



Origination 06/1999
Effective 05/2021
Last Revised 08/2021

Area Ambulatory
Patient Care
Applicability UMHS-Clinical
Public
References Guideline

Ambulatory Adult Urinary Tract Infection Guideline

Urinary Tract Infection (UTI) in Adults, Pregnant Women and Minors

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Patient population: Adults with UTI

Objective: Implement a cost-effective and evidence-based strategy for UTI management in adults

Key Points

■Diagnosis (Figure 1)

- **History.** Diagnosis is primarily made by history. In women with dysuria and urinary frequency, in the absence of vaginitis, **acute cystitis** is the diagnosis 90% of the time [IC*]. **Complicated cystitis** is associated with factors that either increase the risk of serious outcomes or decrease the efficacy of treatment (Table 1). Diagnose **pyelonephritis** based on symptoms of cystitis plus acute onset of flank pain or tenderness, with a urinalysis indicating bacteriuria or pyuria. In men, consider if prostatitis might be present.
- **Telephone triage.** In nonpregnant women with prior history of uncomplicated cystitis, consider telephone triage [IIC].
- **Urinalysis.** Urinalysis for detection of pyuria by dipstick or microscopy has a sensitivity of 80 - 90% and a specificity of 50% for predicting UTI [IB].
- **Urine culture.** Urine culture is NOT indicated in most cases of acute cystitis in women [IIIC] but should be sent in men [IC]. At a threshold of > 100,000 organisms, urine culture is 50% sensitive for UTI; at a threshold of >100 organisms, it is 90% sensitive. Always perform a urine culture with sensitivities in suspected pyelonephritis. Consider urine culture in patients with recurrent UTI or in the presence of complicating factors. Screen pregnant women at the initial prenatal visit with a urine culture. Always obtain a urine culture in symptomatic pregnant women.

■Treatment

- **Uncomplicated cystitis (Table 2): First line:** nitrofurantoin for 5 days [IA]; **Second line:** trimethoprim/ sulfamethoxazole (TMP/SMX) for 3 days [IA], or oral cephalexin for 3-7 days, or

fosfomycin for 1 day.

- **Complicated cystitis (Table 2): First line:** nitrofurantoin for 7 days [IA]; **Second line:** TMP/SMX for 7 days [IA], or oral cephalexin for 7 days, or fosfomycin every 48 hours for 3 doses.
- **Pyelonephritis (Table 4):** Ceftriaxone 1 g IM or IV x 1 dose, followed by an oral antibiotic: **First line:** TMP/SMX for 7-14 days [IB]; **Second line:** ciprofloxacin for 7 days [IA], or levofloxacin for 5 days;¹ **Third Line:** amoxicillin/clavulanate for 10-14 days [IB].
- **Asymptomatic bacteriuria:** Do not treat asymptomatic bacteriuria [III A], except in pregnancy and prior to some urologic procedures.
- **Prostatitis:** Choose an antibiotic that penetrates the prostate, such as TMP/SMX, ciprofloxacin, or levofloxacin, when concerned about prostatitis [IC].

■ Follow-up and Prevention

- **Patients with resolved symptoms** require no routine laboratory follow-up [III B].
- **Patients with recurrent UTIs (Table 3)** (≥ 2 UTIs in 6 months, or 3 episodes in 1 year):
 - In postmenopausal women, offer intravaginal estrogen [IB].
 - Encourage premenopausal women to drink at least 1.5 L of water per day [IB].
 - Consider antibiotic prophylaxis or self-initiated therapy if behavioral strategies are not effective [II A].
 - Assess for urinary retention in men [IA] and postmenopausal women [IB].
 - Cystoscopy and urinary tract imaging are rarely indicated in patients with recurrent UTI [III D].
 - **Avoid catheterization** whenever possible. When needed, choose clean intermittent catheterization over an indwelling catheter.

* Strength of recommendation:

I = generally should be performed; II = may be reasonable to perform; III = generally should not be performed.

Level of evidence supporting a diagnostic method or an intervention:

A = Systematic review of randomized controlled trials; B = Randomized controlled trials; C = Systematic review of nonrandomized controlled trials; D = Individual observation descriptive studies; E = Expert opinion.

Figure 1. Diagnosis and Management of UTI in Adult Non-Pregnant Women

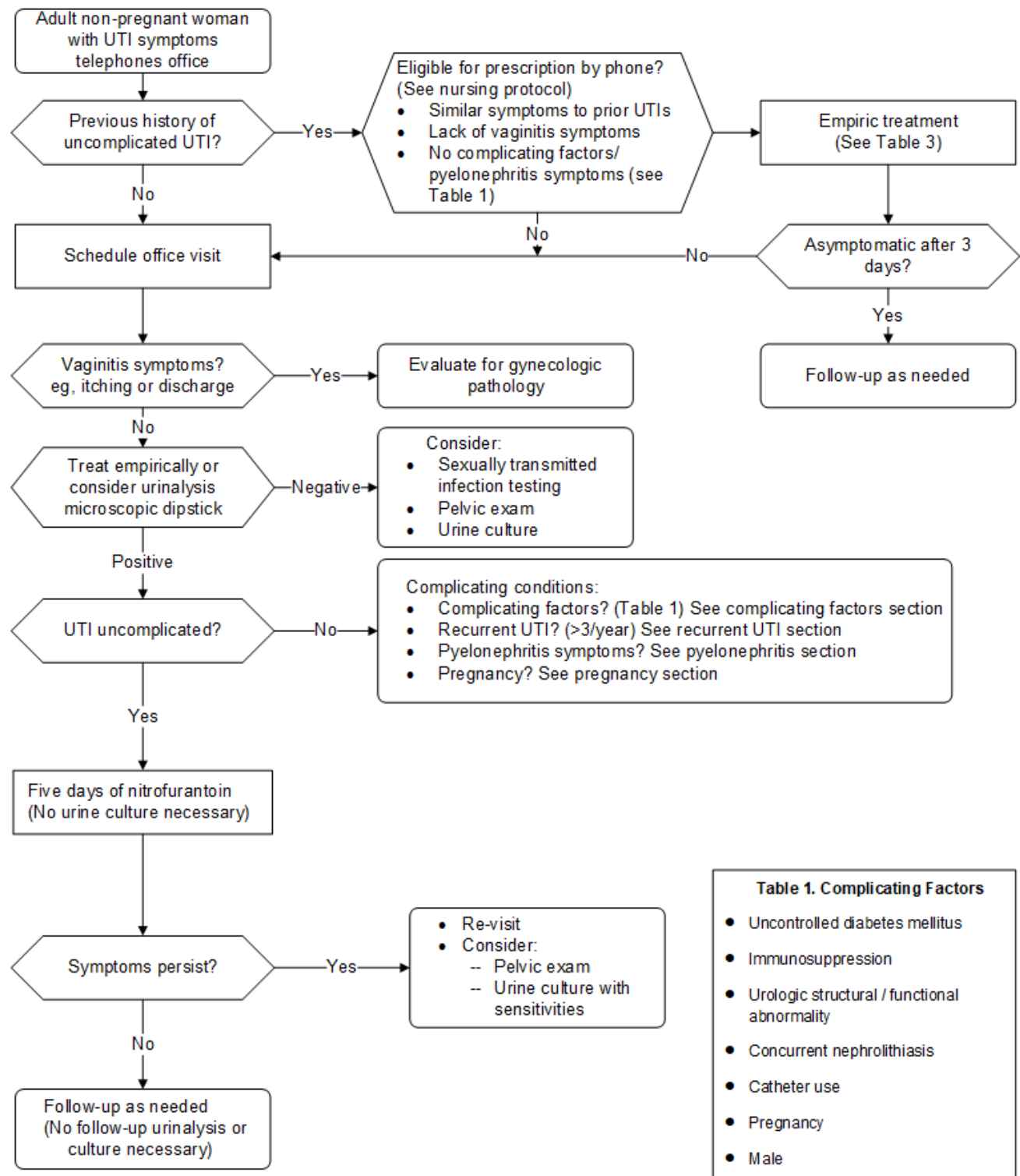


Table 1. Complicating Factors

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• Uncontrolled diabetes mellitus
• Immunosuppression
• Urologic structural / functional abnormality
• Concurrent nephrolithiasis
• Catheter use
• Pregnancy
• Male

