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Diagnosis and Management of Urinary Tract Infection in Older Adults

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DEFINITIONS OF URINARY TRACT INFECTION

Urinary tract infection (UTI) is one of the most commonly diagnosed infections in both hospitalized and community-dwelling older adults. The definition of symptomatic UTI in older adults generally requires the presence of localized genitourinary symptoms, urinary tract inflammation as demonstrated by pyuria, and a urine culture with an identified urinary pathogen (Table 1).[1] Although several consensus guidelines have developed UTI definitions for surveillance purposes, a universally accepted definition of symptomatic UTI in older adults does not exist.[1–4]

DEFINITIONS OF ASYMPTOMATIC BACTERIURIA

Asymptomatic bacteriuria (ASB) is defined as the presence of bacteria in the urine in quantities of 10^5 colony-forming units per milliliter (cfu/mL) or more in 2 consecutive urine specimens in women or 1 urine specimen in men, in the absence of clinical signs or symptoms suggestive of a UTI.[5] Distinguishing UTI from ASB in older adults, although challenging, is particularly important, as antibiotics are necessary for the treatment of symptomatic UTI, but not for ASB. This review focuses on the most recent literature and guidelines on diagnosis, management, and prevention of both UTI and ASB in older adults.

EPIDEMIOLOGY OF URINARY TRACT INFECTION

Both ASB and UTI are common among older adults. UTI is the second most common infection diagnosed in the acute hospital setting,[6] and accounts for almost 5% of all emergency department visits by adults aged 65 years and older in the United States each year.[7] In long-term care facilities, UTI accounts for approximately 30% to 40% of all health

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care–associated infections, with an estimated point prevalence of 1.5% to 1.64%.[8,9] In community-dwelling older adults, the incidence and prevalence of UTI varies with age and gender. The incidence of UTI ranges from 0.07 per person-year in postmenopausal women[10] to 0.13 per person-year in adults older than 85.[11] The prevalence of UTI in one cohort study in women older than 65 years was found to be approximately 16.5% over a 6-month period.[12] Another cohort study in women older than 85 found almost 30% of women to have reported at least 1 UTI within a 12-month period.[13] In men, the annual incidence of UTI ranges from 0.05 in men aged 65 to 74 years and is estimated to increase to 0.08 in men aged 85 and older.[14] Although UTI is one of the most commonly reported infections in older adults, definitions for symptomatic UTI vary significantly across the literature, making the reported incidence and prevalence of symptomatic UTI in this population variable.

EPIDEMIOLOGY OF ASYMPTOMATIC BACTERIURIA

ASB is uncommon in younger adults, but increases significantly with age in both men and women. The prevalence of ASB is estimated to be between 6% and 10% in women older than 60 years and approximately 5% in men older than 65.[15] A cohort study by Rodhe and colleagues[16] found the prevalence of ASB in adults 80 years or older living in the community to be approximately 20% in women and 10% in men over an 18-month period. Almost 25% of individuals in this study with persistent ASB over 18 months had been treated with antibiotics, suggesting ongoing colonization despite antibiotic use. In institutionalized adults the incidence of bacteriuria is even higher, with estimates ranging from 25% to 50% for women and 15% to 35% for men.[15,17]

