

Urinary Tract Infection

Urinary Tract Infection Guideline Team

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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.

Patient population: Adult women with uncomplicated UTI

Objective: Implement a cost-effective strategy for uncomplicated UTI in women

Key Points

■ Diagnosis

- **History.** Diagnosis is made primarily by history. In women with dysuria and frequency, in the absence of vaginitis, the diagnosis is UTI 80% of the time [IC*].
- **Phone triage.** In women with prior history of uncomplicated UTI's, consider phone triage [IIC*].
- **Urinalysis.** Urinalysis for detection of pyuria by dipstick or microscope has a sensitivity of 80-90% and a specificity of 50% for predicting UTI [IB*].
- **No urine culture.** Urine culture is NOT indicated in the vast majority of UTI's [IIIC*]. UC has a sensitivity of 50% (if threshold for positive is >10⁵ organisms), sensitivity can be increased to >90% if threshold is >10² organisms. Consider urine culture only in recurrent UTI or in the presence of complicating factors.

■ Treatment

- **First line** - Five days of nitrofurantoin [IA*].
- **Second line** -Three days of trimethoprim / sulfa [IA*].
Seven days of 1° cephalosporin or amoxicillin-clavulanic acid [IA*].

■ Follow-up

- **No tests if asymptomatic.** No laboratory follow-up is necessary if asymptomatic [IIIB*].
- **For recurrent UTI's.** In patients with recurrent UTI's (>3 / year)
 - consider antibiotic prophylaxis / self-initiated therapy [IIIA*]
 - urologic structural evaluation rarely indicated [IIID*]

* 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=randomized controlled trials; B=controlled trials, no randomization; C=observational trials; D=opinion of expert panel.

Clinical Background

Clinical Problem and Management Issues

Incidence

Urinary tract infections (UTI) are estimated to account for over 7 million office visits per year, at a cost of over \$1 billion. Up to 40% of women will develop UTI at least once during their lives, and a significant number of these women will have recurrent urinary tract infections.

Cost-Effective Strategy

Establishing a cost-effective strategy for the diagnosis and treatment of UTI is important because of its high incidence. Laboratory tests should be ordered only when the results are likely to alter the process or outcome of care.

Antibiotic treatment should be prescribed only for as long as necessary to be effective. Recurrent UTI's may be managed better by self-initiated therapy or prophylaxis than by continuing to treat each case emergently. This guideline provides an approach to uncomplicated UTI that results in good clinical outcomes and utilizes clinical care resources appropriately.

Rationale for Recommendations

The rationale for recommendations addresses:

- Risk factors
- Complicating factors
- Uncomplicated UTI
- Recurrent UTI's
- Asymptomatic bacteriuria
- Acute uncomplicated pyelonephritis
- UTI in pregnancy

(Continued on page 3)

