Diagnosis and Management of Urinary Tract Infection in the Emergency Department and Outpatient Settings

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KEYWORDS

• Cystitis • Pyelonephritis • Emergency department • Sepsis • Urolithiasis

KEY POINTS

- The extent of diagnostic work-up in emergency departments (EDs) varies widely depending on severity of illness and underlying comorbidities.
- Most patients with pyelonephritis can be successfully managed as outpatients, even if they appear seriously ill on initial presentation.
- It is important to follow-up on pending culture and susceptibility results for patients discharged home from an ED.
- Urinary obstruction should be ruled out in patients with a urinary tract infections (UTIs) and severe sepsis/septic shock. Bedside ultrasound is often used for this in an ED.

INTRODUCTION

Urinary tract infections (UTI) are common clinical conditions seen EDs. Patients with UTIs often become acutely symptomatic and seek care in an ED during off-hours, when they cannot get a timely appointment with their primary care physician, or when they do not have access to primary care. Patients who present to an ED are often more ill than those who present to an office-based practice.

Infectious disease specialists typically become involved in management of UTIs only in unusual or complicated cases (**Box 1**). In contrast, emergency physicians see a wide spectrum of illness severity, from uncomplicated cystitis to septic shock. The challenges of managing UTIs in EDs include limited history, lack of longitudinal follow-up, and lack of culture and susceptibility results. EDs frequently provide

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Box 1
Selected characteristics that make urinary tract infections complicated

- Pregnancy
- Male gender
- Moderate to severe diabetes or other immunosupressed state
- Structural abnormalities of urinary tract (kidney stones, renal and perinephric abscess, emphysematous pyelonephritis, or polycystic kidney disease)
- Functional abnormality of urinary tract (vesico-ureteral reflux, spinal cord injury, neurogenic bladder)
- Hospital-acquired infections
- Presence of external catheters (urethral, suprapubic, or nephrostomy tubes)

medical care for patients without medical insurance in the United States, and many patients have no other access to care or follow-up.

The role of the emergency physician is to determine complicated versus uncomplicated infection, make disposition decisions regarding hospitalization and level of care, and choose appropriate empiric antimicrobial treatment based on the likely bacterial etiologies and the ever-changing patterns of antimicrobial resistance. Because UTIs are common, it is also important to consider cost issues in the diagnostic evaluation and management. It may be neither practical nor advisable to send cultures for every case of uncomplicated cystitis. This article reviews the diagnostic approach to and treatment of adults presenting to EDs with UTI.

CLASSIFICATION/DEFINITIONS

UTIs can be described by their location and the presence of functional or structural abnormalities. Acute cystitis is an infection of the bladder and is referred to as a lower UTI. Pyelonephritis, an upper UTI, is more severe and can occur in conjunction with acute cystitis. In practice, it is sometimes difficult to make a clear distinction between these clinical syndromes during an ED evaluation. Uncomplicated UTIs are episodes of acute cystitis or pyelonephritis occurring in healthy premenopausal women who are not pregnant with no history of structural abnormalities or without any functional abnormalities in the urinary tract.[1–3] These infections are generally considered at lower risk for drug-resistant organisms and treatment failure. All other cases are classified as complicated infections.

Complicated UTIs are heterogeneous: broadly defined, they are associated with a condition that increases the risk of acquiring infections or failing therapy.[1,4] Distinguishing between complicated and uncomplicated is important because it influences the initial evaluation and the choice and duration of antibiotics.

EPIDEMIOLOGY

UTIs are common, with approximately half of all women reporting having at least one infection. In 2010, there were more than 3 million ED visits with a primary diagnosis of a UTI.[5,6] Of these, 84.5% were women and approximately half of all UTI presentations to an ED were among patients aged 18 to 44. Overall, the acuity of presentations to EDs is higher than those seen by primary care providers. More than 400,000 (13%) ED visits for UTIs in 2010 were for pyelonephritis, approximately 13 visits per 10,000 people. In the general population, pyelonephritis occurs in 1 case per 28 cases of cystitis.[7]

MICROBIOLOGY

The pathogens responsible for uncomplicated UTIs have been consistent for many years, with *Escherichia coli* the primary pathogen in the vast majority of acute uncomplicated cystitis and most episodes of complicated UTIs and pyelonephritis.[1] *Staphylococcus saprophyticus* accounts for 5% to 15% of UTIs, typically seen in sexually active younger women with acute cystitis.[8] Other gram-negative bacilli, such as Klebsiella and *Proteus mirabilis*, and the gram-positive cocci—enterococcus and group B streptococcus—make up the majority of the remaining cases.[9,10]