Uncontrolled diabetes mellitus
 Immunosuppression
 Urologic structural / functional abnormality
 Concurrent nephrolithiasis
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 Pregnancy
 Male

Table 2. Treatment of Acute Uncomplicated and Complicated Cystitis

Uncomplicated	Cost ¹	Complicated	Cost ¹
First Line: Nitrofurantoin ² 100 mg twice daily x 5 days	Brand Generic \$27\$11	First Line: Nitrofurantoin 100 mg twice daily x 7 days	Brand Generic \$38\$14
Second Line: TMP/SMX DS twice daily x 3 days Cephalexin 500 mg twice daily x 3 - 7 days Fosfomycin 3 g x 1 dose	\$17\$4 \$56-132\$6 \$99NA	Second Line: TMP/SMX DS twice daily x 7 days Cephalexin 500 mg twice daily x 7 days Fosfomycin 3 g every 48 hours for 3 doses	\$40\$5 \$132\$6 \$295NA

NA = not applicable. TMP/SMX DS = trimethoprim/sulfamethoxazole double strength.

¹ Cost = Average Wholesale Price minus 10%. AWP from Lexicomp Online 11/2020. For generic drugs, Maximum Allowable Cost plus \$3 from BCBS of Michigan MAC List, 06/2020.

² Nitrofurantoin should not be used with creatinine clearance <30 mL/min

Table 3. Management of Recurrent UTI

<ol style="list-style-type: none"> 1. Treat acute UTI (see Table 2). 2. Obtain urine culture to confirm diagnosis. 3. Counsel about risk factors: <ul style="list-style-type: none"> • Consider alternative to use of spermicide • Prescribe vaginal estrogen in postmenopausal women • Recommend increased hydration (> 1.5 L daily) in premenopausal women 4. Consider, if behavioral modification is not effective: <ul style="list-style-type: none"> • Use of daily or post-coital antibiotic (TMP/SMX SS 80/400 mg daily, or nitrofurantoin 50-100 mg at bedtime) • Self-initiated therapy (Table 2) 5. Cystoscopy and imaging are generally not indicated.
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TMP/SMX SS = trimethoprim/sulfamethoxazole single strength.

Table 4. Treatment of Pyelonephritis

Medication	Cost ¹	
	Brand	Generic
Ceftriaxone 1 g IM or IV x 1 dose*, followed by:	\$46	\$8
First Line: TMP/SMX DS twice daily x 7-14 days	\$40-80	\$6
Second Line: Ciprofloxacin 500 mg twice daily x 7 days	\$87	\$6
Levofloxacin 750 mg once daily x 5 days	\$162	\$6
Third Line Amoxicillin/clavulanate 875/125 mg 2 x daily x 10-14 days	\$76	\$13

IM = intramuscular. IV = intravenous. NA = not applicable. TMP/SMX DS = trimethoprim/sulfamethoxazole double strength.

¹ Cost = Average Wholesale Price minus 10%. AWP from Lexicomp Online 02/2020. For generic drugs, Maximum Allowable Cost plus \$3 from BCBS of Michigan MAC List, 02/2020.

- Give initial dose of broad-spectrum parenteral antibiotic if the local prevalence of fluoroquinolone or TMP/SMX resistance exceeds 10%. Physicians may use their clinical judgment based on the severity of the patient's pyelonephritis to defer ceftriaxone.

Background

Urinary tract infections (UTIs) lead to over 10 million office visits per year,² at a cost of several billion dollars annually in the United States.^{3,4}

There are two key principles for cost-effective care of most UTIs. First, order laboratory tests only when the results are likely to alter management or outcome. Second, prescribe antibiotics only for as long as necessary to be effective.

Recurrent UTIs are managed by modifying risk factors and using intermittent or daily antibiotic prophylaxis.

This guideline addresses the following topics:

- Types of UTI and definitions
- Risk factors
- Microbial etiology
- Complicating factors and medical conditions
- Cystitis, uncomplicated and complicated
- Recurrent UTI
- Asymptomatic bacteriuria
- Pyelonephritis
- UTI in pregnancy
- UTI in men
- UTI in older persons

Epidemiology

UTIs are common, with an annual US incidence of 12% among women and 3% among men.⁵ UTIs are most common among sexually active women age 18-29 years.⁶ Roughly 50% of women will develop acute cystitis at least once during their lives,⁴ and about a quarter will experience recurrence.⁷ The lifetime prevalence of UTI in men is about 12%.⁸ Data from 1996-2001 reveal about 7 million patient visits per year for uncomplicated UTI.⁹ Morbidity for most UTIs is low, but because UTIs are so common, the annual cost of UTIs in the US is about \$2.3 billion.⁶

Types of UTI and Definitions

UTI in adults is classified as cystitis or pyelonephritis. In both men and women, the differential diagnosis includes urethritis, a sexually transmitted infection. In men, the UTI spectrum encompasses acute and chronic bacterial prostatitis. Related infections in men include epididymitis, orchitis, and epididymo-orchitis.

Uncomplicated cystitis: A bladder infection in a healthy, nonpregnant, premenopausal female with a normal urinary tract.

Complicated cystitis: A bladder infection associated with factors that either increase the risk of serious outcomes or decrease the efficacy of treatment. This includes: cystitis plus a foreign body (such as a catheter or urinary tract stone), recent instrumentation, urinary tract abnormalities, or vesicoureteral reflux. It also includes cystitis in men, pregnant women, and patients with renal transplant or other causes of an immunocompromised state, and UTIs due to atypical organisms or multi-drug resistant bacteria.

Uncomplicated pyelonephritis: A kidney infection that occurs in a healthy nonpregnant patient with a normal urinary tract.

Complicated pyelonephritis: A kidney infection that occurs during pregnancy or in a patient with other

complicating factors (as noted above, under complicated cystitis), typically requiring hospital admission.

Recurrent UTI: Defined as ≥ 2 UTIs in 6 months, or ≥ 3 UTIs in 12 months.

Asymptomatic bacteriuria (colonization): $> 100,000$ cfu/mL of bacteria are present on clean catch urine culture without signs or symptoms of illness.

Risk Factors

Females are at higher risk of UTI than males, likely due to the shorter distance from the urethral opening to the bladder, and the closer proximity of the urethral opening to the bacteria-rich vagina and rectum. For healthy premenopausal females, the risk of both acute cystitis and recurrent UTI is increased with recent or frequent sexual activity, or with use of spermicide, either of which increases the risk of periurethral *E. coli* colonization.^{10,11}

Older age (≥ 65 years, and particularly ≥ 80 years) increases the risk of UTI for both women and men. UTI is uncommon in men under age 60 years, but the rate increases substantially thereafter, such that by age 80, both men and women have similar rates of UTI.¹²

Decreased estrogen levels in postmenopausal women is a risk factor.

Incontinence of urine quadruples the risk of UTI.¹³ Fecal incontinence exposes the urethral opening to bacteria, but most are rapidly cleared from the urinary tract unless they are uropathogenic strains.

Family history and genetics also influence risk. A woman whose mother had UTIs is at a 2-4 fold increased risk.¹⁴ There appears to be a genetic predisposition affecting UTI severity as well.¹⁵⁻¹⁷

Catheterization markedly increases the risk of UTI, particularly with longer duration of catheterization.^{18,19} Catheter-associated UTIs account for about 70% of UTIs in hospitalized patients.²⁰ Clean intermittent catheterization is safer than using an indwelling catheter. Problems requiring catheterization (such as incomplete bladder emptying, neurogenic bladder, and anatomic abnormalities of the genitourinary tract) all increase the risk of UTI.