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

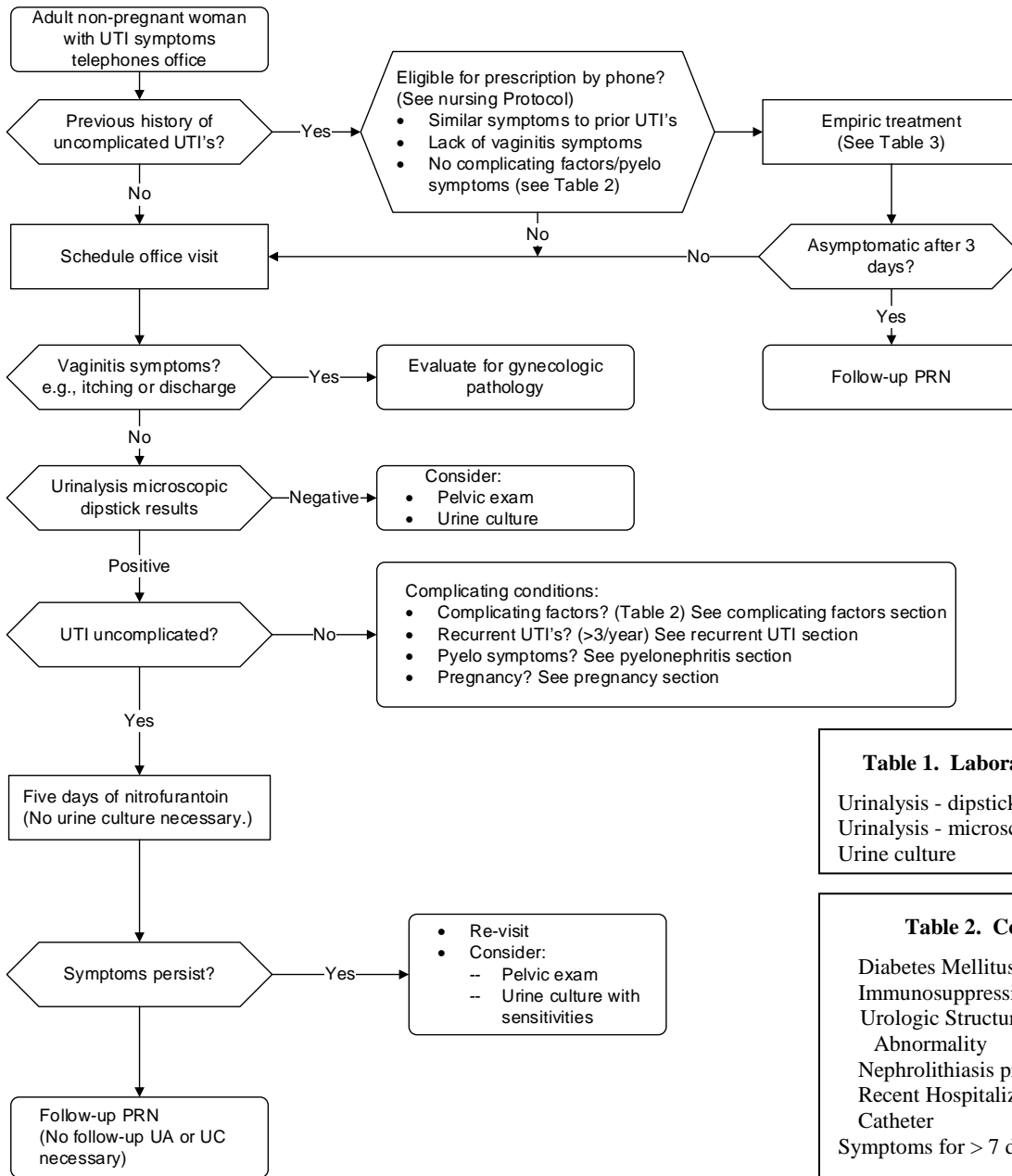


Table 1. Laboratory Charges (M-Labs)

| | |
|-------------------------------------|------|
| Urinalysis - dipstick | \$27 |
| Urinalysis - microscopic (complete) | \$27 |
| Urine culture | \$35 |

Table 2. Complicating Factors

- Diabetes Mellitus
- Immunosuppression
- Urologic Structural / Functional Abnormality
- Nephrolithiasis present
- Recent Hospitalization / Nursing home
- Catheter
- Symptoms for > 7 days

Table 3. Treatment Regimens and Cost¹

| First Line: | Brand | Generic |
|---|-------|---------|
| Nitrofurantoin ² 100 mg BID x 5 days | \$32 | \$17 |
| Second Line: | | |
| Trimethoprim/Sulfa DS BID x 3days | \$17 | \$5 |
| Cephalexin 500 mg BID x 7 days | \$130 | \$28 |
| Amoxicillin-clavulanic acid 875-125 mg x 7 days | \$7 | \$5 |
| Fosfomycin 3 gm x 1 dose | \$70 | n/a |

Table 4. Management of Recurrent UTI

1. Treat acute UTI (see Table 3).
2. Check follow-up urine culture if necessary to distinguish relapse from recurrence, otherwise generally not necessary.
3. Educate. Counsel about risk factors:
 - consider alternative to use of spermicide
 - consider vaginal estrogen in postmenopausal women
4. Prophylaxis. Consider:
 - continuous or postcoital antibiotic (trimethoprim / sulfa SS 80/400 daily or nitrofurantoin 50-100 mg at bedtime)
 - self initiated therapy (Table 3)
5. Structural evaluation is generally not indicated.