Complicated UTIs and catheter-associated UTIs have a wider range of associated pathogens. Polymicrobial infections are encountered more frequently. Resistant organisms, such as extended-spectrum β-lactamase (ESBL), producing enterobacteriaceae, *Pseudomonas aeruginosa,* or *Enterococcus faecium*, are more common in complicated infections. Young men without a history of UTIs typically have a uropathogenic *E coli*. Older men, with a history of obstruction, can have a variety of organisms. If *Staphylococcus aureus* is isolated, a bacteremic source seeding the kidney should be considered.

CLINICAL PRESENTATION

The anatomic location and type of UTI can often be determined by the clinical presentation, but some degree of clinical uncertainty is common in the ED. Acute cystitis is characterized by dysuria and frequent or urgent urination and occurs primarily in healthy, premenopausal, adult women who are not pregnant. These symptoms of urethral irritation can also occur in sexually transmitted infections (STIs), in vaginitis, and with exposure to chemical or allergic irritants. Because UTIs and STIs are both common and may coexist in the same population, it is a frequent differential diagnosis challenge.[11]

Acute pyelonephritis involves the upper urinary tract and is typically associated with systemic symptoms, characterized by fevers, chills, nausea, and flank pain. Patients often also have symptoms of acute cystitis (dysuria, frequency, and urgency). Some patients may describe the pain associated with pyelonephritis in atypical locations, such as the epigastric region or right or left upper abdominal quadrants. Fever is commonly present, and its absence should heighten suspicion for the presence of other clinical conditions. In a retrospective cohort study of women 15 years of age or older admitted to the hospital with the diagnosis of pyelonephritis, those patients lacking fever (temperature less than 37.8–C) were more often found to have other diagnoses, such as cholecystitis, pelvic inflammatory disease, and diverticulitis.[12] The presentation of pyelonephritis can be particularly challenging in the elderly, who may be afebrile or have only a low-grade temperature. They may not be able to verbalize their symptoms (eg, patients with dementia or stroke) and may present with altered mental status, lethargy, or complaints of abdominal pain or generalized weakness.

Uncomplicated UTIs are a disease of reproductive age women. Known risk factors include recent sexual intercourse, the use of spermicides, and a personal history of UTIs. Patients with a history of a UTI are often able to accurately self-diagnose. The 4 symptoms that increase the probability of a UTI are dysuria, frequency, hematuria, and back pain. Having vaginal discharge decreases the probability of a UTI. The combination of dysuria and frequency without vaginal discharge makes the probability of a UTI greater than 90%.[13] These older studies still have not been validated, however.

The distinction between cystitis and pyelonephritis is clinical. Although a diagnosis of pyelonephritis may be obvious in patients with fever and flank pain, many clinical

presentations may suggest the possibility of infection involving the kidneys but without certainty. Many women who complain of dysuria and frequency also report subjective fever or vague pain in the back without significant costovertebral angle tenderness. In these circumstances, clinical judgment dictates whether to treat for cystitis (such as with nitrofurantoin) or to give treatment that achieves adequate levels in the kidney tissue and treat pyelonephritis. Older techniques for distinguishing upper tract disease from cystitis, such as a bladder washout with antibiotic solution or detection of antibody-coated bacteria, are never used in practice but have added to knowledge of the subject; it is not uncommon to have subclinical pyelonephritis.[14,15] Patients who are at higher risk for subclinical pyelonephritis include patients with complicating features, such as history of recurrent UTIs; patients with longer duration of symptoms (greater than 7 days); patients who have failed short-course UTI therapy; male patients; and patients with diabetes, pregnancy, or immunosuppression. In clinical practice, the diagnosis of subclinical pyelonephritis is often made in patients who fail a short course of antibiotics for acute cystitis.

LABORATORY DIAGNOSIS

The clinical diagnosis is often not straightforward, and urine testing is usually helpful. This starts with careful collection of urine for urinalysis and possibly a culture. The bladder is normally sterile—urine collected by suprapubic aspiration should not contain leukocytes or bacteria. This is invasive and rarely necessary in clinical practice. The most common method for obtaining urine samples is a clean-catch midstream specimen.[16] In a prospective study of 105 women with UTI symptoms in the ED, there were no statistically significant differences in urinalysis findings or the rate of positive urine cultures when urine was obtained through a midstream clean-catch or in-and-out catheterization.[17] Midstream clean-catch technique can be difficult, however, especially for elderly patients and those with other impairments. Even for those who perform the procedure correctly, surrounding areas can be difficult to clean well. Catherization may be necessary for those who are too ill or immobilized to provide an accurate specimen.