Procedure. UTI risk increases in the days following a urinary tract procedure, such as flexible ureteroscopy for stone management or treatment of urinary tract carcinomas. A Cochrane review showed that antibiotic prophylaxis for patients undergoing cystoscopy may reduce the risk of symptomatic UTI.²¹ Women undergoing urogynecologic surgery are at increased risk of UTI. Between 7% and 24% of women undergoing surgery for pelvic organ prolapse or stress urinary incontinence will develop a postoperative UTI.²²

Kidney or bladder stones can retain bacteria and cause recurrent UTI, usually with the same organism. The presence of ureteral stones in patients with pyelonephritis increases the risk of urosepsis.

Diabetes mellitus doubles the risk of UTI.²³ Obesity has been statistically associated with an increased risk of UTI, but it is unclear if obesity is the cause.²⁴

Immunocompromised status, particularly kidney transplant or other solid organ transplant, increases the risk of UTI.²⁵ In one study, UTI occurred in 28% of 417 patients within 13 days of kidney transplant.²⁶ Infection with human immunodeficiency virus (HIV) is not thought to affect the risk of symptomatic UTI, even in patients with low CD4 counts.²⁷

Microbial Etiology

The microbial etiology of UTI is fairly consistent across multiple studies, although there are differences between populations.^{15,28,29} Uropathogenic strains of *E. coli* are the most common cause, found in 70-95% of outpatient UTIs. These strains have virulence factors that help them survive within the urinary tract and evade host immune responses.

Staphylococcus saprophyticus causes 5-15% of outpatient UTIs, but is more common in women. Non-*E. coli* Enterobacteriaceae, such as *Klebsiella pneumoniae* and *Proteus spp*, are also fairly common causes of UTI. *Enterococcus faecalis* and *Streptococcus agalactiae* (Group B Streptococci) are also found.

Pseudomonas aeruginosa rarely causes UTI, but it is associated with complicated UTIs with high morbidity and mortality, partly because of its virulence factors, biofilm formation, and tendency for antibiotic resistance.^{30,31} Candida UTI is uncommon, and candiduria more often represents colonization. When it occurs, it is associated with diabetes, prolonged antibiotic therapy, or immunosuppression.^{32,33,34}

The prevalence of UTI due to drug-resistant (including fluoroquinolone-resistant) strains of *E. coli* and other Enterobacteriaceae, is increasing.^{35,36} Risk factors for multi-drug resistant Enterobacteriaceae infections include: fluoroquinolone use within the past 3-6 months, catheter use, hospital stay or nursing home admission, and obstructive uropathy.^{37,38} Risk factors for methicillin resistant *Staphylococcus aureus* (MRSA) bacteriuria include increased age, patient comorbidity, hospital exposure, and catheter use.³⁹ Multi-drug resistant UTI is a complicated UTI that may require hospital admission and IV antibiotic treatment.

Complicating Factors and Medical Conditions

The most severe complication of UTI is urosepsis, with a mortality rate of 20-40%. The underlying infection usually is a complicated UTI involving a urogenital organ, typically prostate or kidney. Obstructive pyelonephritis due to urolithiasis is the most common cause of urosepsis, but about 17% of cases are associated with urological procedures. The elderly, diabetics, and immunosuppressed are at highest risk. Management of urosepsis is beyond the scope of this guideline, but rapid diagnosis and prompt intensive care are essential.⁴⁰

Patients with complicating factors and medical conditions are at increased risk of developing pyelonephritis or infection with resistant organisms. Complicating factors are listed in Table 1. It is necessary to differentiate these patients from those with uncomplicated UTI in terms both of evaluation and treatment. Unlike patients with uncomplicated UTI, care for those with complicating factors may include:

1. **Culture.** Obtain pretreatment urine culture and sensitivity.
2. **Treatment.** Initiate longer antibiotic treatment course.
3. **Possible structural evaluation.** If there is concern for concurrent urolithiasis or urinary tract structural or functional abnormality, consider CT with and without IV contrast and urology consultation for cystoscopy.⁴¹

Acute Cystitis

Diagnosis

Recommendations:

- Diagnose acute cystitis by history.
- Do not routinely perform additional diagnostic testing.
- Consider initiating treatment without laboratory testing if the clinical presentation supports the diagnosis.
- Do not perform a urine culture for uncomplicated cystitis.

Symptoms. History alone is often sufficient to make a diagnosis of acute uncomplicated cystitis. Patients with dysuria as an isolated symptom have an approximately 50% probability of acute cystitis. The presence of both dysuria and urinary frequency, in the absence of vaginal discharge, raises the probability of cystitis to greater than 90%.⁴² When the history is typical for cystitis, do not perform additional diagnostic testing; it is unlikely to be of additional benefit or to alter management. In a patient with a strongly suggestive history, for example, a negative dipstick urinalysis does not rule out UTI. Testing is not required prior to initiating treatment, given the high probability of UTI with classic symptoms.

UTI symptoms typically have an abrupt onset (< 3 days); longer or intermittent symptoms increase the likelihood of other etiologies. The presence of vaginal discharge or irritation reduces the probability of cystitis and may suggest vaginitis or cervicitis. Consider a diagnosis of interstitial cystitis or painful bladder syndrome in patients who have recurrent symptoms without identifiable cause, with negative laboratory testing.

Physical examination. Physical exam is generally not necessary to diagnose UTI, unless symptoms suggest pyelonephritis (see Pyelonephritis section). Perform a pelvic exam if vaginal symptoms are present.

Laboratory tests. If laboratory testing is determined to be necessary, urine dipstick and microscopy are usually sufficient. Dipstick urinalysis is quick and inexpensive. The presence of leukocyte esterase or nitrite is consistent with inflammation or bacteriuria, and in the context of urinary signs and symptoms (urinary urgency, frequency, dysuria, suprapubic pain, new onset hematuria), can further confirm the diagnosis of UTI. Several studies found nitrites to be the most predictive of bacteriuria, but nitrites only turn positive in the presence of bacteria that produce nitrate reductase.^{43,44}

Do not routinely perform a urine culture in uncomplicated cystitis. Consider a urine culture if dipstick urinalysis is negative but clinical suspicion remains high, or in the setting of complicating factors. Previous diagnosis thresholds for UTI were 100,000 cfu/mL of a single organism. Lower colony counts of 100 to 10,000 cfu/mL in voided urine from symptomatic patients may constitute UTI versus contamination.¹⁵ Symptomatic patients with low colony counts may respond as well to antibiotic treatment as those with high colony counts.

Treatment

Recommendations:

- Consider acetaminophen or ibuprofen for pain, and phenazopyridine for symptom relief in patients with cystitis.
- Prescribe nitrofurantoin as first-line treatment for both uncomplicated and complicated cystitis.
- Consider trimethoprim / sulfamethoxazole (TMP/SMX), cephalexin, and fosfomycin as second-line treatment options.
- Treatment duration for uncomplicated cystitis depends on the medication (Table 2).
- Treat most cases of complicated cystitis for 7 days.
- Do not use fluoroquinolones for the treatment of cystitis if a first or second-line treatment option exists.

Non-antibiotic treatment of cystitis. Acetaminophen or ibuprofen may be used for symptom relief in cystitis, but should not be recommended as the primary treatment of UTI. In randomized trials, women given only NSAIDs may be at increased risk of pyelonephritis. Delayed antibiotic use with close follow-up may be reasonable for a subset of women with mild cystitis.^{45,46}

Phenazopyridine, a urinary analgesic, also relieves dysuria. Dysuria typically diminishes within a few hours of initiation of antimicrobials, but some women with severe dysuria may benefit from up to 2 days of phenazopyridine.

Uncomplicated Cystitis: Antibiotic Selection and Duration.

Nitrofurantoin is the first line treatment recommendation for acute uncomplicated cystitis. Nitrofurantoin achieves good concentration in the urine, has low resistance rates for *E. coli*, and can be used in patients with CrCl > 30 mL/min/1.73 m².⁴⁷ Alternatives include TMP/SMX, cephalexin, and fosfomycin (Table 2).

The rate of resistance to TMP/SMX is > 30% in some areas. In contrast, nitrofurantoin resistance remains < 5%. The 2010 resistance rates to TMP/SMX for *E. coli* in the US were 28%, which led to TMP/SMX no longer being recommended as first line therapy for uncomplicated cystitis. However, it remains a reasonable alternative. Since TMP/SMX is concentrated in the urine, *in vitro* resistance does not necessarily translate into therapeutic failures. Reported TMP/SMX resistance rates may be misleadingly high as they represent patients receiving urine cultures, whereas most acute uncomplicated cystitis is not assessed with a urine culture.