¹ Cost = Average wholesale price based -10% for brand products and Maximum Allowable Cost (MAC) + \$3 for generics, from Red Book Online, 9/2016, and Michigan Department of Community Health M.A.C. Manager, 9/2016.

² Nitrofurantoin should not be used with creatinine clearance less than 50 ml/min

Rationale for Recommendations (continued)

Risk Factors

The majority of UTIs occur in sexually active women. Risk increases by 3-5 times when diaphragms are used for contraception. Risk also increases slightly with not voiding after sexual intercourse and use of spermicide. Increased risk has not been demonstrated with oral contraceptives, not voiding before intercourse, non-cotton underwear, and use of condoms.

Microbial Etiology

Escherichia coli is the predominant pathogen in uncomplicated UTI in women, associated with more than 80% of cases. *Staphylococcus saprophyticus* is found in 15% of cases. Other members of the Enterobacteriaceae family, such as *Klebsiella* sp., *Proteus* sp., or *Enterobacter* sp. are associated with uncomplicated UTI. Group B streptococci are an uncommon pathogen in UTI in young healthy women, but requires treatment in pregnant women.

Complicating Factors and Medical Conditions

Patients with complicating factors and medical conditions are at increased risk of development of pyelonephritis or infection with resistant organisms. Complicating factors are listed in Table 2 and include underlying urologic structural abnormalities, diabetes, immunosuppression, pregnancy, recent hospitalization, or urologic tract manipulation. It is necessary to differentiate these women from those with uncomplicated UTI in terms of both work-up and treatment. Unlike women with uncomplicated UTI, care for women with complicating factors may include:

- **Culture.** Obtain pretreatment culture and sensitivity.
- **Treatment.** Initiate treatment with nitrofurantoin or fosfomycin for 7-14 days; longer durations, 10-14 days are recommended if delayed response to treatment. Fluoroquinolones are contraindicated in pregnancy. Fluoroquinolones should be used only if there is a contraindication to trimethoprim/sulfa as they have been shown to have high rates of *E coli* resistance and propensity for collateral damage (resistance, *C difficile* infection, tendinopathy).
- **Follow-up UA.** Obtain follow-up urinalysis to document clearing.
- **Possible structural evaluation.** Lower threshold for urologic structural evaluation with cysto / IVP.

Uncomplicated UTI

Diagnosis. A practical, time- and cost-effective approach to the diagnosis of uncomplicated UTI in women is limited by the lack of a "gold standard" for presence of UTI. At the heart of this problem lies a debate over what actually constitutes a UTI. Traditionally, 10^5 cfu/mL in cultured urine was the threshold. More recently, however, it is

apparent that low colony counts (10^2 to 10^4) may simply represent early UTI; moreover, it appears that symptoms associated with low colony counts respond to antibiotic treatment, as well as symptoms with high counts.

Laboratory diagnosis. Common tests used are: urinalysis by dipstick and urine microscopy under 40x power, both generally readily available in the clinic setting. Urine culture is more expensive and requires 24 to 48 hours for results. None of these tests have been shown to be ideal screening tools.