The definitive diagnosis of a UTI is made with a urine culture showing significant bacteriuria. Practically, culture information is not available within the time frame of an ED visit, so diagnosis is based on rapid tests that predict bacteriuria. Several methods are used to evaluate the urine in the clinical laboratory. These include dipstick testing, microscopic examination, and urine flow cytometry. Studies on the utility of these various methods are limited because of varying criteria for defining UTIs.[16] Additionally, leukocytes in the urine occur in both UTIs and noninfectious diseases. Emergency physicians must evaluate the urinalysis in light of these known limitations.

The urine dipstick continues to have a prominent role in the diagnosis of UTI. This test is more convenient and less expensive, and its accuracy in predicting a UTI is comparable to urine microscopy.[18] The dipstick is limited by what it tests. Pyuria is present in the vast majority of patients with acute cystitis and pyelonephritis.[19] There is, however, a wide range of reported sensitivities to detect bacteruria. Leukocyte esterase has a sensitivity of 62% to 98% and specificity of 55% to 96%. In a systematic review, the urine nitrite was found highly specific.[20] Sensitivity is poor, however, because some pathogens, such as *Staphylococcus saprophyticus* and enterococcus, do not reduce nitrate. A positive test also requires sufficient incubation of the urine in the bladder and nitrate in the patient's diet (vegetables).[21] False-positive results are rare but can occur when urine is discolored (eg severe dehydration or

phenazopyridine), making the test difficult to interpret.[22] Furthermore, the interpretation of these tests depends on symptoms.[23] No component of the dipstick can rule out disease in patients with a moderate to high pretest probability.[20]

Patients with classic UTI symptoms occasionally have a negative urinalysis. A common clinical practice in these patients (although not unique to EDs) is to obtain a urine culture, initiate antimicrobial therapy for UTI, and exclude other potential causes for the symptoms (eg, STIs). In a prospective, double-blind, randomized, placebo-controlled trial of 59 women 16 to 50 years of age, presenting with complaints of dysuria and frequency and with a negative urine dipstick test for leukocytes and nitrites, 3 days of antimicrobial therapy significantly reduced dysuria. At the completion of therapy, 76% of patients who received antibiotics reported resolution of dysuria compared with 26% of women in the placebo group ($P = .0005$). At day 7, 90% of the treated women reported resolution of dysuria compared with 59% of women in the placebo group ($P = .02$) (number needed to treat = 4).[24]

Automated instruments perform most of the microscopic analysis in modern hospital laboratories. Some instruments also report the presence of bacteria. The utility of this test may show promise, because these instruments can directly detect bacteria, not just indirect evidence of infection.[25] The absence of bacteria on automated systems should not dissuade clinicians, however, from the diagnosis of UTI if the symptoms are appropriate.

Although urine culture is the reference standard for confirming the diagnosis of UTI, it provides no immediate diagnostic utility in EDs. Urine cultures are recommended in those situations in which they are most likely beneficial, including complicated infections, pyelonephritis, and recent prior antimicrobial treatment.[4] Pretreatment urine cultures are often not performed in patients who present with symptoms of uncomplicated cystitis, where routine cultures have not been shown cost effective or predictive of the therapeutic outcome.[26] These studies were conducted, however, when resistance to standard UTI therapies, such as trimethoprim-sulfamethoxazole and fluoroquinolones, was not as prevalent as today. In the current era of increasing resistance, especially as resistance has been shown to translate into clinical and microbiologic failure, there may be justification for culturing patients with uncomplicated infections.[27,28] It is recognized that a small fraction of uncomplicated cystitis cases may become more complicated as the illness progresses. Hindsight criticism regarding lack of cultures in these cases must be balanced against the recognition that many unnecessary cultures would be required to identify these few. This is an area of reasonable debate and further studies are warranted to optimize use of this resource.