MICROBIOLOGY

Escherichia coli (*E. coli*) is the most frequent pathogen isolated from urinary cultures in both community-dwelling and institutionalized older adults.[12,18,19] Several population-based studies in community-dwelling postmenopausal women have found *E. coli* to be the most common urinary isolate, accounting for 75% to 82% of UTIs in this population. Other common organisms include *Klebsiella* spp., *Proteus* spp., and *Enterococcus* spp.[12,18] Organisms responsible for UTI and ASB in long-term care residents are similar to those in community populations. In a cohort of long-term care residents, *E. coli* was found to be the predominant organism, accounting for 53.6% of positive urine cultures. Other Enterobacteriaceae were also common and accounted for a total of 34.8% of cultures, specifically *Proteus* (14.6%), *Klebsiella* (13.9%), and *Providentia* (3.7%). Gram-positive organisms including *Enterococcus* and *Staphylococcus* accounted for 4.5% and 4.1% of cases, respectively.[19] Another larger study of older adults living in 32 long-term care facilities also found *E. coli* to be the most common organism isolated from urinary cultures, accounting for 69% of positive urine cultures in this cohort. *Klebsiella* spp. was the second most common (12%) followed by *Enterococcus faecalis* (8%).[20] It is postulated that the postmenopausal state, worsening incontinence and disability, and greater exposure to antibiotics changes the vaginal microbiome of older women, thereby changing the profile of uropathogens causing UTI in community-dwelling and institutionalized women. Fig. 1 shows the most common organisms isolated from urine cultures in older adults.

ANTIMICROBIAL RESISTANCE

UTI is the most common reason for antimicrobial use in older adults, and inappropriate use of antibiotics leads to the development of multidrug-resistant organisms (MDROs). The high rate of ASB in older adults, particularly long-term care residents, often leads to overtreatment with antibiotics, and thus fosters the development of resistant pathogens in this population. A recent study in long-term care residents found a significant association between an increase in episodes of observed bacteriuria and isolation of multidrug resistant gram-negative rods.[21] Although MDROs are more common in health care settings, the prevalence of resistant urinary pathogens in community populations is also growing.[22] In a cohort of community-dwelling older women with UTI, 32% of *E. coli* urinary isolates were reported as resistant to trimethoprim/sulfamethoxazole (TMP/SMX), and 17% were resistant to fluoroquinolones. In women with ASB the rate of resistance was even higher, with 42% of urinary isolates reported as resistant to TMP/SMX and 35% resistant to flouroquinolones.[12] In a cohort of long-term care residents with bacteriuria, approximately 26% of all urinary isolates were found to be resistant to TMP/SMX and approximately 40% were resistant to fluoroquinolones. *E. coli*, in particular, had high rates of resistance to fluoroquinolones (60%), but was often sensitive to TMP/SMX (73%) and nitrofurantoin (93%).[19]

RISK FACTORS

A variety of factors predispose older adults to infections. Age-associated changes in adaptive and innate immunity may increase susceptibility to infections. Multiple medical comorbidities often increase the risk of hospitalization, in addition to the need for invasive procedures, prosthetic devices, and short-term and long-term urinary catheterization. Older adults are also more likely to reside in long-term care facilities, exposing them to nosocomial pathogens and increasing the risk of acquiring MDROs.[23]

Risk Factors in Older Community-Dwelling Older Adults

In community-dwelling older adults, one of the strongest predictors for developing UTI is having a history of UTI.[18,24] In a study of postmenopausal women aged 55 to 75 years, having a history of UTI increased the risk of UTI by more than 4-fold (odds ratio [OR] 4.20; 95% confidence interval [CI] 3.25–5.42) in comparison with postmenopausal women without a history of UTI.[25] Another study by Jackson and colleagues[10] found a significant increase in the risk of UTI in postmenopausal women with prior history of multiple UTIs. In this study, having a history of 6 or more UTIs increased the risk of having a subsequent UTI by almost 7-fold (hazard ratio [HR] 6.9; 95% CI 3.5–13.6). Other risk factors associated with developing UTI in older women include a history of urinary incontinence, presence of a cystocele, and a history of diabetes mellitus.[18,24] Sexual activity has also been associated with an increased risk of UTI in this population, although the association is not as strong as in premenopausal women.[18,26] A change in vaginal flora as a result of declining estrogen levels is thought to predispose postmenopausal women to UTI. However, oral estrogen replacement therapy has not been associated with prevention of UTI in this population.[18] In men, prostatic hypertrophy causing urinary retention and high postvoid residuals may be associated with developing UTI.[27] A recent study evaluating high postvoid residual in

women did not find a significant association between women with postvoid residual of 200 mL or more and 1-year risk of developing a UTI when compared with women with postvoid residual of less than 50 mL, after adjustment for potential confounders.[28]

