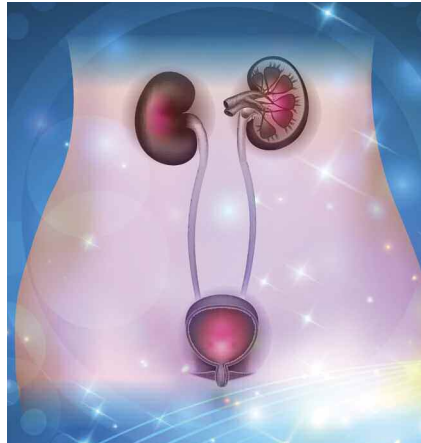


Diagnosis, treatment, and prevention of cystitis

A case report to guide nurse practitioners.

By Myriam Jean Cadet, PhD, APRN, MSN, FNP-C

CYSTITIS (inflammation of the bladder) is a lower urinary tract infection (UTI) commonly caused by a uropathogenic agent such as *Escherichia coli* (*E. coli*). (See *UTI facts*.) Signs and symptoms include urinary urgency and frequency, as well as burning on urination. Untreated cystitis can lead to renal in-



fections such as pyelonephritis, which is an upper UTI that affects the kidneys. As a nurse practitioner (NP), you'll encounter this significant health problem in primary care settings. This article uses a case description to analyze NPs' role in the diagnosis, treatment, and prevention of uncomplicated cystitis.

CASE DESCRIPTION

Chief complaint

Laura Johnson*, a 42-year-old woman, arrives for her clinic appointment that she made because of urological symptoms.

History of present illness

Ms. Johnson reports dysuria, which she describes as painful, burning, and stinging. In addition, she reports urinary frequency every 2 to 3 hours, including during the night, and urgency that began prior to other symptoms. Ms. Johnson decreased her fluid intake to alleviate her symptoms, but the dysuria got worse every day and increased in intensity. She's taking acetaminophen 650 mg for her discomfort, which hasn't improved her condition.

Medications

Ms. Johnson's medications include a daily multivitamin and 650 mg of acetaminophen as needed for pain. She's allergic to nitrofurantoin, trimethoprim-sulfamethoxazole, and fosfomicin.

History

Ms. Johnson's family history includes cataracts, glaucoma, hypertension (HTN), and coronary artery disease (CAD). Her mother died from HTN and CAD 3 years ago, and her father died from prostate cancer 5 years ago. Ms. Johnson has three brothers and one

sister; all have been diagnosed with HTN.

Personal and social history

Ms. Johnson is married and has three children—two sons (14 and 16 years old) and one daughter (12 years old). She lives in a private house in the suburbs. She denies any drug use or smoking currently or in the past; she drinks one glass of wine occasionally on the weekends. Her hobbies are quilting, reading, dancing, and needlepoint.

Pertinent exam findings

The physical examination reveals that Ms. Johnson is afebrile, weighs 145 pounds, is 5 feet 6 inches tall, and has a body mass index of 23.4 kg/m². Her vital signs are blood pressure 122/78 mmHg, heart rate 67 beats per minute, respiration rate 14 breaths per minute, and oxygen saturation 97% on room air. Ms. Johnson says that her pain on urination ranges between 4 and 6 on a 10-point pain scale. She complains of urinary frequency and voids 10 or 14 times daily. Her urine is cloudy, with a strong odor. She reports no vaginal discharge, irritation, sores, lesions, or itching. She also denies any flank pain or costovertebral-angle tenderness. She's sexually active, and her last period was the previous week. Her menstrual flow is moderate and lasts 5 to 6 days. She doesn't use any contraceptive pills, patches, or rings.

*Name is fictitious.