In those cases of cultures sent from the ED, there should be a system for following-up the results or for insuring that results are sent to the appropriate clinicians for follow-up. Because this can be a time-consuming task in a busy department, it is another consideration when deciding whether to send cultures on low-risk patients. This is also a reason the authors do not recommend screening asymptomatic patients for pyuria or bacteruria. Results are often reviewed later by physicians or nurse practitioners with limited access to clinical information. These clinicians may be more likely to recommend unnecessary treatment of a positive culture if the appropriate clinical context is not available, which may lead to undesirable outcomes, such as antimicrobial resistance, adverse drug effects, and cost without benefit.

When culture results demonstrate resistance to the prescribed antimicrobial, patients should be contacted and informed of the result. If symptoms have improved or resolved, it may not be necessary to prescribe a new antimicrobial. Due to high urinary concentrations of many UTI antimicrobials, some infections with demonstrated in vitro resistance may nonetheless be clinically cured. If symptoms have not

adequately improved, however, alternate treatment based on susceptibility results should be provided.

Blood cultures have a limited role in the management of most UTIs. Blood culture is virtually never advised for acute cystitis. The role of blood cultures in pyelonephritis is more controversial. Various studies have investigated the utility of blood cultures in patients with pyelonephritis.[29–31] Although patients with pyelonephritis can often be bacteremic, the blood and urine culture results are almost always concordant, and management is not changed. A 7-day course of ciprofloxacin is adequate even in patients with positive blood cultures.[32] Positive blood cultures from skin contaminants are not uncommon and can lead to increased utilization of resources, repeated blood cultures, and prolonged hospitalization. On the basis of the available evidence, it is best to reserve blood cultures for postmenopausal women (for whom cultures are more often discordant), complicated infections, and immunosuppressed patients. Other less common circumstances may also prompt blood cultures. For example, a patient with fever and pyuria but without other symptoms of pyelonephritis could have endocarditis, and blood cultures could be useful.

When blood cultures are obtained, it is again important to have a system to follow-up on the results for patients who have been sent home from an ED. In many cases, pyelonephritis patients are advised to return to the hospital when blood cultures are positive for a typical uropathogen (eg, *E coli*). This is probably unnecessary in most cases. The authors recommend that patients be contacted by telephone to inform them of the results and inquire as to how they are feeling. If symptoms are improved and the organism is susceptible to prescribed antibiotics, then patients can be instructed to complete the course of treatment and return if symptoms worsen or fail to resolve.

IMAGING

There are no specific formal guidelines for the use of imaging studies for patients with UTIs. In most instances, especially in young women with uncomplicated infections, routine radiographic evaluation is not warranted. Underlying structural abnormalities are uncommon, and focal complications rarely occur in this population. Imaging studies may provide insight, however, as to the cause of the symptoms (eg, kidney stone with or without infection) in situations in which there is diagnostic uncertainty (eg, moderate-to-severe illness with low degree of pyuria) or in patients who have failed therapy or present with recurrent infections. Imaging studies are especially valuable in identifying patients who may have lesions requiring surgical correction (eg, renal or extrarenal abscess, emphysematous pyelonephritis, or obstruction).

Early and expedited imaging studies are also recommended in patients who present with UTIs associated with severe sepsis/septic shock. Source control is an essential component of therapy in patients with severe sepsis/septic shock.[33,34] The clinical diagnosis of complications associated with UTI that requires surgical intervention (eg, obstruction, abscess, or emphysematous pyelonephritis) can be difficult, and imaging studies can be critical in revealing these conditions. In practice, the decision to perform an imaging study in the ED setting is most often based on the clinical suspicion of the presence of underlying structural abnormality or other complicating factors (eg, renal or extrarenal abscess, urolithiasis, and emphysematous pyelonephritis). For patients with severe illness, however, the clinical diagnosis of such complications is insufficiently accurate and urgent radiographic evaluation is recommended.

Imaging tests often used in the ED for further evaluation of renal pathologies include plain-film abdominal radiography, ultrasound, and CT scan. Plain-film abdominal

radiography (kidneys, ureters, and bladder [KUB]) is of limited use by itself. It may show the presence of renal calculi or gas; however, the sensitivity is lower than that of CT scan and does not demonstrate complications, such as obstruction or hydronephrosis. Plain-film abdominal radiography (KUB) is useful for the rapid evaluation of urinary stent position.