Risk Factors in Older Adults in Long-Term Care Facilities

Older adults residing in long-term care facilities are more likely to suffer from significant functional and cognitive impairments, both of which have been shown to increase the risk of developing UTI in this population. Disorders such as dementia, Parkinson's disease, and stroke often lead to voiding abnormalities, impede adequate self-hygiene, and increase the need for urinary catheterization. In a study by Eriksson and colleagues,[13] having a history of UTI within the previous year was significantly associated with vertebral fractures, multi-infarct dementia, and stroke. Many of these impairments have also been shown to increase the risk of persistent bacteriuria in older adults. In a cohort of long-term care residents without indwelling catheters, having persistent bacteriuria was significantly associated with requiring total nursing care, in comparison with adults with transient or no bacteriuria (OR 3.2; 95% CI 1.6–6.6). This study also concluded that persistent bacteriuria in women was significantly associated with the diagnosis of dementia (OR 2.4; 95% CI 1.2–4.8).[29]

DIAGNOSIS OF UTI IN COMMUNITY-DWELLING OLDER ADULTS

The diagnosis of symptomatic UTI in community-dwelling older adults who are cognitively intact requires the presence of genitourinary symptoms in the setting of urinary tract inflammation demonstrated by pyuria and a documented microbiologic pathogen. Symptoms suggestive of UTI in older adults are similar to those in younger patients, and include dysuria with or without frequency, urgency, suprapubic pain, or hematuria.[30] Older adults, however, may also initially present with generalized symptoms such as lower abdominal pain, back pain, and constipation.[25] Although urinary symptoms are common in community-dwelling older adults, not all patients who present with urinary symptoms have symptomatic UTI, and overuse of antibiotics for the treatment of UTI in this population remains a significant problem. A recent study by Little and colleagues[31] sought to examine the impact of several different management strategies on the use of antibiotics for cases of uncomplicated UTI in community-dwelling women. The investigators hypothesized that a delay in antibiotics would result in worse symptom control in comparison with immediate antibiotics. In this study, women suspected of having UTI were randomized into 1 of 5 different management approaches: (1) empiric immediate antibiotics, (2) delayed antibiotics (>48 hours), (3) antibiotics if 2 or more symptoms were present (cloudy urine, offensive urine odor, moderate to severe dysuria, or nocturia), (4) dipstick (antibiotics offered if nitrites or leukocytes and a trace of blood were detected), or (5) midstream urine (only symptomatic treatment until microbiology results were available). The investigators found no differences in symptom duration, severity of frequency symptoms, or severity of unwell symptoms between the antibiotic management strategies. However, they did find that use of urinary dipstick testing with a delayed prescription as backup, or empiric delayed prescriptions, helped to reduce antibiotic use. Almost all women in the immediate antibiotic group took antibiotics (97%), in contrast to those in the dipstick group (80%) and the delayed antibiotic group (77%). This study suggests that use of urinary dipstick with delayed

antibiotic use may not lead to poorer symptom control and may reduce the use of antibiotics. The study included all women aged 18 to 70 years, so may not be applicable to older adults beyond the age of 70.[31]

Diagnostic Algorithm for UTI in Community-Dwelling Older Adults

In older adults who are cognitively intact and present with symptoms suggestive of UTI, a urinary dipstick to evaluate for the presence of nitrite or leukocyte esterase, along with a urinalysis, should be performed to evaluate for the presence of pyuria. Urinary culture is preferred to confirm the presence of bacteriuria and to evaluate for antimicrobial susceptibilities, although it is not required in all cases of uncomplicated UTI.[30] Fig. 2 shows an algorithm proposed by the authors for use in community-dwelling older adults with suspected UTI.