Discussion

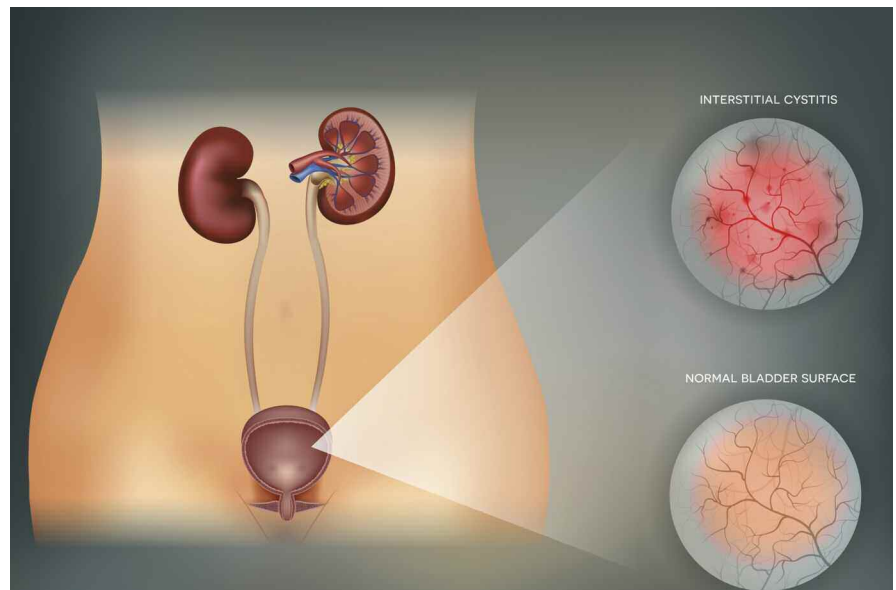
Cystitis causes inflammation to the bladder and can be subclassified as complicated or uncomplicated. Patients with uncomplicated cystitis experience urinary incontinence, urgency, and burning on urination, which may persist for days or weeks. Complicated cystitis manifests with the same symptoms as uncomplicated cystitis, but additional characteristics include urinary obstruction, male gender, diabetes, history of drug resistance, recurrent cystitis, or pregnancy. Complicated cystitis may need more extensive evaluation and longer antibiotic treatment.

Adequately assessing cystitis can be challenging because symptoms overlap with other urologic conditions, such as pyelonephritis. As an NP, you should be prepared to initiate effective medical treatment to provide safe, quality care for patients with cystitis. We'll use Ms. Johnson's case of uncomplicated cystitis to guide your diagnosis and treatments.

Pathogenesis and etiology

Cystitis usually occurs when fecal flora colonize in the urethra and then ascend through the urinary tract into the bladder. *E. coli* accounts for about 80% of all outpatient UTIs. Other uropathogens that cause cystitis are *Staphylococcus*, *Proteus*, *Candida*, *Klebsiella*, and *Enterococcus*. Women are predisposed to cystitis because their urethras are short and close to the anus, which facilitates the entry of bacteria into the urinary tract.

Behavioral and biologic factors may predispose patients to cystitis. Behavioral factors include urinary catheterization or sexual intercourse; biologic factors include structural abnormalities and metabolic or hormonal conditions. Other biologic factors include spinal cord injury, renal calculi, transplant, cysts, urinary incontinence, prostate enlargement, kidney stones, urinary obstruction,



UTI facts

- Urinary tract infections (UTIs) account for about 10 million healthcare visits per year.
- UTI prevalence in women is estimated to be 150 million cases worldwide.
- The incidence of UTI increases substantially after age 85.
- Women are more likely than men to get a UTI.
- Cystitis occurs in 40% to 60% of women during their lifetime.

Sources: American Urological Association 2016; National Institute of Diabetes and Digestive and Kidney Disease, Definition & facts: What is a bladder infection, 2017; National Kidney Foundation 2017; Rowe, Juthani-Mehta 2013.

Adequately assessing *cystitis* can be challenging because symptoms overlap with other urologic conditions, such as pyelonephritis.

pyelonephritis, diabetes, AIDS, and pregnancy.

Other potential predisposing factors for cystitis include age, reduced mobility, changes in acidity in the vagina, and being premenopausal.

Ms. Johnson's risk factors for uncomplicated cystitis include being female and sexually active.

Differential diagnoses

Differential diagnoses include urethritis, vaginitis, pelvic inflammatory disease, nephrolithiasis, and pyelonephritis. All have been associated with dysuria, but dysuria usually is caused by urethritis, vaginitis, cystitis, or pyelonephritis. Dysuria, vaginal discharge, sexually transmitted infection, irritation, and itching may be related to urethritis or vaginitis (candidiasis or trichomonas vaginitis). A patient who presents with dysuria, flank pain, fever, and chills, and who looks ill may have pyelonephritis. (See *Differential diagnoses for cystitis*.)