Bedside renal ultrasound is done commonly by many emergency physicians. Emergency medicine residency programs include ultrasound training in their curriculum. Renal ultrasound is a valuable diagnostic tool for the evaluation of acute flank pain, especially in unstable patients who cannot tolerate other diagnostic tests, such as CT scan.[35,36] Ultrasound can reveal complications, such as hydronephrosis, renal or extrarenal abscesses, and distal hydroureter (eg, ureterovesical or uteropelvic junction). **Figs. 1** and **2** show images of bedside ultrasound revealing nephrolithiasis and hydronephrosis. In comparison with CT scan, renal ultrasound is not a good test for the detection of ureteral stones or the evaluation of upper and midureter dilatation.

Helical CT scan, in contrast to renal ultrasound, provides more detailed information and is considered the imaging modality of choice for most renal pathologies in the evaluation of flank pain.[37,38] Noncontrast CT scan accurately localizes the size of urinary calculi, hydroureter at all levels, hydronephrosis, gas, and abscess. The precise localization of gas has important therapeutic and prognostic implications and is crucial for the differentiation of emphysematous pyelonephritis from other conditions, such as emphysematous pyelitis, perinephric emphysema, or abscess. The addition of contrast better enables the delineation of abscess from other structures and can provide insight into renal perfusion and reveal renal infarction, renal artery occlusion, or renal vein thrombosis.

UROLITHIASIS AND UTI

Patients with ureteral stones are commonly treated in EDs because they are in severe pain. The diagnosis of UTI accompanying urolithiasis can be challenging, especially when a patient does not have overt signs of infection. A variable degree of pyuria is frequently encountered in acute presentations of urolithiasis. Whether this finding reflects nonspecific inflammation or true infection is, however, unclear. In a prospective observational study of 360 adult patients presenting with acute urolithiasis, approximately 8% were found to have UTI. Clinical features associated with higher likelihood

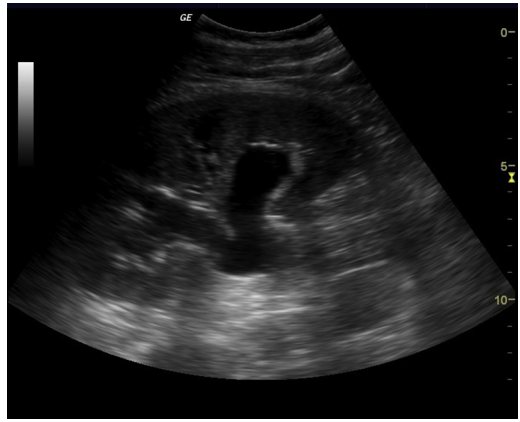

Fig. 1. Hydronephrosis shown on a bedside ultrasound. (*Courtesy of* Michael Stone, MD, Boston, MA.)

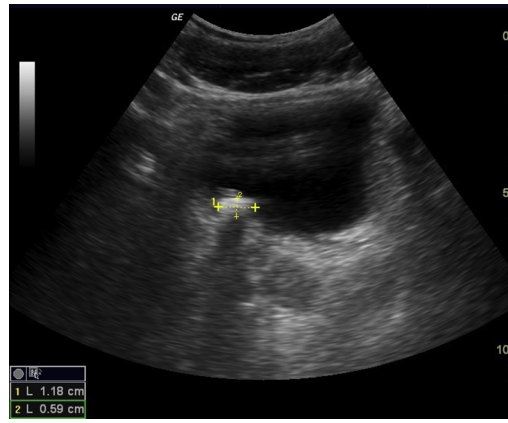

Fig. 2. Bedside ED ultrasound showing a large distal ureterovesical junction stone. (*Courtesy of* Michael Stone, MD, Boston, MA.)

of UTI were female gender, history of dysuria, frequent urination, chills, prior UTI, or fever. Pyuria was only moderately accurate as an indicator of UTI. Pyuria at a cutoff of 5 white blood cells per high-power field was 86% sensitive and 79% specific for UTI. The probability of infection became progressively greater as the level of pyuria increased.[39]

Because of the potential for serious complications (eg, abscess formation, pyonephrosis, and severe sepsis), it is reasonable to initiate antibiotics in patients with urolithiasis who have pyuria regardless of the presence or absence of clinical signs and symptoms of infection. In a study of patients with pyonephrosis associated with nephrolithiasis, a wide spectrum of clinical presentations was found, varying from asymptomatic bacteriuria to urosepsis, including patients without fever or peripheral leukocytosis.[40] Urine cultures can be falsely negative in the presence of an obstructing stone if the infection is proximal to the obstruction.[41]

MANAGEMENT

Uncomplicated Cystitis

The Infectious Diseases Society of America (IDSA) released updated clinical practice guidelines in 2011 for the management of uncomplicated cystitis and pyelonephritis.[3] The recommendations now more emphatically recommend nitrofurantoin, fosfomycin, and trimethoprim-sulfamethoxazole as first-line treatments (**Table 1**). They also emphasize the concept of collateral damage to intestinal and vaginal flora from broad-spectrum antibiotics, highlighting the overuse of fluoroquinolones.