In uncomplicated cystitis, consider shorter courses of oral antibiotics, with specific duration dependent on the specific antibiotic. In trials, shorter courses were as effective as longer courses, with fewer adverse events.^{48,49} Advantages of shorter therapy include decreased prescription costs, improved adherence, and decreased adverse effects of antibiotic treatment.^{48,49} No benefit is apparent in increasing the duration of TMP/SMX treatment. Cystitis cure rates of about 85% have been achieved with 3-day therapy, while adverse effects increase markedly if treatment is continued longer than 3 days.^{49,50}

When beta-lactam therapy, such as cephalexin, is chosen due to allergies or other factors, little evidence guides treatment duration for cystitis. Three to 7 days are recommended, depending on symptom severity.

Single-dose cystitis treatment regimens are less efficient than 3-5 day regimens at eradicating bacteriuria (23-81% versus 77-91% long-term cure, respectively). A 2018 randomized controlled trial demonstrated

decreased efficacy of a single dose of fosfomycin compared to 5 days of nitrofurantoin.⁵¹

Avoid fluoroquinolones for uncomplicated cystitis due to high rates of *E. coli* resistance and risk of collateral damage (resistance, *C. difficile* infection). Fluoroquinolones may cause permanent injury to tendons, muscles, joints, nerves, and the central nervous system. For uncomplicated cystitis, the FDA recommends fluoroquinolones be reserved for patients with no other treatment options.⁵²

Complicated Cystitis: Antibiotic Selection and Duration.

Prescribe longer courses of antibiotics for male patients with cystitis and for patients who have complicating factors, including: uncontrolled diabetes, pregnancy, nephrolithiasis, catheter use, anatomic or functional abnormalities, or immunosuppression. (See text sections below for management of UTI in pregnancy and UTI in men.) As a general rule, 7 days of oral antibiotics are recommended for complicated cystitis.

Follow-up. Follow up urinalysis and urine cultures (so-called "test-of-cure") are not indicated for patients with uncomplicated cystitis. Approximately 5-10% of women treated for uncomplicated cystitis will have persistent bacteriuria after therapy completion. The vast majority of these women will be symptomatic and return for medical attention. Those who are asymptomatic require no treatment except in pregnant patients, or patients undergoing urologic procedures. (See section on asymptomatic bacteriuria.)

Telephone triage-nurse managed evaluation. Most UTIs in women are uncomplicated and resolve readily with a short course of antibiotics. Therefore, many women can be assessed and safely managed without an office visit or laboratory evaluation. Studies have found that use of a telephone triage guideline decreased cost and increased appropriate antibiotic use with no increase in adverse outcomes.^{53,54}

Consider telephone triage and treatment without an office visit or laboratory testing for nonpregnant women who previously had acute cystitis that responded to antibiotics. Management without an office visit is not recommended for men, patients with symptoms of pyelonephritis, or those with complicating factors. Patients who do not respond promptly should be evaluated in the office.

Recurrent UTI

Diagnosis

Recommendations:

- Diagnose recurrent UTI based on 2 culture-proven UTIs in the past 6 months or ≥ 3 in 1 year.
- Obtain urine culture with sensitivities prior to initiating treatment for recurrent UTI.
- Consider measuring bladder postvoid residual volume in men and postmenopausal women with recurrent UTI.
- Do not routinely perform cystoscopy or imaging in patients with recurrent UTI.

Recurrent urinary tract infections are defined as 2 culture-proven UTIs in the past 6 months, or ≥ 3 in 1 year. In sexually active college women, the risk of a second UTI was 24% in 6 months.⁵⁵ A large study of US women, ages 18 to 64 years, showed that about 1 in 1,000 women per year develop an uncomplicated recurrent UTI. The incidence of recurrent UTI was highest in postmenopausal women, approximately double that of younger women.⁵⁶ Recurrent UTI also is more common in older men; see section on UTI in men.

Reinfection is the cause for most women with recurrent UTIs, while a minority have relapse. Reinfection

typically occurs at least 2 weeks after UTI treatment and is caused by a different organism. In relapse, the same strain of bacteria causes recurrent UTI.^{57,58} The bacteriuria persists during treatment or recurs soon (1-2 weeks) after treatment is completed. Symptomatic recurrent UTI due to relapse tends to occur much sooner than does reinfection. Relapse typically implies an unresolved infection and may be associated with an underlying urologic abnormality.

Risk factors for recurrent UTI in premenopausal women include frequent intercourse, a new sexual partner, a maternal history of UTI, and a history of UTI before age 15 years. In postmenopausal women, risk factors include urinary incontinence and increased bladder postvoid residual volume.^{57,59} In men, urinary retention is the main risk factor.

There is no proven association between recurrent UTI in women and pre- or postcoital voiding patterns, frequency of urination, wiping patterns, douching, tight underwear, delayed voiding habits, or hot tub use. There have been no prospective randomized studies of these factors.¹⁴

Physicians should confirm the diagnosis of recurrent UTI by urine culture. Cystoscopy and urinary tract imaging are not routinely recommended, but may be performed in certain circumstances, such as suspected stone or obstruction.^{57,59} Physicians should measure bladder postvoid residual volume in men and postmenopausal women with recurrent UTI to evaluate for retention.⁵⁷

Treatment

Recommendations:

- Treat recurrent UTI with the recommended antibiotic regimens for acute cystitis, taking into account prior culture and sensitivity results.
- Counsel patients on risk factors for recurrent UTI.
- Consider lower threshold for imaging and urology referral.

Most patients with recurrent UTIs respond to recommended antibiotic regimens (Table 3). Persistent bacteriuria or early clinical recurrence (within 2 weeks) should raise the concern for possible relapse. In cases of relapse, physicians should have a lower threshold for imaging and urology referral.

Most uncomplicated recurrent UTI represents reinfection rather than relapse. Use prior urine culture and sensitivity results to guide empiric treatment.⁵⁹ These patients rarely have a urologic structural abnormality causing the reinfection, so imaging is not indicated. Counsel them about modifying risk factors for recurrent UTIs, and consider use of prophylactic or self-initiated antibiotic therapy.

In patients with recurrent typical symptoms of cystitis, yet persistently negative urine cultures and negative STI testing, consider a referral to urology for evaluation of interstitial cystitis, or painful bladder syndrome. Asymptomatic patients with recurrent positive urine cultures should not be diagnosed with recurrent UTI, as they have asymptomatic bacteriuria.

Prophylaxis of Recurrent UTIs

Recommendations:

- Offer intravaginal estrogen to reduce recurrent UTIs in postmenopausal women.
- Encourage premenopausal women to drink 1.5 L of water per day to prevent recurrent UTI.
- Consider intermittent single-dose post-coital or daily antibiotic prophylaxis to reduce risk of recurrent UTI in nonpregnant women if behavioral strategies are not effective.
- Assess for urinary retention in men with recurrent UTI.