Diagnosis

Ms. Johnson's symptoms of urinary urgency and frequency in addition to dysuria are consistent with a diagnosis of uncomplicated cystitis. To confirm this diagnosis, a urine dipstick, microscopic urine analysis, or urine culture may be ordered. Im-

Differential diagnoses for cystitis

Consider the following conditions when determining if the patient has cystitis.

Condition	Patient presentation	Etiology
Nephrolithiasis	<ul style="list-style-type: none"> • Flank pain • Renal colic • Hematuria • Fever • Dysuria • Abdominal pain • Suprapubic pain 	<ul style="list-style-type: none"> • Gout • Hypercalciuria • Hyperparathyroidism • Obesity • Renal tubular acidosis • History of GI surgery • Cystic kidney disease • Medications such as <ul style="list-style-type: none"> - calcium-based antacids - indinavir - topiramate - antiseizure agents
Pelvic inflammatory disease	<ul style="list-style-type: none"> • Endocervical discharge • Cervical motion tenderness • Pelvic pain • Fever • Dysuria • Lower abdominal pain 	<ul style="list-style-type: none"> • Intrauterine device • Gonorrhea • Chlamydia • Abortion • Miscarriage
Pyelonephritis	<ul style="list-style-type: none"> • Urinary urgency • Urinary frequency • Flank pain • Costovertebral angle tenderness • Nausea/vomiting • Dysuria • Fever 	<ul style="list-style-type: none"> • Recurrent infection • Benign prostatic hyperplasia • Renal stone • Pregnancy • Diabetes
Urethritis	<ul style="list-style-type: none"> • Urethral irritation or itching • Dysuria • Urethral discharge 	<ul style="list-style-type: none"> • Gonorrhea • Chlamydia • Herpes simplex virus • Yeast infection
Vaginitis	<ul style="list-style-type: none"> • Vaginal discharge or odor • Dysuria • Pruritus • Vaginal dryness • Dyspareunia • Urinary urgency or frequency 	<ul style="list-style-type: none"> • Bacterial vaginosis • Trichomoniasis • Yeast infection • Douching • Tampons • Contraceptive devices <ul style="list-style-type: none"> • <i>E. coli</i> • HIV

Sources: Giarenis, Robinson 2016; Michels, Sands 2015; National Institute of Diabetes and Digestive and Kidney Disease 2017; National Kidney Foundation 2017; National Kidney Foundation® 2016; Sharp et al. 2014; Zak 2014.

aging studies aren't recommended for uncomplicated cystitis.

Urine dipstick

A urine dipstick checks for urine pH, glucose, protein, bilirubin, blood, and white blood cells (WBCs). It's

the simplest tool to screen for cystitis, but its low specificity and sensitivity may generate false results. Positive leukocyte esterase and nitrite tests from a urine dipstick may indicate cystitis, but they also may indicate bacterial growth and pyuria.

However, negative test results, when combined with positive clinical presentations, don't rule out cystitis.

Ms. Johnson's urine dipstick results are positive for leukocyte esterase and nitrite, so cystitis treatment should be considered.

Microscopic urinary analysis

A microscopic exam measures red blood cells (RBCs) and WBCs in the urine and detects casts, bacteria, hematuria, and crystals.

Ms. Johnson's urinary sediment results are positive for WBCs, RBCs, and bacteria, which may be associated with cystitis.

Urine culture

A urine culture is a definitive diagnostic test to guide drug treatment and provide a cure for UTIs. It helps determine the source of infection, so that proper antibiotic treatment can be ordered, thereby avoiding unnecessary therapy. A urine culture of > 10⁵ CFU/mL is diagnostic for UTIs.

A culture was not needed in Ms. Johnson's case because her cystitis was considered uncomplicated; a urine cultures is used to diagnose complicated cystitis.

Managing uncomplicated cystitis

Antibiotic treatment goals for cystitis include relieving symptoms, preventing bacterial resistance and kidney complications, and curing the infection. Local resistance rates, bacterial pathogens (if known), patient allergies and comorbidities, drug costs and adverse effect profiles, and history of medication adherence should guide your choice of antibiotic treatment.

A 3-day course of antibiotic therapy, as recommended by the Infectious Diseases Society of America 2011 guidelines, usually is sufficient to eradicate uncomplicated cystitis. (See *Treatment options*.)