DIAGNOSIS OF UTI IN LONG-TERM CARE FACILITIES

The diagnosis of symptomatic UTI in older adults residing in long-term care facilities is challenging, as most accepted definitions of UTI require the presence of localized genitourinary symptoms. Institutionalized older adults, however, often have significant underlying medical comorbidities such as dementia and stroke, which impair their ability to communicate, and are more likely present with atypical or nonspecific symptoms when infected.[1] Furthermore, older adults residing in long-term care facilities have a high prevalence of bacteriuria, making it difficult for providers to distinguish symptomatic UTI from ASB. In the past several decades, overtreatment of suspected UTI with antimicrobials has led to a variety of negative consequences, including the development of MDROs. To improve infection control practices and prevent the negative effects of overutilization of antibiotics, several consensus guidelines have been developed to assist providers in the diagnosis and treatment of UTI in long-term care residents. In 1991, McGeer and colleagues[32] first proposed a set of infection definitions for surveillance purposes in long-term care facilities. According to the original McGeer criteria, the definition of symptomatic UTI for residents without an indwelling catheter includes at least 3 of the following signs and symptoms:

- Fever (≥38°C) or chills
- New or increased burning pain on urination, frequency, or urgency
- New flank pain or suprapubic pain or tenderness
- Change in character of urine
- Worsening mental or functional status[32]

Although the original McGeer criteria were adopted for use by several regulating agencies, these criteria were never validated. In 2001, Loeb and colleagues[4] proposed a set of guidelines aimed to assist providers in prescribing antibiotics for residents in long-term care facilities. According to Loeb and colleagues, the minimum criteria for initiating antibiotics for UTI in residents without an indwelling urinary catheter include:

- Acute dysuria alone or

- Fever (>37.9°C or 1.5°C increase above baseline temperature) and at least 1 of the following:
- New or worsening
  - Urgency
  - Frequency
  - Suprapubic pain
  - Gross hematuria
  - Costovertebral tenderness
  - Urinary incontinence[4]

Although both the original McGeer and Loeb criteria are widely accepted, clinicians caring for patients in long-term care facilities often do not use them.[2,33,34] A recent study of 12 nursing homes in North Carolina found an overall low adherence to the Loeb criteria (0%–38.9%, mean 10.2%) when deciding on whether to institute antibiotic therapy for suspected UTI.[34] Furthermore, they did not find a significant association between adherence to the Loeb criteria and prescribing rates of antibiotics for UTI.

A significant challenge faced by clinicians when diagnosing symptomatic UTI in residents in long-term care facilities is the low incidence of localized genitourinary symptoms, many of which are necessary components of the original Loeb and McGeer criteria. In a recent study of long-term care residents with advanced dementia, the most common reason for suspected UTI was a change in mental status (44.3%). Localized genitourinary symptoms such as dysuria, urgency, and suprapubic pain were infrequent or absent.[33] In this study, almost 75% of residents who did not meet the minimum criteria for antibiotic initiation still received antibiotics.[33] Another study by Rotjanapan and colleagues[35] reported that more than 40% of patients living in 2 Rhode Island long-term care facilities who did not meet the original McGeer criteria for UTI still received antibiotics. These studies illustrate that although guidelines exist, providers often rely on components not included in the original McGeer or Loeb criteria, such as nonspecific symptoms, when deciding on whether to prescribe an antibiotic.