The basic principles that guide recommendations for treatment of cystitis are that antimicrobials should be active against the likely pathogens, should achieve adequate concentrations in the urine, and should have minimal effect on normal flora and that shorter courses are generally associated with lower cost and fewer adverse events. Although cystitis is often a self-resolving infection and cure rates with placebo are as high as 25% to 42%,[3] antimicrobial resistance is associated with greater likelihood of treatment failure. The laboratory cutpoints for resistance attempt to correlate with the urine concentration and, although many antibiotics are concentrated in the urine, the susceptibility tests still correlate with clinical failure rates.

Widespread resistance of coliform bacteria to trimethroprim-sulfamethoxazole has made nitrofurantoin and fosfomycin first-line drugs. Both are effective against *E coli*,

Table 1
Treatment of uncomplicated cystitis

Antibiotic	Dosage	Comments
First-line agents		
Nitrofurantoin monohydrate macrocrystals	100 mg PO BID for 5 d	Low rates of resistance. Does not achieve adequate tissue level to treat pyelonephritis. Not recommended in elderly.
Fosfomycin trometamol	3-g Sachet PO × 1 dose	Does not achieve adequate tissue levels to treat pyelonephritis. Possibly inferior to other agents.
Trimethoprim-sulfamethoxazole	(160/800 mg) 1 PO BID for 3 d	Recommended when resistance rates are lower than 20%.
Pivmecillinam	400 mg BID for 3 d	Not available in the United States. Good reported efficacy with minimal ecologic effects.
Second-line agents		
Ciprofloxacin	500 mg PO BID for 3 d	Increasing rates of resistance. Consider using if possible upper tract infection.
Levofloxacin	500 mg PO QD for 3 d	Same as ciprofloxacin.
Cefpodoxime	100 mg PO BID for 5 d	Consider if known resistance to first line agents. β-Lactam agents are generally inferior agents for UTIs.

are well tolerated, and have few ecologic effects.[7] Nitrofurantoin is less active against other pathogens, however, and inactive against Proteus and *Pseudomonas aeruginosa* and, thus, should not be used for empiric therapy for complicated UTIs, in which these organisms are more common. Fosfomycin is appealing for ED use because it can be given as a single dose for simple cystitis and, therefore, does not require that a patient go to the pharmacy. The clinical data on fosfomycin are sparse and single-dose fosfomycin may be inferior to trimethoprim-sulfamethoxazole and ciprofloxacin.[2] *Staphylococcus saprophyticus* remains susceptible to most antibiotics used for UTIs.

Although antimicrobials with high urine concentrations and minimal effects on normal flora (eg, nitrofurantoin) are preferred, emergency physicians may hesitate to use these drugs for patients who have symptoms suggesting possible upper tract disease, such as subjective fever or back pain. Nitrofurantoin and fosfomycin do not achieve adequate blood and tissue levels and are, therefore, not effective for pyelonephritis. These concerns are magnified because emergency physicians generally do not provide longitudinal care and are not able to follow-up patients' symptoms, and this may encourage physicians to use broader-spectrum antibiotics. For these equivocal cases, the authors give ciprofloxacin (500 mg twice daily for 3 days). Patient satisfaction ratings are increasingly used as quality indicators for physicians. Effective initial therapy may be more important to emergency physicians because of the lack of follow-up. A strategy of narrow-spectrum initial treatment with follow-up for

alternate treatment of failures is more problematic in the ED setting. Furthermore, repeat visits for the same condition may not be covered by insurance companies.