Dipstick analysis for leukocyte esterase, an indirect test for the presence of pyuria, is the least expensive and time intensive test. It is estimated to have a sensitivity of 75-96% and specificity of 94-98%. Depending on the cut-off used for "abnormal" pyuria as detected by urine microscopy, the positive predictive value for pyuria is only 50%. No studies were found directly comparing dipstick for leukocyte esterase with urine culture. When compared to culture, dipstick is less sensitive for lower thresholds for UTI (i.e., 10^2 - 10^4 cfu/mL) and specificity is correspondingly higher for the same thresholds. Nitrite testing by dipstick is considerably less useful, probably in large part because it is only positive in the presence of bacteria that produce nitrate reductase, and can be confounded by consumption of ascorbic acid.

Microscopic examination of unstained, centrifuged urine by a trained observer under 40x power has a sensitivity from 82-97% and a specificity of 84-95%, again varying depending on defined thresholds for UTI. Microscopic urinalysis showing pyuria has a widely variable predictive value for urinary tract infection, depending upon the pretest probability.

For urine culture, sensitivity varies from 50 to 95%, depending on threshold for UTI, and specificity varies from 85-99%. Urine culture is not recommended to diagnose or verify uncomplicated UTI because the sensitivity of urine culture is limited and the required delay for results. With short treatment courses, treatment is nearly complete before culture results are available.

Several factors may affect the validity of diagnostic testing. Apparent pyuria in a "clean-catch" urine specimen in clinic may in fact represent contamination from vaginal discharge. Apparent bacteriuria may similarly represent perineal or vaginal contamination. Leukocyte esterase, an indirect test for the presence of WBCs, may be negative in early but significant infection.

Diagnosis based on symptoms. In the setting of uncertain validity of testing, the prior probability of infection (i.e. before diagnostic testing) helps to determine which patients will likely benefit from treatment. Available data indicate that dysuria with either urgency or frequency, in the absence of vaginal symptoms, yield a prior probability of UTI of at least 70-80%. Dysuria alone is less useful, yielding only a 25% probability of UTI. Similarly, the presence of vaginal symptoms in addition to urinary

symptoms markedly decreases the likelihood of UTI (about 25% probability).

Back pain and previous history of UTI have also been shown to increase the likelihood of UTI. Other symptoms that conceptually may increase likelihood of UTI (but about which no data were found) include urinary urgency, new urinary incontinence, voiding of small volumes, suprapubic pain, and nocturia. Generally, UTI symptoms are of abrupt onset (< 3 days); a longer or intermittent course of symptoms increases the likelihood of other etiologies besides UTI.

Summary of diagnostic approach. The diagnostic evaluation for UTI therefore begins with an estimation of prior probability of UTI based on the patient's symptoms. From the preceding, it is clear that presence of vaginal symptoms necessitates pelvic examination; however, in the absence of vaginal symptoms, vaginitis is very uncommon and pelvic examination is unnecessary. One caveat: the physician, nurse practitioner or triage nurse should be wary of anything in the patient's history that would increase the risk for sexually transmitted infection, as this may call for pelvic examination as well.

Beyond performing a pelvic examination in patients for whom it is indicated, no formal physical exam is needed, unless the patient has complaints suggestive of pyelonephritis (see that section).

With a number of "classic" UTI symptoms, the prior probability of UTI very likely exceeds 80% and may in fact exceed the predictive usefulness of either dipstick urinalysis or urine microscopy. Therefore, it may be appropriate to simply treat a patient with classic UTI symptoms without any diagnostic testing.

If diagnostic testing is desired, dipstick UA (the cheapest and quickest test) should be performed first. If this confirms a high likelihood of UTI, no further testing need be done, and treatment can be initiated. If dipstick UA is equivocal, possible next steps would be to perform a pelvic exam, perform urine microscopy, and/or defer treatment and send urine for culture.

Treatment. Acute uncomplicated cystitis in women historically has been treated with longer (7-10 day) courses of antibiotics. However, studies have found shorter courses (3-5 days) of oral antibiotics to be as effective as traditional courses. A review of 28 treatment trials of adult women with uncomplicated cystitis concluded that no benefit was achieved by increasing the length of therapy beyond 5 days. The advantages of shorter course therapy include decreased costs of antibiotics, improved patient compliance and decreased adverse effects of antibiotic treatment (e.g., amoxicillin associated vaginitis).