In 2007, a study of residents living in long-term care facilities in Connecticut attempted to identify features that would predict bacteriuria plus pyuria, both of which are necessary components in the diagnosis of UTI as they provide evidence of a host inflammatory response in the setting of a microbiological pathogen. Dysuria, change in character of the urine (eg, gross hematuria, change in color of urine, change in odor of urine), and change in mental status (eg, change in level of consciousness, periods of altered perception, disorganized speech, or lethargy) were significantly associated with the outcome of bacteriuria plus pyuria. Dysuria alone predicted 39% of residents with bacteriuria plus pyuria; however, in combination with change in character of the urine or change in mental status, the predicted probability increased to 63%.[36] The positive predictive value for detecting bacteriuria plus pyuria using the original McGeer or Loeb criteria is 57%. These findings suggest that a combination of clinical features, which include change in mental

status, should be further investigated and potentially incorporated into a diagnostic algorithm to be used by clinicians for diagnosing UTI. Although change in mental status is often reported by providers, only 3 measures of mental status (ie, periods of altered perception, disorganized speech, lethargy) and 1 measure of behavior (ie, resists care) have been shown to be reliably assessed by clinicians in nursing homes.[37] Falls, although a common reason for clinicians to suspect symptomatic UTI in nursing-home residents, have not been shown to be significantly associated with bacteriuria plus pyuria.[38]

In 2012 the Society for Healthcare Epidemiology of America (SHEA) updated the surveillance definitions of infections in long-term care facilities, based on the growing body of evidence-based literature on infections in older adults living in long-term care facilities.[3] These guidelines incorporated the acute care hospital surveillance definitions of the Centers for Disease Control and Prevention National Healthcare Safety Network. Major changes were made to the diagnosis of UTI for residents both with and without an indwelling urinary catheter. For residents without an indwelling urinary catheter, the diagnosis of UTI in the revised McGeer criteria includes:

Criteria from both 1 and 2

1. At least 1 of the following subcriteria of signs or symptoms
    - Acute dysuria or acute pain, swelling, or tenderness of the testes, epididymis, or prostate

      Or
    - Fever or leukocytosis and at least 1 of the following localizing urinary tract subcriteria
        - Acute costovertebral angle pain or tenderness
        - Suprapubic pain
        - Gross hematuria
        - New or marked increase in incontinence
        - New or marked increase in urgency
        - New or marked increase in frequency
    - In the absence of fever or leukocytosis, then 2 or more of the following localizing urinary tract subcriteria
        - Suprapubic pain
        - Gross hematuria
        - New or marked increase in incontinence
        - New or marked increase in urgency
        - New or marked increase in frequency
2. One of the following microbiological subcriteria

- At least 10^5 cfu/mL of no more than 2 species of microorganisms in a voided urine sample
- At least 10^2 of any number of organisms in a specimen collected by in-and-out catheter[3]

Diagnostic Algorithm for UTI in Older Adults in Long-Term Care Facilities

Although several guidelines are available to assist clinicians, diagnosing UTI in older adults remains challenging. According to the Infectious Disease Society of America (IDSA), the diagnostic laboratory evaluation of suspected UTI should be reserved for long-term care residents who present with acute onset of UTI-associated symptoms and signs (eg, fever, dysuria, gross hematuria, new or worsening urinary incontinence, and/or suspected bacteremia). The minimum laboratory evaluation for suspected UTI should include urinalysis to evaluate for pyuria and urinary dipstick to evaluate for evidence of leukocyte esterase and nitrite. If pyuria is present or the urinary dipstick is positive for leukocyte esterase or nitrite test, a urine culture should be obtained to evaluate for the presence of bacteriuria and to document antimicrobial susceptibility testing.[1] The absence of both leukocyte esterase and nitrite has been shown to have 100% negative predictive value for the diagnosis of UTI in long-term care residents suspected of having UTI.[39] In another study by Sundvall and Gunnarsson[40] evaluating 655 residents from 32 nursing homes, the negative predictive value for urinary dipstick was 88% for detecting bacteriuria. Thus, in most cases urinary culture should not be obtained in cases of a negative dipstick for leukocyte esterase and nitrite, and causes other than UTI should be evaluated. Urine culture alone often is not helpful in evaluating diffuse nonspecific symptoms in older long-term care residents[20] and should not be performed routinely in asymptomatic patients.[1] Fig. 3 is a proposed algorithm based on the revised McGeer criteria, with additional suggestions by the authors based on adding empirically derived criteria.