Based on Ms. Johnson's diagnosis and allergies to nitrofurantoin, trimethoprim-sulfamethoxazole, and

Treatment options

The Infectious Diseases Society of America's 2011 guidelines recommend a 3-day course of antibiotics to treat cystitis. Medication options include nitrofurantoin, trimethoprim-sulfamethoxazole, fosfomycin, and fluoroquinolone. You can view the algorithm at academic.oup.com/cid/article/52/5/e103/388285.

Nitrofurantoin

The Infectious Disease Society in America (IDSA) recommends oral nitrofurantoin as first-line treatment for patients with uncomplicated cystitis who have no urologic abnormalities, aren't pregnant, and are premenopausal.

Dosage: 100 mg twice daily for 5 days

Considerations: Avoid if pyelonephritis is suspected, and administer with caution if creatinine clearance < 30 mL/min.

Trimethoprim-sulfamethoxazole

Trimethoprim-sulfamethoxazole is a bacteriostatic antimicrobial agent that inhibits folic acid synthesis from bacteria growth.

Dosage: 160/800 mg twice daily for 3 days

Considerations: Possible adverse effects include hemolytic anemia, liver injury, and bone marrow suppression; it also may cause systemic toxicity when used concomitantly with methotrexate.

Fosfomycin

Fosfomycin is a bactericidal broad-spectrum antibiotic that inhibits bacterial cell wall synthesis.

Dosage: Single 3-g dose

Considerations: Fosfomycin is contraindicated in patients with *Clostridium difficile*-associated diarrhea, hepatic necrosis, heart failure, or an asthma exacerbation. I.V. administration can result in hypokalemia.

If none of the recommended antibiotics can be used, consider the following:

Fluoroquinolone

Fluoroquinolone is toxic to the kidneys and liver, so baseline creatinine and liver function tests are needed before treatment begins.

Dosage: 250 mg twice daily for 3 days

Considerations: Contraindications include tendinitis, peripheral neuropathy, tendon rupture, high bacterial recurrence rates, and increasing antimicrobial resistance. Fluoroquinolone also potentiates warfarin drug therapy.

Beta-lactams

Use of a beta-lactam requires close follow-up because it's related to vaginal reservoirs of infection.

Dosage: Varies by drug

Considerations: Avoid using ampicillin or amoxicillin alone; they have lower efficacy than other beta-lactams. Adverse effects for both ampicillin and amoxicillin include oral and vulvovaginal candidiasis, rash, and urticaria.

Source: Gupta et al 2011.

fosfomycin, you prescribe a 3-day course of fluoroquinolone 250 mg twice daily.

Education and prevention

Prevention begins with education. Explain to patients that treatment adherence will help prevent reinfection and relapse of cystitis. Instruct

them to take the full course of antibiotics to cure the infection and prevent antimicrobial resistance. In addition, review possible medication adverse effects and when the patient should seek help. Patients with complicated cystitis should have a repeat urine culture to confirm the infection is cured.

Suggest other steps patients can take at home to prevent cystitis, such as drinking adequate amounts of water to help clear bacteria from the body. This is especially important for someone who has difficulty emptying his or her bladder because of conditions such as bladder spasms. Other preventive measures include cleaning the perineal area as needed, wiping from front to back after urinating, changing underwear every day, and cleaning with soap and water after each bowel movement.

Some patients benefit from cranberry products, which acidify the urine and inhibit bacterial growth in the bladder. In one study, cranberry juice consumption for 8 weeks (4 ounces daily) significantly reduced UTI symptoms among 24 female participants. However, another study acknowledged that cranberry products have limited evidence in cystitis prevention.

For patients with recurrent UTIs, prescribe a bactericidal prophylaxis antibiotic therapy. Methenamine 1 g by mouth four times daily can be used as a preventive therapy. Refer patients with recurrent UTIs to urology or urogynecology for further evaluation.

When Ms. Johnson returned for her next office visit for a routine checkup, she reported that she had had no further episodes of infection.

Role of NP

Through careful assessment, diagnosis, and education, NPs can ensure that patients with cystitis are successfully treated. Taking the additional step of explaining self-care actions also can promote a positive outcome and lay the groundwork for preventing recurrence of infection and antibiotic resistance. ★

Visit americannursetoday.com/?p=47632 to view a list of selected references.

Myriam Jean Cadet is a family nurse practitioner and an adjunct professor at Lehman College in Bronx, New York.