Despite the 1999 IDSA guidelines for management of UTI, fluoroquinolones were the most commonly prescribed antibiotics for UTI. In 2010, 40.4% of adult patients presenting to US EDs with a primary diagnosis of a UTI received either ciprofloxacin or levofloxacin, representing 1.2 million patients; 13% of patients received trimethoprim-sulfamethoxazole (370,000) and 11% received nitrofurantoin (311,000).[6]

Fluoroquinolones and β-lactam antibiotics are reserved for patients who have failed first-line therapy or have contraindications. Most emergency physicians are not aware that multiple trials have demonstrated that β-lactams are not as effective for UTIs as the other recommended regimens. A recent trial comparing ciprofloxacin and cefpodoxime provides further evidence that even third-generation cephalosporins are not appropriate 3-day regimens.[42]

UTI Versus STI

Another common scenario of diagnostic uncertainty in EDs is making the distinction between UTI and genital STI. Both are common in otherwise healthy individuals of reproductive age, and there is much overlap in the clinical syndromes of dysuria and associated symptoms. In men, the clinical syndromes of prostatitis and epididymitis are known to be caused by either typical uropathogens, such as *E coli*, or by sexually transmitted pathogens, such as *Chlamydia trachomatis* or *Neisseria gonorrhoeae*. In women, dysuria may be a presentation of UTI but can also be a presentation of chlamydia or gonorrhea as well as herpes simplex. Urethritis from any of these pathogens can be associated with pyuria on a clean-catch specimen. Identification of the pathogen by urine culture or by nucleic acid amplification test is generally not available within the time frame of an ED visit.

Clinicians are, therefore, left with the options of providing empiric treatment of UTI, providing empiric treatment of STI, or providing empiric treatment that is active against both possibilities. If clinicians choose to treat for only one possibility, then it is important to follow-up on the results of urine cultures or STI tests so treatment can be provided later if they are positive. Because of the difficulty contacting patients from EDs and having them return for treatment, there is an incentive to provide empiric treatment that covers both possibilities when there is reasonable diagnostic uncertainty. One option is to use levofloxacin, which has activity against common uropathogens as well as chlamydia, with or without an intramuscular dose of ceftriaxone.

Pyelonephritis

Patients with pyelonephritis are frequently quite ill when they present to an ED. Many are in severe pain, febrile, tachycardic, vomiting, and dehydrated, often meeting criteria for sepsis. Nonetheless, a majority can be successfully treated as outpatients if symptomatically improved after a period of observation and treatment in an ED that includes intravenous hydration, antibiotics, antipyretics, and antiemetics. When patients fail to improve in the ED, bedside ultrasound should be considered to rule out ureteral obstruction, perinephric abscess, or other complication. For patients with severe sepsis/septic shock, it is important to provide aggressive fluid resuscitation and use other modalities to optimize tissue oxygen delivery.[33]

Empiric antibiotic recommendations for pyelonephritis are different from those for cystitis for a couple of reasons. Pyelonephritis is more often associated with systemic illness and progression to severe sepsis. It is important to choose therapy that achieves adequate levels not only in the urine but also in renal tissue and blood due to the real possibility of bacteremia. For these reasons, fluoroquinolones are usually

the first-line choice, despite concerns about greater likelihood of selecting resistance among intestinal flora (Table 2).

Fluoroquinolone resistance has increased greatly in recent years. Although this was largely driven by use of fluoroquinolones for respiratory infections, the greatest impact has been on management of UTIs. In areas where there is more than 10% fluoroquinolone resistance, IDSA guidelines recommend giving a long-acting parenteral antibiotic, such as ceftriaxone. The rationale is that this provides more reliable antimicrobial coverage during the first day while culture and susceptibility results are pending. In a study of trimethoprim-sulfamethoxazole versus ciprofloxacin for pyelonephritis patients in an ED, cure rates were significantly higher in patients with organisms resistant to the oral antibiotic when they were given an initial dose of ceftriaxone.[43]

In addition to increasing resistance to trimethoprim-sulfamethoxazole and fluoroquinolones, uropathogens producing ESBL are also becoming more common.[44–47] Although they are more common in many other countries, they are now emerging in some areas of the United States.[48] In areas in which ESBLs are found, clinicians may consider initial empiric treatment with a carbapenem for UTI associated with severe sepsis or septic shock. Patients with uncomplicated pyelonephritis can be treated with a 7-day course of oral ciprofloxacin, even if they are found bacteremic.[3,32,43] Alternate treatments should be considered if there is a history of infection with resistant organisms.