When comparing different treatment strategies, single-dose regimens are less efficient at eradicating bacteriuria, than 3-5 day regimens (23-81% versus 77-91% long-term cure, respectively). No benefit is apparent in increasing the

duration of trimethoprim/ sulfamethoxazole (TMP/SMX) or trimethoprim (TMP) beyond 3 days. Cure rates of 82 to 85% have been achieved with 3-day therapy. Adverse effects increase markedly if treatment is continued past 3 days.

Longer courses of therapy should be used in women who are diabetic, pregnant have had symptoms longer than 7 days, or have other evidence for complicated UTI (see Table 2). In general, older women with lifelong history of UTI and no history of complicating factors are managed as uncomplicated UTI. However, specific treatment algorithms in this age group have rarely been assessed. Consider 5-days of nitrofurantoin for those patients whose health status increases risk of urological defects. However, nitrofurantoin is contraindicated in patients with a CrCl < 50 ml/min.

Since 1990, the rate of resistance to TMP/SMX has been a steadily increasing, reaching >30% in some areas. In contrast, nitrofurantoin resistance remains less than 5%. The 2010 resistance rates to TMP/SMX for *E. coli* in the US is 28%. Since TMP/SMX is concentrated in the urine, in vitro resistance does not necessarily translate into therapeutic failures. Gupta et al (2001) have estimated clinical and bacteriologic outcomes for varying levels of TMP/SMX resistance for uncomplicated UTI:

| TMP/SMX resistance rates | Expected Bacteriologic Eradication Rate | Expected Clinical Success Rate |
|--------------------------|---|--------------------------------|
| 0% | 93% | 95% |
| 10% | 89% | 92% |
| 20% | 84% | 88% |
| 30% | 80% | 85% |

Fluoroquinolones are no longer recommended as treatment option due to high rates of *E coli* resistance and propensity for collateral damage (resistance, *C difficile* infection). Fluoroquinolones are also associated with permanent side effects of the tendon, muscles, joints, nerves, and central nervous system. In 2016, the FDA recommended that fluoroquinolones should be reserved for use in patients who have no other treatment options for with uncomplicated UTI.

Recommending alternative forms of contraception is not necessary when prescribing antibiotics for UTI in women using oral contraceptives. Theoretically, antibiotics can alter hormone levels, suggesting that backup contraception may be advisable when using antibiotics and oral contraception. However, in practice no cases of oral contraceptive failure have been definitely related to antibiotic use for UTI.

Follow-up. Follow up urinalysis and urine cultures (so called "test-of-cure") are not indicated for women with uncomplicated UTI's. Approximately 5-10% of women treated for uncomplicated UTI will have persistent bacteriuria after therapy is completed. The vast majority of

these women will be symptomatic and will therefore seek medical attention. Those who are asymptomatic do not require any treatment except in select cases (see section below on asymptomatic bacteriuria). Follow up urinalysis and urine culture and sensitivity (UA/C & S) should be considered in women with recurrent UTI's or complicating factors.

Phone triage - nurse managed evaluation. The majority of UTI's in women are uncomplicated and resolve readily with brief courses of antibiotics. Therefore, many women can be assessed and safely managed without an office visit or laboratory evaluation. A study in Seattle examined a phone triage guideline. Use of the guideline decreased cost and increased appropriate antibiotic use without any increase in adverse outcomes.

A form for telephone triage and management of UTI is appended to this guideline. Women who have had previous UTI's that have responded to antibiotics can be considered for phone triage and treatment without an office visit or laboratory evaluation. Management without an office visit is not recommended for women with symptoms of pyelonephritis, with complicating factors, or for women who have never been treated for a UTI. Patients who do not respond promptly (2-3 days) should be evaluated in the office.

