

Asymptomatic Bacteriuria in Adults

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A common dilemma in clinical medicine is whether to treat asymptomatic patients who present with bacteria in their urine. There are few scenarios in which antibiotic treatment of asymptomatic bacteriuria has been shown to improve patient outcomes. Because of increasing antimicrobial resistance, it is important not to treat patients with asymptomatic bacteriuria unless there is evidence of potential benefit. Women who are pregnant should be screened for asymptomatic bacteriuria in the first trimester and treated, if positive. Treating asymptomatic bacteriuria in patients with diabetes, older persons, patients with or without indwelling catheters, or patients with spinal cord injuries has not been found to improve outcomes. (Am Fam Physician 2006;74:985-90. Copyright © 2006 American Academy of Family Physicians.)

Urinary tract infections (UTIs) are one of the most common infections for which antibiotics are prescribed. The Infectious Diseases Society of America (IDSA) issued guidelines for the treatment of uncomplicated acute bacterial cystitis and acute pyelonephritis in women.¹ The presence of bacteria in the urine of an asymptomatic patient is known as asymptomatic bacteriuria. The IDSA also has published guidelines on indications for the screening and treatment of asymptomatic bacteriuria in various patient populations.²

Epidemiology

Asymptomatic bacteriuria is common, with varying prevalence by age, sex, sexual activity, and the presence of genitourinary abnormalities (Table 1³⁻⁸). In healthy women, the prevalence of bacteriuria increases with age, from about 1 percent in females five to 14 years of age to more than 20 percent in women at least 80 years of age living in the community.³ *Escherichia coli* is the most common organism isolated from patients with asymptomatic bacteriuria. Infecting organisms are diverse and include Enterobacteriaceae, *Pseudomonas aeruginosa*, Enterococcus species, and group B streptococcus. Organisms isolated in patients

with asymptomatic bacteriuria will be influenced by patient variables: healthy persons will likely have *E. coli*, whereas a nursing home resident with a catheter is more likely to have multi-drug-resistant polymicrobial flora (e.g., *P. aeruginosa*). Enterococcus species and gram-negative bacilli are common in men.^{9,10}

Diagnosis

The presence of a significant quantity of bacteria in a urine specimen properly collected from a person without symptoms or signs of a UTI characterizes asymptomatic bacteriuria.¹¹ Quantitative criteria for identifying significant bacteriuria in an asymptomatic person are: (1) at least 100,000 colony-forming units (CFUs) per mL of urine in a voided midstream clean-catch specimen; and (2) at least 100 CFUs per mL of urine from a catheterized specimen^{9,12,13} (Table 2). According to the IDSA guideline, the diagnosis of asymptomatic bacteriuria in women is appropriate only if the same species is present in quantities of at least 100,000 CFUs per mL of urine in at least two consecutive voided specimens.^{2,3}

The leukocyte esterase and nitrite tests often are used in primary care settings to evaluate urinary symptoms; however, they

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SORT: KEY RECOMMENDATIONS FOR PRACTICE

<i>Clinical recommendation</i>	<i>Evidence rating</i>	<i>References</i>
Pregnant women should be screened for asymptomatic bacteriuria in the first trimester of pregnancy.	A	23, 24
Pregnant women who have asymptomatic bacteriuria should be treated with antimicrobial therapy for three to seven days.	B	2
Pyuria accompanying asymptomatic bacteriuria should not be treated with antimicrobial therapy.	C	3, 14

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, see page 906 or <http://www.aafp.org/afpsort.xml>.

are not useful for diagnosing UTI in an asymptomatic patient. A urine dipstick leukocyte esterase test showing trace or more white blood cells has a sensitivity of 75 to 96 percent and specificity of 94 to 98 percent for detecting pyuria¹⁴; however, pyuria is not specific for UTI and may occur with

other inflammatory disorders of the genitourinary tract (e.g., vaginitis). Urinalysis with microscopic examination for bacteria remains a useful test for the identification of bacteriuria.

Limitations of the dipstick nitrite test in diagnosing bacteriuria include: infection with non-nitrite-producing pathogens; delays between obtaining and testing the sample; and insufficient time since the last void for nitrites to appear at detectable levels. Combining the leukocyte esterase and nitrite tests results in higher specificity than using either test alone.