Complicated Urinary Tract Infections

It is difficult to make overall recommendations on complicated UTIs because of the broad range of complicating factors and associated pathogens. Because the bacteriology of complicated infections is more diverse and antimicrobial resistance more common, it is especially important to obtain culture specimens in these cases. Not surprisingly, there are no published consensus guidelines for these circumstances, and the vast amount of literature on UTIs deals with uncomplicated UTIs. Some

Table 2
Treatment of uncomplicated pyelonephritis[a]

Antibiotic	Dosage	Comments
First-line agents		
Ciprofloxacin	500 mg PO BID for 7 d	Fluoroquinolones are the drug of choice for pyelonephritis despite ecologic adverse effects. There is increasing resistance, however, of *E coli* to these agents
Levofloxacin	750 mg PO QD for 5 d	Same as for ciprofloxacin.
Second-line agents		
Cefpodoxime	200 mg PO BID for 10–14 d	Minimal evidence on using cefpodoxime or other β-lactam agents for pyelonephritis.
Trimethoprim-sulfamethoxazole	(160/800 mg) 1 PO BID for 14 d	Give ceftriaxone or aminoglycocide.

[a] An initial dose of 1 g of ceftriaxone or once-a-day dose of gentamicin (5–7 mg per kg) is recommended if using second-line agents or if there is greater than 10% resistance of *E coli* to fluoroquinolone.

patients who are classically grouped as having complicated infections, such as those with controlled diabetes or postmenopausal women, can usually be treated the same as those with uncomplicated infections.

One complicated UTI scenario commonly encountered in the ED is the presence of an indwelling urinary catheter, in which diagnosis of UTI can be challenging. Depending on the duration of catheterization, most catheterized patients have bacteriuria often accompanied with pyuria. Hence, on the basis of urinalysis, the distinction between those who are merely colonized and those who have a ''true'' infection is not straightforward.[49] Because culture results are not available during ED evaluation, emergency physicians rely on the presence of clinical signs and symptoms of infection to diagnose catheter-associated UTI. This approach has its pitfalls, however. Most patients with indwelling urinary catheters who present to the ED are elderly and residing in nursing homes. These patients frequently have multiple medical problems, are on numerous medications, and are usually not able to verbalize their symptoms. In addition, they may lack clinical signs of infection and often present with an altered level of consciousness. Another pitfall is attributing the source of infection to the urine and overlooking other causes (eg, pneumonia or ischemic bowel). Because catheter-associated UTI is a common cause of nosocomial morbidity and mortality, empiric antimicrobial therapy, in addition to replacement or removal of the catheter, is often appropriate in such patients.

DISPOSITION

Probably the single most important decision made in the ED is whether a patient is admitted to the hospital or sent home. This decision has a great impact on cost—outpatient treatment of UTI typically costs 10s of dollars, but inpatient treatment costs 1000s. Cost must be balanced against the need for specialized inpatient services and the risk of rapid deterioration at home that may not be adequately addressed by return precautions. Although there are validated decision rules to inform admission decisions for some other infections, such as pneumonia, there is no validated decision rule to determine who gets admitted for UTI. **Box 2** lists some common indications for admission.

Many patients with pyelonephritis initially appear toxic with high fevers, vomiting, and tachycardia, but their symptoms can improve quickly in an ED with antipyretics, intravenous fluids, antiemetics, and antibiotics. Most can then be discharged home with oral antibiotics. With increasing fluoroquinolone resistance, it is especially important to follow-up on culture and susceptibility results after patients are discharged home.

Box 2
Possible indications for admission for patients with pyelonephritis

- Intractable nausea or vomiting
- Hemodynamic instability
- Presence of obstruction or complications (emphysematous pyelonephritis)
- Failure of outpatient therapy
- Poor social support (inability to purchase medications or obtain follow-up)
- Suspicion of resistant organism with no oral treatment option

Because of the potential for both maternal and fetal complications, pregnant women with pyelonephritis are most often admitted to the hospital (at least for a brief period of observation) and treated with intravenous antibiotics. Oral outpatient therapy has been shown safe and effective for the treatment of selected pregnant patients with pyelonephritis.[50,51] These studies included initial observation and treatment with parenteral antibiotics; however, no outpatient trials have been done in pregnant patients in whom oral therapy was used alone.

SUMMARY

Emergency physicians encounter UTIs in a wide spectrum of disease severity and patient populations. Unusual presentations are common, and some patients may lack the classic symptoms of UTI. The diagnosis is especially challenging in the elderly, patients with indwelling catheters, and in patients with acute urolithiasis. Most patients do not require an extensive diagnostic evaluation and can be safely managed as outpatients with oral antibiotics.

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