Recurrent UTI's

The management of recurrent UTI's is summarized in Table 4 and elaborated below.

Diagnosis. Eighty to ninety percent of women who have a UTI will experience another one in their lifetime. A smaller subset of these women (5-10%) will experience recurrent urinary tract infection, defined as 3 or more UTI's per year or 2 UTI's in the past 6 months. Most women with recurrent UTI's have reinfection, while a minority (5-10%) have relapse. Reinfection occurs when recurrent urinary colonization by different organisms occurs at different times, each cured or resolved before the next one begins. In relapse, the bacteriuria often persists during therapy or recurs soon after completion (1-2 weeks). Symptomatic recurrent UTI due to relapse tends to occur much sooner than does reinfection. Bacteriologic and DNA typing shows identical bacteria in relapse.

Treatment. Most women with recurrent UTI's respond to recommended antibiotics regimens (see Table 3). Persistent bacteriuria or early clinical recurrence should raise the possibility of relapse. These patients can be identified by early positive post therapy cultures with sensitivities showing "sensitive" to the agent used to treat them. Patients with documented relapse should be treated with prolonged courses of antibiotics (2-6 weeks) with follow-up urine cultures to document sterility. Consideration should then be made for prophylactic therapy. One should also have a somewhat lower threshold for urologic structural evaluation.

In women with typical lower tract symptoms, pyuria and persistently negative urine cultures, consider evaluation for Interstitial Cystitis.

The vast majority of women with uncomplicated recurrent UTI's experience reinfection. They will respond clinically and bacteriologically to the usual courses of antibiotic therapy. These women rarely have any urologic structural abnormality causing the recurrent reinfections, and structural evaluation is therefore not indicated. Patients should be counseled about risk factors for recurrent UTI's (frequent sexual intercourse, maternal history of UTI's, new sex partner in the past year, spermicide use, diaphragm use, postmenopausal changes in the vaginal flora). Post therapy urine cultures could occasionally be checked in women with recurrent UTI's to differentiate relapse from reinfection, but in general are not necessary. In women with recurrent UTI's due to reinfection, prophylactic or self-initiated therapy should be considered.

Prophylaxis of Recurrent UTI's. Prevention of recurrent UTI's may be possible using antibiotics or non-pharmacologic therapies. The decision to use prophylaxis or not, and which agent to use, should be made jointly by the physician and patient, taking into account the individual preferences of each woman.

Prophylactic antibiotic use has been shown to reduce frequency of UTI in sexually active women. Post-coital prophylaxis appears to be as effective as daily intake. The benefits accrue only during active prophylaxis. Once antibiotics are discontinued, UTI's 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 (i.e. oral or vaginal candidiasis may be seen as a severe side effect by some, mild by others.)

Commonly used prophylactic antibiotics include nitrofurantoin, trimethoprim/sulfamethoxazole, or cephalexin. Nitrofurantoin appears to have the highest withdrawal rate, followed by cephalexin. Fluoroquinolones should be avoided. Due to high rates of *E coli* resistance and propensity for collateral damage (resistance, *C difficile* infection). Fluoroquinolones are also associated with permanent side effects of the tendons, muscles, joints, nerves, and central nervous system. In 2016, the FDA recommended that fluoroquinolones should be reserved for use in patients who have no other treatment options for with uncomplicated UTI.

Recent studies focus on the use of alternative therapies to prevent recurrent UTI's given the increasing resistance to antibiotics, the risk of adverse effects of antibiotics on the normal bacterial flora, and serious side effects from antibiotics.

A Cochrane review has shown that cranberry products do not significantly reduce the annual incidence of UTI's in

women with a history of recurrent UTI's. Long-term use of cranberry juice may not be well-tolerated.

A few small studies have shown that vaginal estrogen therapy in post-menopausal women decreases their risk of recurrent UTI, but the best type of estrogen is unknown.