MANAGEMENT

In older adults who present with nonspecific symptoms, identifying which patients require antibiotic treatment of symptomatic UTI is challenging. In the setting of uncertainty, clinicians frequently elect treatment with empiric antibiotics. This strategy, however, often leads to the overuse of antimicrobials and high rates of bacterial resistance. For most women who present with nonspecific symptoms, clinicians should encourage hydration and delay empiric antibiotic use until a diagnostic workup for UTI (ie, urinary dipstick, urine microscopy, urine culture) can be performed. A recent study by Knottnerus and colleagues[41] found that delaying antibiotics in women who present with nonspecific symptoms decreases the use of antibiotics. In this study, women who presented with symptoms suggestive of UTI were asked to delay antibiotic use. More than half of the women (55%) who delayed use had not used antibiotics after 1 week, and the majority (71%) of these patients reported improvement in their symptoms. None of the women who delayed antibiotics developed pyelonephritis.

In older adults with symptomatic UTI requiring antibiotics, selection of the optimal antimicrobial agent, dose, and duration should be chosen carefully to target the causative

organism and minimize unwanted side effects. Older adults, particularly residents in long-term care facilities, often have baseline renal insufficiency, making it necessary to adjust common dosages using the estimated glomerular filtration rate.

Treatment of UTI in Community-Dwelling Older Adults

Treatment of uncomplicated UTI in older adults without significant medical comorbidities follows the same algorithm used in younger patients.[42] For treatment of uncomplicated UTI in women, the International Clinical Practice Guidelines proposed by the European Society for Microbiology and Infectious Diseases and the IDSA recommend:

- Nitrofurantoin monohydrate/macrocrystals, 100 mg twice daily for 5 days

  Or

- TMP/SMX, 160/800 mg, 1 double-strength tablet twice daily for 3 days

Fosfomycin (3 g as a single dose) is an acceptable alternative, although it may have inferior efficacy compared with other regimens. Antibiotics with local resistance rates greater than 20% should only be used if a urinary culture with antimicrobial sensitivity is available.[43] In men, the duration of antimicrobial treatment is often extended for a 7-to 14-day course. However, a recent study of UTI in male veterans found that longer duration of treatment (>7 days) was not associated with a reduction in the recurrence rate when compared with shorter-course treatment (<7 days), suggesting that shorter treatment in men may be warranted.[44] Further studies to evaluate the optimal treatment length of UTI in older men are needed.

Treatment of UTI in Older Adults in Long-Term Care Facilities

Both nitrofurantoin and TMP/SMX are acceptable empiric antimicrobial choices for residents in long-term care facilities. Nitrofurantoin is often underutilized in older adults because of its contraindication in patients with renal insufficiency. However, recent data suggest that nitrofurantoin is an effective agent for the treatment of UTI in older adults with a creatinine clearance greater than 40 mL/min.[45,46] Nitrofurantoin also has lower rates of overall resistance compared to TMP/SMX and fluoroquinolones, making it an effective empiric antibiotic choice for many older adults.[47] Although most *E. coli* isolates are susceptible to nitrofurantoin, other Enterobacteriaceae such as *Proteus mirabilis* may have intrinsic resistance to nitrofurantoin. In patients with a history of gram-negative infections with resistance to nitrofurantoin, TMP/SMX would be the preferred empiric antibiotic choice.[19] Residents of long-term care facilities, in whom treatment with antimicrobials for UTI is initiated, should have a urine culture obtained to test for antibiotic susceptibilities. Once available, antibiotics should be tailored based on antimicrobial susceptibility patterns. In most cases, the most narrow-spectrum antibiotic with activity against the confirmed microbiological pathogen should be used. In 2001, the SHEA recommended a 7-day course of antibiotics for women with a lower-level UTI residing in long-term care facilities; however, the optimal duration of antimicrobial treatment has not been well studied in this population.[48] For simple cystitis, a 3- to 5-day course of antibiotics is sufficient, as is used for younger populations.[43]