Premenopausal, Nonpregnant Women

Premenopausal, nonpregnant women with asymptomatic bacteriuria experience no adverse effects and usually will clear their bacteriuria spontaneously. However, these women are more likely to experience subsequent symptomatic UTI than women who do not have asymptomatic bacteriuria.¹⁵ One study randomized women with bacteriuria to receive one week of nitrofurantoin (Furadantin) or placebo; those receiving the antibiotic had a significantly lower prevalence of bacteriuria at six months, but not at one year.¹⁶ The patients treated with antibiotics were just as likely as those in the placebo arm to have a symptomatic UTI in the year after therapy. Although women with asymptomatic bacteriuria are more likely to have subsequent symptomatic UTIs, treatment of asymptomatic bacteriuria does not decrease the frequency of symptomatic

TABLE 1
Prevalence of Asymptomatic Bacteriuria in Selected Populations

<i>Population</i>	<i>Prevalence (%)</i>
Healthy premenopausal women ³	1.0 to 5.0
Pregnant women ³	1.9 to 9.5
Postmenopausal women (50 to 70 years of age) ³	2.8 to 8.6
Patients with diabetes	
Women ⁴	9.0 to 27.0
Men ⁴	0.7 to 1.0
Older community-dwelling patients	
Women (older than 70 years) ³	> 15.0
Men ⁴	3.6 to 19.0
Older long-term care residents	
Women ⁴	25.0 to 50.0
Men ⁴	15.0 to 40.0
Patients with spinal cord injuries	
Intermittent catheter ⁵	23.0 to 89.0
Sphincterotomy and condom catheter ⁶	57.0
Patients undergoing hemodialysis ⁷	28.0
Patients with an indwelling catheter	
Short-term ⁸	9.0 to 23.0
Long-term ⁸	100

Information from references 3 through 8.

TABLE 2
Diagnostic Criteria for Asymptomatic Bacteriuria

Midstream clean-catch urine specimen:

For women, two consecutive specimens with isolation of the same species in quantitative counts of at least 100,000 CFUs per mL of urine.

For men, a single specimen with one bacterial species isolated in a quantitative count of at least 100,000 CFUs per mL.

Catheterized urine specimen:

In women or men, a single specimen with one bacterial species isolated in a quantitative count of at least 100 CFUs per mL.

CFU = colony-forming unit.

UTI or prevent further episodes of bacteriuria. Asymptomatic bacteriuria has not been shown to be associated with detrimental long-term outcomes (e.g., hypertension, renal failure, genitourinary cancer, or decreased survival). For these reasons, the IDSA does not recommend screening for or treatment of asymptomatic bacteriuria in premenopausal nonpregnant women.²

Pregnant Women

Women with asymptomatic bacteriuria during pregnancy are more likely to deliver premature or low-birth-weight infants and have a 20- to 30-fold increased risk of developing pyelonephritis during pregnancy compared with women without bacteriuria.¹⁶ A Cochrane systematic review found that studies have consistently reported that treatment of asymptomatic bacteriuria in pregnancy decreases the risk of subsequent pyelonephritis from a range of 20 to 35 percent to a range of 1 to 4 percent.¹⁷ Antimicrobial treatment of asymptomatic bacteriuria also improves fetal outcomes, with decreases in the frequency of low-birth-weight infants and preterm delivery.^{18,19} Early studies usually continued antimicrobial therapy for the duration of pregnancy; however, more recent studies reported similar benefits in patients treated for 14 days with nitrofurantoin

or trimethoprim/sulfamethoxazole (TMP/SMX; Bactrim, Septra) compared with those treated with continuous antimicrobial therapy to the end of pregnancy.²⁰ The IDSA recommends a course of three to seven days of antimicrobial therapy for pregnant women with asymptomatic bacteriuria.² A Cochrane systematic review found insufficient evidence to determine whether a single dose regimen is as effective as treatments of longer duration.²¹

Because leukocyte esterase and nitrite tests have low sensitivity for identifying bacteriuria in women who are pregnant, these patients should be screened with urine cultures²²; however, the optimal frequency of urine culture screening has not been established. A single urine culture at the end of the first trimester generally is recommended based on clinical outcomes and cost-effectiveness.^{23,24} Women with asymptomatic bacteriuria or symptomatic UTI during pregnancy should be treated (*Table 3*) and should undergo periodic screening for the duration of their pregnancy. The IDSA makes no recommendations for subsequent screening of

TABLE 3
Oral Antibiotics for Treatment of Pregnant Women with Asymptomatic Bacteriuria