Poorly-designed studies suggest that methenamine hippurate may help prevent UTI's in patients without renal tract abnormalities, but it is less effective than daily prophylaxis with nitrofurantoin or trimethoprim/sulfa.

Current clinical trials suggest that a vaginal mucosal vaccine reduces the recurrence of UTI's caused by *E. coli* in sexually active premenopausal women.

Acute Uncomplicated Pyelonephritis

Patients presenting with typical lower tract symptoms (dysuria, frequency, urgency, etc.) with associated flank pain, abdominal pain, nausea, vomiting, fever or chills should be suspected of having pyelonephritis. In fact, a significant percentage (up to 20% in some cases) of patients who present with seemingly uncomplicated UTI without typical pyelonephritis symptoms can be shown by bacteriologic localization studies to have involvement of the kidney. Many women with pyelonephritis can be safely managed on an outpatient basis with oral antibiotics. Hospital admission with intravenous antibiotics is indicated for acutely toxic patients, pregnant or immunocompromised women, women unable to take in oral fluids, or in those where compliance is a significant issue.

In patients suspected of having pyelonephritis a urine culture and susceptibility should be performed. Treatment options include 7 days of oral ciprofloxacin 500 mg po BID or oral Bactrim for 14 days after Ceftriaxone 1 gm IM/IV or 10-14 days of a beta- lactam. Adequate response to therapy is defined as clear improvement in clinical condition over 48-72 hours. (It does not necessarily include becoming afebrile.) Follow-up urinalysis and cultures should be considered 1-2 weeks after completion of therapy, however routine structural evaluation is rarely indicated.

Asymptomatic Bacteriuria (ASB)

Diagnosis. Asymptomatic bacteriuria is the presence of "significant" numbers of bacteria in the urine without the presence of symptoms. The presence of one organism per high-powered field in a clean-catch, midstream, unspun urine sample represents significant bacteriuria (equivalent to $>10^5$ CFU/ml).

Patients with chronic indwelling catheters are at particular risk for developing bacteriuria. The risk of UTI can be decreased by using catheters only when necessary, insertion of the catheter under aseptic technique, use of a closed

drainage system, avoidance of irrigation, and change of catheters every 2-3 weeks. Intermittent catheterization and external catheters are associated with fewer infections than indwelling catheters.

Asymptomatic bacteriuria occurs in 40% of elderly adults, especially in nursing homes. In controlled studies that address issues of underlying illness, asymptomatic bacteriuria does not increase risk of death.

Treatment. Screening and/or treatment of asymptomatic bacteriuria in most settings is not recommended because of unproved efficacy, risk of side effects from antibiotics, development of antibiotic resistance, and cost issues.

Treatment of asymptomatic bacteriuria is recommended in the following conditions:

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

Treatment of asymptomatic bacteriuria in women with diabetes does not reduce complications. Therefore diabetes is not an indication for screening or treatment of asymptomatic bacteriuria.

UTI in Pregnancy

UTI is the most frequent medical complication of pregnancy. Physiologic changes, both hormonal and mechanical, predispose the bacteriuric woman to an increased risk for developing acute pyelonephritis, preterm birth, and unexplained perinatal death. Factors contributing to increased risk of disease include dilation of the ureters and renal pelvises, increased urinary pH, and glycosuria promoting bacterial growth and decrease in the ureteric muscle tone.

Asymptomatic bacteria (ASB). ASB occurs in 4-7% of pregnant patients. Unlike nonpregnant women with ASB, in whom intervention is not recommended, pregnant patients with ASB will go on to develop pyelonephritis in up to 40% of cases if left untreated. Pyelonephritis in the pregnant patient leads to septicemia in 10-20% of cases and ARDS in 2%. Screening for asymptomatic bacteriuria is recommended for pregnant women at the first prenatal visit. Urine culture is an appropriate screening tool. Clean catch urine analysis is recognized as an appropriate screening tool by the American College of Obstetricians and Gynecologists.