Strategies for preventing recurrent UTI include using antibiotics or nonpharmacologic therapies. Whether to use antibiotic prophylaxis, and which agent, should be a shared decision between the physician and patient. Before prescribing antibiotics, clinicians should counsel patients about behavioral strategies to prevent recurrent UTIs given the increasing resistance to antibiotics, adverse effects of antibiotics on normal flora, and potential for serious adverse effects.⁵⁹

In sexually active women, prophylactic antibiotic use reduces the frequency of recurrent UTIs compared to placebo (NNT = 2).⁵⁹ Intermittent single-dose antibiotic prophylaxis after coitus appears as effective as daily prophylaxis, with fewer adverse effects.⁶⁰ Single-dose prophylaxis is the preferred option for women who develop cystitis related to sexual intercourse.⁵⁹ The reduction in recurrent UTI only lasts as long as the woman takes the antibiotic. Once antibiotics are discontinued, UTIs occur at the same rate as in placebo-treated sexually active women. Adverse events from antibiotic use are generally mild, although women vary in their evaluation of the impact of various side effects (ie, vaginal candidiasis may be perceived as a severe side effect by some, mild by others).⁵⁹

For recurrent UTI prevention, nitrofurantoin, TMP/SMX, beta-lactams, and fluoroquinolones are equally effective.⁵⁹ Review prior urine culture and sensitivity results to guide antibiotic choice. If prescribing prophylactic antibiotics, use nitrofurantoin 50 mg daily (first-line as long as CrCl > 30 mL/min/1.73 m²) or TMP/SMX SS 80/400 mg daily. Avoid fluoroquinolones due to high rates of *E. coli* resistance and other potential complications (*C. difficile* infection, tendinopathy). Consider prescribing prophylactic antibiotics for up to 6 months.⁵⁹

Advise patients to increase their daily consumption of water. According to one randomized controlled trial, nonpregnant premenopausal women who drank 1.5 L of additional water per day decreased their risk of recurrent UTI compared to women who consumed their usual fluid intake.⁶¹

Recurrent UTIs are more common in older patients. In postmenopausal women, one possible cause is low levels of estrogen leading to increased pH in the vagina, enabling its colonization by uropathogens.³ Randomized controlled trials showed that a vaginal estrogen ring or cream prevented recurrent UTIs in postmenopausal women (NNT range 2-9).^{3,59} Women using vaginal estrogens had more vaginal irritation compared to those taking oral antibiotics.⁵⁹ In older men, urinary retention can cause recurrent UTI (see section on UTI in men).

Meta-analyses have produced conflicting results regarding whether cranberry products help prevent recurrent UTIs in nonpregnant women, and the studies comprise low quality evidence. The type of cranberry product and frequency of administration varied across the studies.⁵⁹ Most women cannot tolerate drinking large quantities of cranberry juice but may be amenable to cranberry tablets or capsules. Cranberry products do not reduce the risk of recurrent UTIs in pregnant women, elderly women, or men.⁵⁹

One small randomized controlled trial showed that oral D-mannose (200 mL of 1% solution daily) prevents

recurrent UTIs in nonpregnant women compared to no treatment, with significantly fewer adverse effects compared to antibiotics.⁶²

Other interventions, such as lactobacillus probiotics and methenamine hippurate lack good quality evidence to show whether they reduce the risk of recurrent UTI.^{59,63,64}

Asymptomatic Bacteriuria

Diagnosis

Asymptomatic bacteriuria is the presence of significant numbers of bacteria in the urine in a person without symptoms. The presence of one organism per high-power field in a clean-catch, midstream, unspun urine sample, is considered significant bacteriuria (equivalent to > 100,000 cfu/mL).

Asymptomatic bacteriuria occurs in 30-50% of elderly adults, especially in nursing homes. In controlled studies that address issues of underlying illness, asymptomatic bacteriuria does not increase risk of death.^{65,66}

Patients with chronic indwelling catheters are at particular risk for developing asymptomatic bacteriuria. The risk of UTI can be decreased by using a catheter only when necessary, inserting the catheter under aseptic technique, using a closed drainage system, and avoiding irrigation (unless clinically necessary). Intermittent catheterization and external (condom type) catheters are associated with fewer infections than indwelling catheters.

Screening and Treatment

Recommendation:

- Do not screen for, or treat asymptomatic bacteriuria, except in pregnancy and patients undergoing urologic procedures.

Screening and treatment of asymptomatic bacteriuria in most settings is not recommended because of unproved efficacy, risk of adverse effects from antibiotics, development of antibiotic resistance, and excess costs.

Treatment of asymptomatic bacteriuria is recommended in the following situations:

- Pregnancy. See pregnancy section.
- Before transurethral resection of the prostate or other urologic procedure in which mucosal bleeding is anticipated. Postoperative complications, including bacteremia, are reduced by treating bacteriuria prior to such procedures.

Pyelonephritis

Diagnosis

Recommendations:

- Diagnose pyelonephritis based on acute onset of flank pain or tenderness plus a urinalysis indicating bacteriuria or pyuria.
- Obtain a urine culture with sensitivities prior to starting antibiotics in suspected acute pyelonephritis.
- Imaging is not indicated for the diagnosis of acute uncomplicated pyelonephritis.
- If complicated pyelonephritis is suspected, or when the infection does not respond to antibiotics within 48-72 hours, order CT imaging of the abdomen and pelvis with and without IV contrast.
- Consider MR with diffusion-weighted imaging or Doppler ultrasound of the kidneys and bladder for the diagnosis of pyelonephritis in pregnant women.

Suspect acute pyelonephritis in patients presenting with sudden onset of typical lower urinary tract symptoms (dysuria, frequency, urgency) with associated fever, chills, back or flank pain, nausea, vomiting, or costovertebral angle tenderness. Specific diagnostic criteria for pyelonephritis do not exist.⁶⁷ Always perform a urine culture with sensitivities in suspected pyelonephritis. Antibiotic therapy should be tailored to the ensuing sensitivity results.^{68,69}

Most acute pyelonephritis is uncomplicated, responds quickly to treatment, and results in no residual kidney damage.⁶⁸ Imaging is not indicated for the diagnosis of uncomplicated pyelonephritis.⁷⁰ Almost all patients with uncomplicated pyelonephritis diagnosed clinically become afebrile within 72 hours of appropriate antibiotic therapy.⁷⁰

Complicated pyelonephritis occurs in individuals with a structural or functional abnormality of the urinary tract (indwelling urinary catheter, urinary obstruction, renal stones), or an underlying disease (pregnancy, diabetes, immunocompromised status) that increases the risk of treatment failure. Complicated pyelonephritis includes patients who do not respond to initial antibiotics.⁷⁰ Bacteria are more likely to be resistant to antibiotics in complicated infections.⁶⁸ Consider CT of the abdomen and pelvis with and without IV contrast to diagnose pyelonephritis in patients with complex clinical presentations and in those who do not improve with antibiotics within 48-72 hours.⁷⁰

Treatment**Recommendations:**

- Consider a 7-day course of antibiotics to treat acute pyelonephritis in a female patient less than 65 years old without comorbidities.
- Use a 14-day course of antibiotics to treat complicated pyelonephritis. (Seven days of a fluoroquinolone may be considered if the patient is not immunosuppressed, has no urinary anatomic abnormalities, is not pregnant, and responds well.)
- Decompress urinary tract obstruction in patients with pyelonephritis related to urinary tract obstruction.

Most patients with pyelonephritis but without risk factors for developing complications can be safely managed on an outpatient basis with oral antibiotics (Table 4). Hospital admission with intravenous antibiotics is indicated for acutely toxic, pregnant, or immunocompromised patients; those who are

dehydrated or unable to take oral fluids; or when compliance is a problem.⁶⁸

If the local prevalence of fluoroquinolone or TMP/SMX resistance exceeds 10%, acute pyelonephritis should be treated empirically with an initial one-time dose of a broad-spectrum, long-acting parenteral antibiotic.^{67,69} Following that initial dose (eg, ceftriaxone 1 g IM or IV), prescribe TMP/SMX 160/800 mg by mouth twice daily for 7-14 days; OR ciprofloxacin 500 mg by mouth twice daily for 7 days; OR levofloxacin 750 mg by mouth daily for 5-7 days; OR amoxicillin/clavulanate 875/125 mg by mouth twice daily for 10-14 days.^{67,69} (Table 4). A meta-analysis showed that ciprofloxacin for 7 days is as effective as a longer 14-day course.⁷¹ One study of nonpregnant women with *E. coli* pyelonephritis showed that oral TMP/SMX for 7 days was as effective as oral ciprofloxacin for 7 days.⁷²

Physicians may use their clinical judgment based on the severity of the patient's pyelonephritis and underlying medical conditions to defer ceftriaxone and monitor closely. For example, an otherwise healthy woman with mild illness may be solely treated with oral ciprofloxacin or TMP/SMX.⁶⁷

Adjust the initial antibiotic choice if indicated, based on the urine culture and sensitivity results.⁷³ Adequate response to therapy is defined as clear improvement in clinical condition over 48-72 hours; it does not necessarily include becoming afebrile. Do not perform a follow-up urine culture if symptoms have resolved.⁷⁴ Routine structural evaluation is rarely indicated.

