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Antibiogram, Clinical Practice Guideline, and Treatment of Urinary Tract Infection

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ABSTRACT

Antibiotic resistance challenges nurse practitioners' treatment of simple outpatient urinary tract infections in young females who present with genitourinary symptoms. Prescribing antibiotics is complicated by the emergence of resistant gram-negative urinary tract pathogens. An antibiogram aids nurse practitioners in determining prescribing information based on local resistance patterns, and a clinical practice guideline provides evidence-based recommendations for prescribing antibiotics. Prescribing based on resistance patterns improves the chances of the initial antibiotic treatment to cure and mitigates antibiotic resistance.

Keywords: antiobiogram, antimicrobial resistance, clinical practice guideline, nurse practitioner, urinary tract infection

A simple, uncomplicated urinary tract infection (UTI) is defined as a UTI in persons who have a normal urinary tract and function. A lower genitourinary UTI is generally referred to as cystitis, resulting from bacteria migrating from the bowel, vagina, or perineum ascending from the urethra into the bladder. Acute uncomplicated cystitis is the most common form of the various UTIs for which premenopausal, nonpregnant females seek outpatient treatment.[1] Common lower UTI symptoms include dysuria, fever, hematuria, frequency, urgency, nocturia, hesitancy, and lower abdominal or low back pain. If dysuria, frequency, back pain, and fever are present in patients who have costovertebral tenderness, the probability of a UTI is 60% to 90%.[2] Recent diaphragm use with spermicide, frequent sexual intercourse, recent sexual partners within 4 months, low vaginal estrogen levels, a history of UTIs in a first-degree relative, and prior UTIs are independent risk factors in younger women.[2] UTIs are among the most common outpatient conditions in which antibiotics are prescribed to healthy women.[3] In the United States, healthy, nonpregnant females who report acute dysuria, frequency, or urgency account for greater than 8 million outpatient visits annually.[1] Gram-negative *Escherichia coli* accounts for 75% to 95% of UTI infections.[4] *Staphylococcus saprophyticus* is the offending pathogen in 5% to 15% of UTI diagnoses in younger women, and other prevalent UTI pathogens include *Klebsiella spp* and Enterobacteriaceae.[5]

ANTIBIOTIC RESISTANCE AND UTIs

Antibiotic resistance (AR) is nonselective and is recognized as a global concern that affects all populations. The overprescribing and inappropriate use of antibiotics contributes to the emergence of multidrug-resistant strains of urotoxic bacteria. In the outpatient setting, gram-negative bacterial UTIs are increasing in prevalence, rate, and resistance, and a specific subset of *E. coli* uropathogens are virulent, decreasing the host and immunologic response.[5] The first case of an *E. coli* UTI resistant to all antibiotic treatment was reported in a 49-year-old woman who lived in the US.[6] The *E. coli* strain detected in the urine was attributed to resistant plasmids, which are genetic structures in plasmid cells that rapidly

Table. January2016-December 2016 Cumulative Listing of Antimicrobial Susceptibility Results for Commonly Isolated Gram-negative Bacilli in a Northeast Emergency Department and Affiliated Urgent Care Center

		Aminoglycoside		Beta-lactams						Cephalosporins
Gram-negative Bacilli	# of Isolates	Amikacin	Gentamicin	Aztreonam (EUCAST Break Points for Enterobacteriacea)	Ampicillin-sulbactam	Imipenem	Ertapenem	Meropenem	Piperacillin-tazobactam	Cefazolin
Escherichia coli	**581**	100	90	94	55		100	100	96	84

replicate regardless of chromosomes.[7] Because of the increased virulence of gram-negative uropathogens, appropriate antibiotic prescribing and attention to local resistance patterns are critical.

HISTORY AND PHYSICAL

Obtaining a thorough history and physical and reviewing prior documentation are essential because the physical examination may be normal in young females who have a simple UTI.[2] The history components should include the onset, location, duration, and characteristics of symptoms. The associated and relieving symptoms, severity of symptoms, and treatment of recent and past UTIs should be documented. Medication reconciliation should include a history of drug allergies, interactions, and adverse effects of prior UTI treatment. Previous dates of UTIs and the actual amount of antibiotic ingested should be documented. A review of prior urine laboratory tests aids in appropriate prescribing, and prior urologic consultations, imaging, surgery, and treatment are essential to review. Differential diagnoses for UTIs include sexually transmitted infections, interstitial cystitis, and urologic malignancy. Based on history, a gynecologic examination may be necessary, and transgender and gender-nonconforming patients should receive patient-centered individualized care.[8]

LABORATORY DATA

Urine is sterile, and urine sample contamination is contingent on how the sample is obtained and stored before examination by the laboratory technician. At an average cost of $3.05, a urinalysis (UA) is cost-effective and yields data on leukocyte esterase (LE), nitrates, protein, pH, blood, specific gravity, urobilinogen, glucose, bilirubin, and ketones.[2] Urinary bacteria do not always convert nitrate to nitrite, and nitrites have a specificity of only 54% for UTIs.[9] White blood cells (WBCs), red blood cells, bacteria, organisms, and epithelial cells are quantified by a urine microanalysis and are highly specific for UTIs when WBCs and bacteria are detected.[2] Indirect markers of UTIs, such as LE (or pyuria) or the presence of $>$ 5 WBCs per high-power field, yield a 32% false-positive rate in younger females.[9] Bacteria and nitrites, or bacteriuria, are poor predictors of UTI, and Enterobacteriaceae is an indirect marker for the presence of nitrite.[9] Dipstick-positive hematuria increases the chance for a UTI and is additive if nitrite is positive but is not diagnostic of a UTI.

Although a negative UA is a good predictor of a negative urine culture and sensitivity (C&S), a positive UA does not always predict a positive urine culture or UTI. If the UA is positive for LE and/or nitrites, or if there are $>$ 5 high-power field WBCs and/or moderate bacteria, a reflex C&S is performed by the laboratory technician. The C&S is the standard test for diagnosing a UTI and should be ordered if $\geq 10^5$ colony-forming units per milliliter are present in symptomatic patients.[2] Recommendations for a C&S include patients who may have a complicated or resistant infection, patients who have a history of clinical treatment failure, and patients who are septic and in whom a uropathogen may be the cause of infection.[10] The C&S is questionable as a cost-effective test and is not routinely recommended for acute, simple UTIs.