FDA Pregnancy Category B: Safety for use in pregnancy has not been established

Amoxicillin
 Amoxicillin/clavulanate (Augmentin)
 Ampicillin
 Cefuroxime (Ceftin)
 Cephalexin (Keflex)
 Nitrofurantoin (Furadantin)

Pregnancy Category C: No adequate well-controlled studies have been performed in women; should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus

Ciprofloxacin (Cipro)
 Gatifloxacin (Tequin)
 Levofloxacin (Levaquin)
 Norfloxacin (Noroxin)
 Trimethoprim/sulfamethoxazole (Bactrim, Septra)

FDA = U.S. Food and Drug Administration.

pregnant women found to have no asymptomatic bacteriuria at the initial screen.²

Women with Diabetes

Studies of women with diabetes show no difference between initially asymptomatic bacteriuric and nonbacteriuric women in the incidence of UTI, mortality, or progression to diabetic complications at 18 months²⁵ or 14 years.²⁶ In a study of antibiotic therapy versus no therapy for women with diabetes and asymptomatic bacteriuria, antimicrobial therapy did not delay or decrease the frequency of symptomatic UTI or the rate of hospitalization for UTI or other causes at up to three years' follow-up.²⁷ These studies support the IDSA guidelines² that screening for or treatment of asymptomatic bacteriuria in women with diabetes is not indicated.

Older Patients with Asymptomatic Bacteriuria

Studies of asymptomatic bacteriuria in pre- and postmenopausal women report similar outcomes regardless of age.^{28,29} A study of ambulatory women in a long-term care facility who were assigned to receive antimicrobial therapy or placebo for bacteriuria showed a decrease in prevalence of asymptomatic bacteriuria at six months among those receiving antibiotics, but no significant difference in symptomatic episodes.³⁰ Adverse outcomes attributable to asymptomatic bacteriuria were not observed in a cohort of ambulatory male veterans older than 65 years at several years' follow-up.¹⁰

Clinical trials of older residents in long-term care facilities have shown no benefits from screening for or antimicrobial treatment of asymptomatic bacteriuria.³¹⁻³³ Although antimicrobial treatment does not decrease symptomatic infection or improve survival, there is an increased incidence of adverse antimicrobial effects and reinfection with antibiotic-resistant organisms. Thus, the IDSA does not recommend screening for or treatment of asymptomatic bacteriuria in older patients.²

Patients with Spinal Cord Injuries

Patients with spinal cord injuries have a higher prevalence of asymptomatic bacteriuria and symptomatic UTI.^{6,34} Patients with spinal cord injuries and with asymptomatic bacteriuria treated using antibiotics uniformly showed early recurrence of bacteriuria following therapy. When treated with seven to 14 days of antibiotics, 93 percent of patients were again bacteriuric by 30 days.³⁵ Posttreatment urine cultures showed increased antimicrobial resistance as well. A prospective, randomized trial in patients with asymptomatic bacteriuria and intermittent catheterization showed similar rates of UTI at follow-up, whether or not prophylactic antimicrobials were administered.³⁶ Although there are few trials addressing the treatment of asymptomatic bacteriuria in patients with spinal cord injuries, review articles and consensus guidelines support the IDSA recommendations² that asymptomatic bacteriuria should not be screened for or treated in patients with spinal cord injuries.

Patients with Indwelling Urethral Catheters

Patients with chronic indwelling Foley catheters are uniformly bacteriuric, but treatment is warranted only if the patient is symptomatic. Urine that is cloudy or foul-smelling often prompts a call from a long-term care facility to the physician, with an expectation that an evaluation, if not antibiotic therapy, will be ordered. However, in the asymptomatic patient, cloudy or foul smelling urine is not an indication for urinalysis, culture, or antimicrobial treatment. A study of residents in long-term care facilities with chronic indwelling catheters and bacteriuria who were treated with cephalexin (Keflex) or no therapy showed no differences in the incidence of fever or reinfection; however, patients who received antibiotic therapy had twice the incidence of subsequent microbial resistance to cephalexin.³⁷

When possible, the indwelling catheter should be removed, and the patient should receive clean intermittent catheterization to reduce the risk of symptomatic UTI. The replacement of a chronic indwelling Foley

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catheter is associated with a low risk for bacteremia, and antimicrobial treatment or prophylaxis is not indicated for this procedure.³⁸ A study in young women with short-term catheterization reported increased symptomatic infection over two weeks following catheter removal, when asymptomatic bacteriuria persisted 48 hours after the removal of the indwelling catheter.³⁹ Accordingly, the IDSA recommends that asymptomatic bacteriuria should not be screened for or treated in patients with an indwelling urethral catheter, but that treatment of women with persistent catheter-acquired bacteriuria at least 48 hours after catheter removal may be considered.²