For pyelonephritis related to urinary tract obstruction, start antibiotics as above, but also promptly decompress the obstruction and consult urology. Use a urinary catheter for obstruction due to prostatic hyperplasia. Immediate consultation with urology for consideration of ureteral stent insertion or percutaneous nephrostomy for pyelonephritis associated with ureteral stones can be lifesaving.⁷³

Special Populations

UTI in Pregnancy

Recommendations:

- Screen pregnant women for bacteriuria at the initial prenatal visit with a urine culture.⁷⁵
- Treat asymptomatic bacteriuria during pregnancy with nitrofurantoin, amoxicillin, or cephalixin, depending on culture results.⁷⁵

Etiology. Pregnancy results in dilation of the ureters and renal pelvises, increased urinary pH, and glycosuria. These changes predispose pregnant women with bacteriuria to an increased risk of pyelonephritis and preterm birth.

Asymptomatic Bacteriuria in Pregnancy

Asymptomatic bacteriuria occurs in up to 10% of pregnant patients. Unlike in nonpregnant patients, asymptomatic bacteriuria in pregnancy should be treated. Treatment decreases the risk of pyelonephritis and associated maternal and neonatal complications, including septicemia, respiratory distress, preterm birth, and low birth weight. Controlled trials found treatment of asymptomatic bacteriuria in pregnancy was associated with a reduced incidence of persistent bacteriuria (NNT = 2), pyelonephritis (NNT = 7), and preterm delivery (NNT = 7).⁵⁹

Treat asymptomatic bacteriuria during pregnancy with antibiotics selected based on culture and

susceptibility testing. Recommended options are nitrofurantoin for 5 days, cephalexin for 7 days, or fosfomycin as a single dose. Avoid using nitrofurantoin after 37 weeks gestation due to the risk of neonatal jaundice. Avoid the use of fluoroquinolones in pregnancy unless other options are contraindicated. Follow up with urine cultures; persistent bacteriuria requires repeat treatment guided by sensitivities, and then consideration of daily suppressive therapy, usually with nitrofurantoin.

Symptomatic Cystitis in Pregnancy

Recommendation:

- Treat cystitis during pregnancy with nitrofurantoin for 7 days (first line) or cephalexin for 7 days.⁷⁵

The diagnosis of cystitis in pregnancy is made based on the presence of lower urinary tract symptoms and laboratory testing. Unlike in nonpregnant patients, urine culture should be routinely obtained to confirm the diagnosis and guide treatment.

Treat cystitis during pregnancy with nitrofurantoin for 7 days (preferred) or cephalexin for 7 days. Avoid use of nitrofurantoin after 37 weeks gestation because it may increase neonatal jaundice.

Pyelonephritis in Pregnancy

Recommendation:

- Admit pregnant patients with pyelonephritis for treatment with IV antibiotics.

The diagnosis of pyelonephritis should be based on symptoms and exam findings (see Pyelonephritis section). Urine culture should be obtained prior to initiation of treatment.

Pregnant patients with pyelonephritis should be admitted to the hospital for treatment with IV antibiotics, due to the increased risks of septicemia, acute respiratory distress syndrome, and obstetric complications. Choice of antibiotics is dependent on urine culture and susceptibility results. A parenteral, broad-spectrum beta-lactam antibiotic (such as ceftriaxone) should be initially given, followed by a course of oral TMP-SMX or a beta-lactam. Fluoroquinolones should be avoided in pregnancy if possible.

UTI in Men

Rates of UTI are low in younger males, but increase significantly in older men. The incidence of UTI in men < 55 years is 0.9 to 2.4 cases per 1000, but in men > 85 years the incidence is 7.7/1000, similar to that of women in the same age group.¹² UTI in men is less well studied than in women. There are relatively few studies of UTI incidence in men; most studies in males focus on UTI in infancy and early childhood, when the risk is highest. Based on an outpatient study in veterans, the overall prevalence of UTI as a primary diagnosis was 2.3 times greater in women than in men.⁷⁶ About 12% of all men will have at least one UTI in their lifetimes, compared to about half of all women.⁸

Etiology. The causes of UTI in men vary with age and risk factors for sexually transmitted infections. In younger males (age 14-35 years), UTI symptoms are more likely to be due to pathogens causing urethritis, such as *Neisseria gonorrhoea* or *Chlamydia trachomatis*, but in older males they are more likely to be due to *E. coli* or other enterobacteriaceae. Other less common causes of male urethritis or epididymitis include

Mycoplasma genitalium, Ureaplasma urealyticum, and Trichomonas vaginalis.

Risk Factors in Men

Urinary Retention. Acute urinary retention is defined as the inability to pass urine, despite having a full bladder, which on exam may be painfully distended or palpable.⁷⁷ In contrast, men with chronic urinary retention can pass some urine, but have a chronically elevated postvoid residual, with slow urinary flow and sensation of incomplete bladder emptying.⁷⁷ Traditionally, chronic urinary retention has been defined as postvoid residual ≥ 300 mL,⁷⁸ but current literature has shifted away from arbitrary volume cut-offs towards patient symptoms.⁷⁹ Both acute and chronic urinary retention are much more common in men than in women.⁸⁰ Prostatic hyperplasia increases the risk of recurrent UTI in men and is an important cause of urinary retention.

Chronic bladder outlet obstruction with an increased volume of urine retention appears to increase the risk of UTI in men, but studies of this have produced inconsistent results, and it is unclear how much retention is too much. In some studies, a bladder postvoid residual volume over 180 mL increased the risk of UTI, but this cutoff was only 28% sensitive and 94% specific for predicting bacteriuria. Other studies used a higher volume cutoff of 300 mL to define retention in men who were voiding, or even 1000 mL in men who were unable to void. Retention of urine is a complex problem in men, and postvoid residual volume is not clearly correlated with age, prostate volume, or PSA.^{79,81,82} Numerous medications have been associated with increased urinary retention; many of these are drugs with anticholinergic effects.⁸⁰ Older men are at higher risk for drug-related urinary retention.

Anatomic Factors. Adult males with a history of hypospadias, whether repaired or unrepaired, are at increased risk for urethral stricture, UTI, and other urologic problems.⁸³

Circumcision reduces the risk of UTI, but this is most relevant in infants. A meta-analysis of 22 studies showed that lifetime UTI risk was 32% in uncircumcised males and 8.8% in circumcised males.⁸⁴

Other Risk Factors. Many of the risk factors mentioned above for female UTI also apply to men. However, men with catheter-associated bacteriuria have a higher risk of bacteremia than women.⁸⁵

Men who undergo transrectal ultrasound-guided prostate biopsy are at risk for UTI, bacteremia, and urosepsis. In a study of 1529 men, about 1.4% developed UTI after such a biopsy.⁸⁶ A 2011 Cochrane review confirmed that antibiotic prophylaxis is effective at preventing infection due to transrectal prostate biopsy.⁸⁷ Transperineal prostate biopsy is an alternate approach that is increasingly used; it appears to be associated with an almost zero rate of urosepsis.⁸⁸

Diagnosis of UTI in Men

Recommendations:

- First obtain initial void urine for STI testing, if indicated.
- Obtain a clean-catch urine sample for urinalysis and culture.
- Measure bladder postvoid residual volume with ultrasound.

Symptoms of cystitis and pyelonephritis are similar in men and women. However, acute UTI in men can also include acute bacterial prostatitis, epididymitis, and urethritis. Suspect urethritis in any sexually active male with dysuria. UTI in men is generally considered to be complicated because of the risk of acute bacterial

prostatitis, which can be a severe and potentially life-threatening systemic infection. Chronic bacterial prostatitis presents as recurrent UTI, typically with the same bacterial strain each time.

Symptoms unique to men include slow urinary stream, a sense of incomplete emptying, penile discharge, suprapubic or groin pain, and testicular pain. Signs of acute UTI in men may include an enlarged and tender boggy prostate, or a tender epididymis or testis.