Treatment of ASB can be accomplished with a variety of FDA category B drugs (see definitions below) including amoxicillin, cephalosporins, nitrofurantoin and fosfomycin. Fluoroquinolones should generally not be used during pregnancy (FDA Category C). A seven day course for

amoxicillin or cephalexin, five day course for nitrofurantoin, or one time dose for fosfomycin is recommended, with follow-up urine cultures to document sterile urine. Persistent bacteruria requires re-treatment guided by sensitivities and then consideration of suppressive therapy, usually with nitrofurantoin.

FDA pregnancy risk categories for drugs are:

- **Category A** = Controlled studies in women fail to demonstrate a risk to the fetus in the first trimester (and there is no evidence of a risk in later trimesters), and the possibility of fetal harm appears remote. The drug should be used during pregnancy only if clearly needed
- **Category B** = Animal-reproduction studies have not demonstrated a fetal risk but there are no controlled studies in pregnant women OR animal reproduction studies have shown an adverse effect that was not confirmed in controlled studies in women in the first trimester. The drug should be used in pregnancy only if clearly indicated
- **Category C** = Studies in animals have revealed adverse effects on the fetus and there are no controlled studies in women OR studies in women and animals are not available. The drug should be used only if the potential benefit justifies the potential risk
- **Category D** = There is evidence of human fetal risk, but the benefits from use in pregnant women may be acceptable despite the risk (e.g., if the drug is needed in a life-threatening situation or for a serious disease for which safer drugs cannot be used or are ineffective).

Symptomatic cystitis in pregnancy. Symptomatic cystitis, in pregnancy, although rare, should be treated and followed-up similarly to ASB. Acute pyelonephritis, which occurs in 1-2% of all pregnancies, should be treated with hospitalization and IV antibiotics.

Strategy for Literature Search

The literature search for this update began with the results of the literature search performed for the earlier version of this guideline (1/1/91-6/30/98; 7/1/98 to 8/31/04. However, instead of beginning the search with literature in 2004, the guideline team accepted the search strategy and results for the search performed through 4/30/07 for the ACOG Practice Bulletin No. 91, Treatment of urinary tract infections in nonpregnant women (see Related National Guidelines).

The additional search for the update of this guideline was conducted prospectively on Medline using the major keywords of: *urinary tract infections; guidelines, controlled trials, and cohort studies; published from 1/1/07 to 4/30/10; humans, adult women.* Specific searches were performed for: *predictive value of tests, diagnosis (other than predictive value of tests), treatment, uncomplicated UTI – treatment, pregnancy, postmenopausal women – treatment, recurrent UTI, self initiated therapy, group B*

strep and non-pregnant women, telephone triage – nursing protocol, other treatment, other references to UTI.

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 recent clinical trials known to expert members of the panel. Negative trials were specifically sought. The search was a single cycle. Conclusions were based on prospective randomized controlled trials if available, to the exclusion of other data; if RCTs were not available, observational studies were admitted to consideration. If no such data were available for a given link in the problem formulation, expert opinion was used to estimate effect size.

Related National Guidelines

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

Treatment of urinary tract infections in nonpregnant women. ACOG Practice Bulletin No. 91. American College of Obstetricians and Gynecologists. *Obstetrics & Gynecology* 2008; 111:785-94.

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

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1999: Steven E. Gradwohl, MD, General Medicine, Carol E. Chenoweth, MD, Infectious Diseases, Karen R. Fonde, MD, Family Medicine, R. Van Harrison, PhD, Medical Education, Kathy Munger, MS, BSN, RN, Ambulatory Care Nursing, Lauren B. Zoschnick, MD, Obstetrics and Gynecology

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Annotated References

Cochrane Database of Systematic Reviews, Antibiotics for preventing recurrent urinary tract infection in non-pregnant women, Volume 4, 2008

Cochrane Database of Systematic Reviews, Cranberries for preventing urinary tract infections, Volume 4, 2009

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