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REFERENCES

- Warren JW, Abrutyn E, Hebel JR, Johnson JR, Schaeffer AJ, Stamm WE. Guidelines for antimicrobial therapy of uncomplicated acute bacterial cystitis and acute pyelonephritis in women. Infectious Diseases Society of America (IDSA). Clin Infect Dis 1999;29:745-58.
- Nicolle LE, Bradley S, Colgan R, Rice JC, Schaeffer A, Hooton TM; Infectious Diseases Society of America; American Society of Nephrology; American Geriatric Society. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. Clin Infect Dis 2005;40:643-54.
- Nicolle LE. Asymptomatic bacteriuria: when to screen and when to treat. Infect Dis Clin North Am 2003;17:367-94.
- Zhanell GG, Harding GK, Nicolle LE. Asymptomatic bacteriuria in patients with diabetes mellitus. Rev Infect Dis 1991;13:150-4.
- Nicolle LE. Asymptomatic bacteriuria in the elderly. Infect Dis Clin North Am 1997;11:647-62.
- Waites KB, Canupp KC, DeVivo MJ. Epidemiology and risk factors for urinary tract infection following spinal cord injury. Arch Phys Med Rehabil 1993;74:691-5.
- Bakke A, Digranes A. Bacteriuria in patients treated with clean intermittent catheterization. Scand J Infect Dis 1991;23:577-82.
- Chaudhry A, Stone WJ, Breyer JA. Occurrence of pyuria and bacteriuria in asymptomatic hemodialysis patients. Am J Kidney Dis 1993;21:180-3.
- Warren JW, Tenney JH, Hoopes JM, Muncie HL, Anthony WC. A prospective microbiologic study of bacteriuria in patients with chronic indwelling urethral catheters. J Infect Dis 1982;146:719-23.
- Mims AD, Norman DC, Yamamura RH, Yoshikawa TT. Clinically inapparent (asymptomatic) bacteriuria in ambulatory elderly men: epidemiological, clinical, and microbiological findings. J Am Geriatr Soc 1990;38:1209-14.
- Rubin RH, Shapiro ED, Andriole VT, Davis RJ, Stamm WE. Evaluation of new anti-infective drugs for the treatment of urinary tract infection. Infectious Diseases Society of America and the Food and Drug Administration. Clin Infect Dis 1992;15(suppl 1):S216-27.
- Lipsky BA, Ireton RC, Fihn SD, Hackett R, Berger RE. Diagnosis of bacteriuria in men: specimen collection and culture interpretation. J Infect Dis 1987;155:847-54.
- Saint S, Chenoweth CE. Biofilms and catheter-associated urinary tract infections. Infect Dis Clin North Am 2003;17:411-32.
- Sobel JD, Kaye D. Urinary tract infections. In: Mandell GL, Douglas RG, Bennett JE, Dolin R. Mandell, Douglas, and Bennett's Principles and Practice of Infectious Disease. 6th ed. Philadelphia, Pa.: Elsevier Churchill Livingstone, 2005:906-26.
- Hooton TM, Scholes D, Stapleton AE, Roberts PL, Winter C, Gupta K, et al. A prospective study of asymptomatic bacteriuria in sexually active young women. N Engl J Med 2000;343:992-7.
- Kincaid-Smith P, Bullen M. Bacteriuria in pregnancy. Lancet 1965;191:395-9.
- Smaill F. Antibiotics for asymptomatic bacteriuria in pregnancy. Cochrane Database Syst Rev 2001;(2): CD000490.

