormally colored urine, and the urinalysis revealed significant pyuria and bacteriuria. This brings us to the bottom line: if patients with a Foley look like they have a UTI and sound like they have a UTI, treat the UTI. In the end, the urine culture grew out *E coli*, confirming the diagnosis, although we're pretty sure the patient knew he had a serious problem when he saw purple tempera paint in his leg bag!

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IMAGES IN EMERGENCY MEDICINE

(continued from p. 436)

DIAGNOSIS:

Purple urine bag syndrome. Purple urine bag syndrome was first reported in 1978.¹ This purple staining of both urine and Foley catheter bag is most often observed in elderly female patients with chronic indwelling catheters.² The syndrome is associated with urinary tract infections and alkaline urine. The purple color occurs when “bacterial indoxyl sulfatase catalyz[es] the conversion of indoxyl sulfate, a metabolite of dietary tryptophan, to indigo in strong alkaline liquid media.”³ A 41-patient case series at a geriatric center in Italy found that 68.3% were catheterized by a plastic Foley, 80.5% had alkaline urine (pH >8), and typical pathogens were either *E coli* (56.1%) or *Proteus mirabilis* (24.3%).⁴ Although not common and potentially alarming to patients, purple urine bag syndrome can be treated with directed antibiotic therapy and catheter exchange.⁵

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