If STI is a consideration, first collect an initial void urine sample (without cleansing), before collecting a clean catch midstream sample. Send the initial void urine sample for gonorrhea and Chlamydia testing in symptomatic males age 14-35 years, as well as in those who have STI exposure risks, a new sexual partner, penile discharge, or signs and symptoms of epididymitis or orchitis. STI testing can also be done on a urethral swab.

Obtain a clean catch urinalysis. The presence of bacteriuria along with symptoms supports a diagnosis of UTI. Pyuria is not diagnostic of UTI, but the absence of pyuria can be used to rule out UTI with a negative predictive value of 95%.⁸⁹

Obtain a urine culture in all men with UTI symptoms, prior to antibiotic initiation. In a patient with symptoms, a culture result showing > 100,000 cfu/mL of a single organism is diagnostic. A clean catch urine culture with > 100,000 cfu/mL of two or more organisms, or a culture with at least 1000 cfu/mL of a single organism may indicate UTI or contamination, but these need to be interpreted in clinical context. The urine sample for culture should be a midstream collection, with retraction of the foreskin (if present) and cleansing prior to collection to minimize risk of contamination.^{12,90}

If the cause of symptoms is unclear, consider testing for less common causes of urethritis and epididymitis, such as *Mycoplasma genitalium*, *Mycoplasma hominis*, and *Ureaplasma urealyticum*. Be aware that asymptomatic carriage of these organisms is common, and the treatment cure rate for mycoplasma is low.⁹¹⁻⁹³ *Trichomonas vaginalis* has been associated with persistent urethritis in some populations of men, so if initial treatment for the more common causes of urethritis is unsuccessful, consider nucleic acid amplification testing of an initial-void urine (or a urethral swab) for *Trichomonas*.⁹³

Use ultrasound to measure bladder postvoid residual volume and assess for urinary retention in symptomatic men. In many healthy men the bladder can empty completely and the postvoid residual will be near zero. Although residual volumes over 100 mL are considered abnormal, the normal range varies widely, and the clinical significance of mild urinary retention is unclear. Physical examination of the bladder is not a reliable way to estimate urinary retention.

Checking PSA is usually neither necessary nor helpful in most men with UTI, but can be considered when prostate cancer is suspected or when the diagnosis is not clear. In more than 90% of men with a febrile UTI, there will be a transient increase in the PSA. Although PSA typically decreases after 1 month, it may not fully normalize for 6 or more months after a febrile UTI.⁹⁴

In men with bacteremia or urosepsis, or who are not responding to antibiotics, transrectal ultrasound can assess for prostate abscess.⁹⁵ Otherwise, prostate imaging is generally not useful in men with UTI.

Differential Diagnosis of UTI in Men

Chronic bacterial prostatitis causes recurrent UTIs, and usually the same bacterial strain is found with each episode. However, only about 10% of men with chronic prostatitis symptoms actually have chronic bacterial prostatitis, with *E. coli* being the most common organism.⁹⁶

Urologic chronic pelvic pain syndrome in men (also known as chronic nonbacterial prostatitis) may cause lower urinary tract symptoms (LUTS).⁹⁷ Urologic chronic pelvic pain syndrome encompasses the related diagnosis that occurs in both men and women, called painful bladder syndrome or interstitial cystitis. Typical symptoms include chronic pelvic pain, often with urinary urgency and frequency. If no infection is found, routine use of antibiotics is not recommended.⁹⁸

Kidney stones and bladder stones can cause UTI-like symptoms, usually with gross or microscopic hematuria. If stone disease is suspected, imaging with a renal stone protocol (noncontrast) abdominal CT is recommended.

Prostate cancer is typically asymptomatic in its early stages, but can cause lower urinary tract symptoms or urinary retention in some men. A full discussion is beyond the scope of this guideline, but an elevated PSA or abnormal prostate on digital rectal exam are indications for a urology consultation.

Epididymitis, orchitis, and epididymo-orchitis may be due to a bacterial infection or an STI such as *Neisseria gonorrhoea* or *Chlamydia trachomatis*. (See Diagnosis of UTI in Men, above.) Viral causes are also possible, so when orchitis is present, consider testing for mumps using a buccal swab, especially if parotitis is also present.

Treatment of UTI in Men

Recommendations:

- Treat acute uncomplicated cystitis with nitrofurantoin (first line) or alternative antibiotics, as per Table 2.
- Choose an antibiotic that penetrates the prostate, such as TMP/SMX, ciprofloxacin, or levofloxacin, when concerned about prostatitis.
- Treat chronic bacterial prostatitis for 4-6 weeks and consider using a shorter duration of 2 weeks for acute bacterial prostatitis.
- Manage acute or chronic urinary retention with an alpha blocker.

Antibiotic Selection and Duration. Before prescribing, review any prior urine culture results and consider if the patient is at risk for a drug-resistant infection. Send a urine culture to guide treatment.

When treating acute uncomplicated cystitis in men, use the recommended antibiotics per Table 2, with nitrofurantoin being the first-line choice. When concerned about prostatitis, choose an antibiotic that penetrates the prostate, such as TMP/SMX, ciprofloxacin, or levofloxacin. Beta lactam antibiotics such as penicillins and cephalosporins can be used when indicated by culture results, but tend to be less effective in men due to poor prostate penetration.⁹⁴ Because nitrofurantoin achieves therapeutic concentrations only in the bladder, it is not effective for pyelonephritis or prostatitis.⁹⁹

For presumed acute bacterial prostatitis, the duration of antibiotic treatment is traditionally 4-6 weeks based on limited observational studies,¹⁰⁰ but 2 weeks may be adequate.^{101,102} Acute prostatitis following a urologic procedure, such as transrectal biopsy of the prostate or cystoscopy, should prompt urologic consult.

Chronic bacterial prostatitis may be difficult to eradicate. TMP/SMX or a fluoroquinolone is the treatment of choice due to better penetration of prostate tissue. A 4-6 week course of treatment resolves chronic bacterial prostatitis in about 60–80% of patients with *E. coli* and other Enterobacteriaceae infections.⁹⁶

Managing Urinary Retention. Men with UTI and acute retention require decompression with either clean intermittent self-catheterization or an indwelling catheter. When there is acute or symptomatic chronic urinary retention in a man with a UTI, consider starting an alpha blocker (eg, tamsulosin 0.4 mg at bedtime) at the same time as the antibiotics.⁷⁷ If symptomatic chronic urinary retention persists, despite appropriate antibiotic treatment and use of an alpha blocker, consider teaching the patient to do clean intermittent self-catheterization, and refer to urology. In the case of very high volume postvoid residuals (ie, >1000 mL) start an alpha blocker, minimize anticholinergic medications, teach intermittent self-catheterization or place an indwelling catheter, consider assessing renal function and obtaining renal ultrasound, and refer to urology.

Prevention

Recommendations:

- Avoid catheterization whenever possible. When needed, choose clean intermittent catheterization over an indwelling catheter.
- Avoid or limit use of anticholinergic medications that can cause or exacerbate urinary retention.

Avoid catheterization whenever possible. When it is needed, limit the duration of catheterization, and use clean intermittent catheterization instead of an indwelling catheter. Assess for urinary retention in men using a bladder scan (ultrasound), rather than catheterization.¹⁰³ Patient education for intermittent self-catheterization for [females](#) and [males](#) can be found at these hyperlinks.

Prophylactic antibiotics are mandatory for patients undergoing transrectal prostate biopsy or other high-risk, contaminated urinary tract procedures.¹⁰⁴

Avoid or limit use of medications that can cause or exacerbate urinary retention, particularly those with anticholinergic effects (eg, diphenhydramine, oxybutynin, scopolamine, and many others). Treat acute or chronic urinary retention with alpha blockers such as tamsulosin. These medicines improve voiding by decreasing smooth muscle sympathetic tone in the bladder neck and prostate; retrograde ejaculation is a common side effect. If urinary retention persists despite use of an alpha blocker, and prostate cancer is not suspected, consider adding a 5-alpha reductase inhibitor (finasteride or dutasteride). The 5-alpha reductase inhibitors decrease prostate volume and will artificially reduce the PSA by about half over 6-12 months. While the effects of alpha blockers can be seen within several weeks, 5-alpha reductase inhibitors take at least 3 months for improvement in symptoms. Refer the patient to a urologist if pharmacotherapy is not effective.