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18. Mittendorf R, Williams MA, Kass EH. Prevention of preterm delivery and low birth weight associated with asymptomatic bacteriuria. *Clin Infect Dis* 1992;14:927-32.
19. Romero R, Oyarzun E, Mazor M, Sirtori M, Hobbins JC, Bracken M. Meta-analysis of the relationship between asymptomatic bacteriuria and preterm delivery/low birth weight. *Obstet Gynecol* 1989;73:576-82.
20. Whalley PJ, Cunningham FG. Short-term versus continuous antimicrobial therapy for asymptomatic bacteriuria in pregnancy. *Obstet Gynecol* 1977;49:262-5.
21. Villar J, Widmer M, Lydon-Rochelle MT, Gulmezoglu AM, Roganti A. Duration of treatment for asymptomatic bacteriuria during pregnancy. *Cochrane Database Syst Rev* 2000;(2):CD000491.
22. Bachman JW, Heise RH, Naessens JM, Timmerman MG. A study of various tests to detect asymptomatic urinary tract infections in an obstetric population. *JAMA* 1993;270:1971-4.
23. Stenvist K, Dahlen-Nilsson I, Lidin-Janson G, Lincoln K, Oden A, Rignell S, et al. Bacteriuria in pregnancy. Frequency and risk of acquisition. *Am J Epidemiol* 1989;129:372-9.
24. Wadland WC, Plante DA. Screening for asymptomatic bacteriuria in pregnancy. A decision and cost analysis. *J Fam Pract* 1989;29:372-6.
25. Geerlings SE, Stolk RP, Camps MJ, Netten PM, Collet JT, Schneeberger PM, et al. Consequences of asymptomatic bacteriuria in women with diabetes mellitus. *Arch Intern Med* 2001;161:1421-7.
26. Semetkowska-Jurkiewicz E, Horoszek-Maziarz S, Galinski J, Manitus A, Krupa-Wojciechowska B. The clinical course of untreated asymptomatic bacteriuria in diabetic patients—14-year follow-up. *Mater Med Pol* 1995;27:91-5.
27. Harding GK, Zhanel GG, Nicolle LE, Cheang M, for the Manitoba Diabetes Urinary Tract Infection Study Group. Antimicrobial treatment in diabetic women with asymptomatic bacteriuria. *N Engl J Med* 2002;347:1576-83.
28. Bengtsson C, Bengtsson U, Bjorkelund C, Lincoln K, Sigurdsson JA. Bacteriuria in a population sample of women: 24-year follow-up study. Results from the prospective population-based study of women in Gothenburg, Sweden. *Scand J Urol Nephrol* 1998;32:284-9.
29. Evans DA, Kass EH, Hennekens CH, Rosner B, Miao L, Kendrick MI, et al. Bacteriuria and subsequent mortality in women. *Lancet* 1982;1:156-8.
30. Boscia JA, Kobasa WD, Knight RA, Abrutyn E, Levison ME, Kaye D. Therapy vs no therapy for bacteriuria in elderly ambulatory non-hospitalized women. *JAMA* 1987;257:1067-71.
31. Nicolle LE, Mayhew WJ, Bryan L. Prospective randomized comparison of therapy and no therapy for asymptomatic bacteriuria in institutionalized elderly women. *Am J Med* 1987;83:27-33.
32. Abrutyn E, Mossey J, Berlin JA, Boscia J, Levison M, Pitsakis P, et al. Does asymptomatic bacteriuria predict mortality and does antimicrobial treatment reduce mortality in elderly ambulatory women [Published correction appears in *Ann Intern Med* 1994;121:901]? *Ann Intern Med* 1994;120:827-33.
33. Ouslander JG, Schapira M, Schnelle JF, Uman G, Fingold S, Tuico E, et al. Does eradicating bacteriuria affect the severity of chronic urinary incontinence in nursing home residents? *Ann Intern Med* 1995;122:749-54.
34. Erickson RP, Merritt JL, Opitz JL, Ilstrup DM. Bacteriuria during follow-up in patients with spinal cord injury: I. Rates of bacteriuria in various bladder-emptying methods. *Arch Phys Med Rehabil* 1982;63:409-12.
35. Waites KB, Canupp KC, DeVivo MJ. Eradication of urinary tract infection following spinal cord injury. *Paraplegia* 1993;31:645-52.
36. Maynard FM, Diokno AC. Urinary infection and complications during clean intermittent catheterization following spinal cord injury. *J Urol* 1984;132:943-6.
37. Warren JW, Anthony WC, Hoopes JM, Muncie HL Jr. Cephalexin for susceptible bacteriuria in afebrile, long-term catheterized patients. *JAMA* 1982;248:454-8.
38. Bregenzer T, Frei R, Widmer AF, Seiler W, Probst W, Mattarelli G, et al. Low risk of bacteremia during catheter replacement in patients with long-term urinary catheters. *Arch Intern Med* 1997;157:521-5.
39. Harding GK, Nicolle LE, Ronald AR, Preiksaitis JK, Forward KR, Low DE, et al. How long should catheter-acquired urinary tract infection in women be treated? A randomized controlled study. *Ann Intern Med* 1991;114:713-9.