Complications of UTI in Men. Bacteremia, urosepsis, and struvite stones are potential complications for both women and men.

In men, prostate abscess is a potential complication of acute prostatitis that increases the risk of urosepsis and requires surgical or needle drainage. Abscess formation is more common in men who are immunocompromised, have diabetes, or require catheterization.⁹⁵

Acute and chronic urinary retention are common in men with prostatic hyperplasia, but acute urinary retention can be precipitated by a urinary tract infection and may require catheterization and initiation of alpha blocker treatment.¹⁰⁵ Urinary retention can in turn cause hydronephrosis and acute kidney injury, and when prolonged can lead to chronic kidney disease.¹⁰⁶

Follow up. Do not perform a follow-up urine culture in men whose symptoms resolve with treatment.¹²

Refer men with UTI to urology if they have urinary retention not improved with medication, a persistently elevated PSA or abnormal prostate exam, an unclear diagnosis, recurrent UTI, or are not responding to treatment. Men who have gross hematuria or persistent microscopic hematuria but have a negative urine culture should also be referred to urology.

UTI in Older Persons

Diagnosis

Recommendation:

- Diagnose UTI in patients older than 65 years in the same way as in younger patients.

The approach to diagnosis of UTI in patients > 65 years old is the same as it is for younger adults. Diagnosis is based on urinary symptoms, abnormal urinalysis, and culture. Older age does not inherently suggest need for diagnosis of a complicated UTI, unless other factors are present (eg, immunosuppression, indwelling catheter, etc.).

Give special attention to the diagnosis of acute cystitis in older patients who have cognitive impairment. Diagnosis in these patients can be challenging as they may have chronic lower urinary tract symptoms and difficulty reporting complaints.

Caregivers often indicate a concern for cystitis in older patients who have a change in mental status or function, such as confusion, agitation, falls, or fatigue. Since asymptomatic bacteriuria is common in this population, finding bacteriuria may lead to an overdiagnosis of cystitis and resulting overtreatment with antibiotics.¹⁰⁷

Nonspecific symptoms do not predictably correlate to UTIs. A 2011 cross-sectional study of 421 nursing home residents showed that patients with and without nonspecific symptoms had similar rates of positive urine cultures.¹⁰⁸ A 2019 systematic literature review looked for links between confusion and UTI in the elderly, but found that evidence was insufficient to reach a conclusion.¹⁰⁹ Treatment of bacteriuria in this setting could cause harm by exposing patients unnecessarily to antibiotics.¹¹⁰

Criteria exist to define acute cystitis in nursing home residents. In noncatheterized patients, diagnosis requires localizing genitourinary or infectious symptoms along with bacteriuria.¹¹¹ Consider an alternate diagnosis in an older patient with nonspecific functional changes without any specific urinary or infectious symptoms, even if he or she has bacteriuria.¹¹¹

Treatment

Recommendations:

- Treat UTI in patients older than > 65 years the same as for younger patients.
- Do not treat asymptomatic bacteriuria.

Treatment of acute uncomplicated cystitis in older patients is the same as for younger adults. A 2008 meta-analysis demonstrated that shorter courses of antibiotics are as effective as longer courses in women over age 65 years.¹¹² Despite prior recommendations to avoid it, nitrofurantoin is a reasonable first-line option for treatment of acute cystitis regardless of age, as long as CrCl is greater than 30 mL/min/1.73 m².^{113,114} For

elderly patients with uncomplicated cystitis living in long-term care facilities, the usual antibiotic guidelines can be used as long as the patient has no history of resistant cystitis.¹¹⁵ Treatment of asymptomatic bacteriuria is not recommended and can cause harm.⁶⁶

Follow up. Do not perform a follow-up urinalysis or urine culture when symptoms have resolved.⁶⁶ Patients with ongoing symptoms after 2-3 days of treatment should have urinalysis and culture to verify ongoing evidence of infection and to test for antibiotic susceptibility.

Strategy for Literature Search

Within the Medline (Ovid) database, the following search strategy was used, searching from 2009 to 2019.

1. Urinary tract infections
2. exp urethritis/ or exp cystitis
3. UTI.ti. or UTIS.ti or urethritis.ti or cystitis.ti
4. Pyelonephritis
5. exp pyelonephritis/ or pyelonephritis.ti,ab.
6. Bacteriuria
7. Asymptomatic or subclinical and bacteriuria,ti, ab, or bacteria urine.ti, ab.
8. Pregnancy or pregnant women/ or pregnan*ab,ti.
9. exp male/ or men or male or males.ab, ti.
10. exp aged/ or elderly or mature or aging or geriatric*. ti, ab.

The Main search retrieved 11472 references. When the search hedges for Guidelines, Clinical Trials, and Cohort Studies were added, the base results are as follows:

Urinary tract infection - Guidelines, total results were 1070

Urinary tract infection - Clinical Trials, total results were 3070

Urinary tract infection - Cohort Studies, total results were 7332

Within the Cochrane Database of Systematic Reviews, 57 reviews were found using the strategy in the search strategies document.

The results were limited to Humans, English, adults and 2009 to current.

The search was conducted in components each keyed to a specific causal link in a formal problem structure (available upon request). The search was supplemented with very recent clinical trials known to expert members of the panel. Negative trials were specifically sought. The search was a single cycle.

Level of evidence supporting a diagnostic method or an intervention:

A = systematic reviews of randomized controlled trials

B = randomized controlled trials

C = systematic review of nonrandomized controlled trials or observational studies, nonrandomized controlled trials, group observation studies (eg, cohort, cross-sectional, case control)

D = individual observation studies (case or case series)

E = opinion of expert panel.

Related National Guidelines

The UMHC Clinical Guideline on Urinary Tract Infection is consistent with:

- National Institute for Health and Care Excellence (NICE): Urinary tract infection (lower): antimicrobial prescribing, Oct 31, 2018.⁷⁵
- National Institute for health and Care Excellence (NICE): Urinary tract infection (recurrent): antimicrobial prescribing, Oct 31, 2018.⁵⁹
- National Institute for Health and Care Excellence (NICE): Pyelonephritis (acute): antimicrobial prescribing, Oct 31, 2018.⁶⁸

Disclosures

The University of Michigan Health System endorses the Guidelines of the Association of American Medical Colleges and the Standards of the Accreditation Council for Continuing Medical Education that the individuals who present educational activities disclose significant relationships with commercial companies whose products or services are discussed. Disclosure of a relationship is not intended to suggest bias in the information presented, but is made to provide readers with information that might be of potential importance to their evaluation of the information.

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Review and Endorsement

Drafts of this guideline were reviewed in clinical conferences and by distribution for comment within departments and divisions of the University of Michigan Medical School to which the content is most relevant: Family Medicine, General Medicine, General Obstetrics & Gynecology, and Infectious Diseases. The Executive Committee for Clinical Affairs of the University of Michigan Hospitals and Health Centers endorsed the final version.

Acknowledgments

The following individuals are acknowledged for their contributions to previous versions of this guideline.

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Initial Release

June 1999

Most Recent Major Update

May 2021

Interim/Minor Revision

September 2016

Ambulatory Clinical

Guidelines Oversight

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These guidelines should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific clinical procedure or treatment must be made by the physician in light of the circumstances presented by the patient.

APPROVALS	
Antimicrobial Committee	Date: 08/10/2020
P&T	Date: 03/16/2021
ACOC	Date: 03/25/2021
CPC	Date: 04/01/2021
ECCA	Date: 05/11/2021

Approval Signatures

Step Description	Approver	Date
Quality Review	April Proudlock: Project Senior Manager	08/2021
Quality Review	Ellen Patrick: Admin Specialist Intermediate	05/2020
Owner	Ellen Patrick: Admin Specialist Intermediate	05/2020

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