Treatment of ASB in Older Adults

Current guidelines do not recommend screening or treatment for ASB in older adults living in the community or living in long-term care facilities. Screening and treatment of ASB is only recommended in older adult men undergoing a urologic procedure in which mucosal bleeding is anticipated.[5]

PREVENTION

UTI is the most common reason antimicrobials are prescribed for older adults. Thus, prevention of UTI will lead to an overall decrease of antibiotic use in older adults. Several pharmacologic and nonpharmacologic strategies for prevention of UTI in older adults have been studied.

Mobility

Decreased mobility in aging adults has been shown to increase the risk for hospitalization for UTI. A recent retrospective cohort study by Rogers and colleagues[49] of older adults admitted to a long-term care facility found a significantly lower rate of hospitalization for UTI in patients who were able to walk. In this study, adults older than 65 years who were able to walk independently had a 69% reduction in risk of hospitalization for UTI in comparison with older adults who did not walk or required significant assistance. Residents who were able to maintain independent walking or show improvement in walking over time had a reduced risk of hospitalization for UTI by 53% (HR 0.47, 95% CI 0.42–0.52). These results suggest that maintaining or improving mobility in older adults admitted to longer-term care facilities may protect against hospitalization for UTI.

Cranberry Formulations

Cranberry formulations have been used for the prevention and treatment of UTI for many years. Cranberry proanthocyanidin (PAC) is the active ingredient in cranberry that is thought to inhibit adherence of P-fimbriated *E. coli* to uroepithelial cells.[50] Although cranberry formulations have been used for the prevention of UTI, the efficacy of cranberry-containing products in preventing UTI is still unknown. In 1994 Avorn and colleagues[51] found a reduction in bacteriuria plus pyuria at 6 months in women living in long-term care and assisted living facilities who drank 10 ounces (300 mL) of cranberry-juice cocktail per day. This study concluded that 10 ounces of cranberry juice cocktail, which contained 36 mg of PAC, was effective in reducing bacteriuria and pyuria in this population. A recent Cochrane review, however, did not find significant evidence that ingestion of cranberry-containing products significantly prevented UTI, although there was a slight trend toward fewer UTIs in persons taking cranberry products.[52] A major limitation in many of the studies included in the Cochrane review is that many participants were unable to ingest the amount of cranberry juice with 36 mg of PAC that is necessary to show a potential benefit. The use of cranberry capsules containing 32 mg PAC has been shown to be a feasible alternative to cranberry juice in this population.[53] In a pilot study, the use of cranberry capsules containing 36 to 108 mg PAC found a trend toward a decrease in bacteriuria and pyuria in female nursing-home residents.[50] Future studies testing cranberry products with at least 36 mg PAC, preferably in

capsule form, are needed to determine whether they are effective in preventing bacteriuria plus pyuria in older adults.

SUMMARY

The diagnosis of symptomatic UTI in older adults continues to be a significant challenge for providers caring for this population. Although guidelines are available to assist providers in diagnosing UTI, they are often not adhered to, and overtreatment with antibiotics remains an important issue. Future studies to improve the diagnostic criteria for UTI in older adults, particularly those living in long-term care facilities, are needed.

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KEY POINTS

- Urinary tract infection (UTI) and asymptomatic bacteriuria (ASB) are common in older adults.
- Distinguishing UTI from ASB is problematic, as older adults may not present with typical signs and symptoms suggestive of UTI.
- Overutilization of antibiotics for suspected UTI is a major problem in older adults living in long-term care facilities, and leads to the development of multidrug-resistant organisms.
- Future studies to improve the diagnostic algorithm for UTI in older adults are needed.

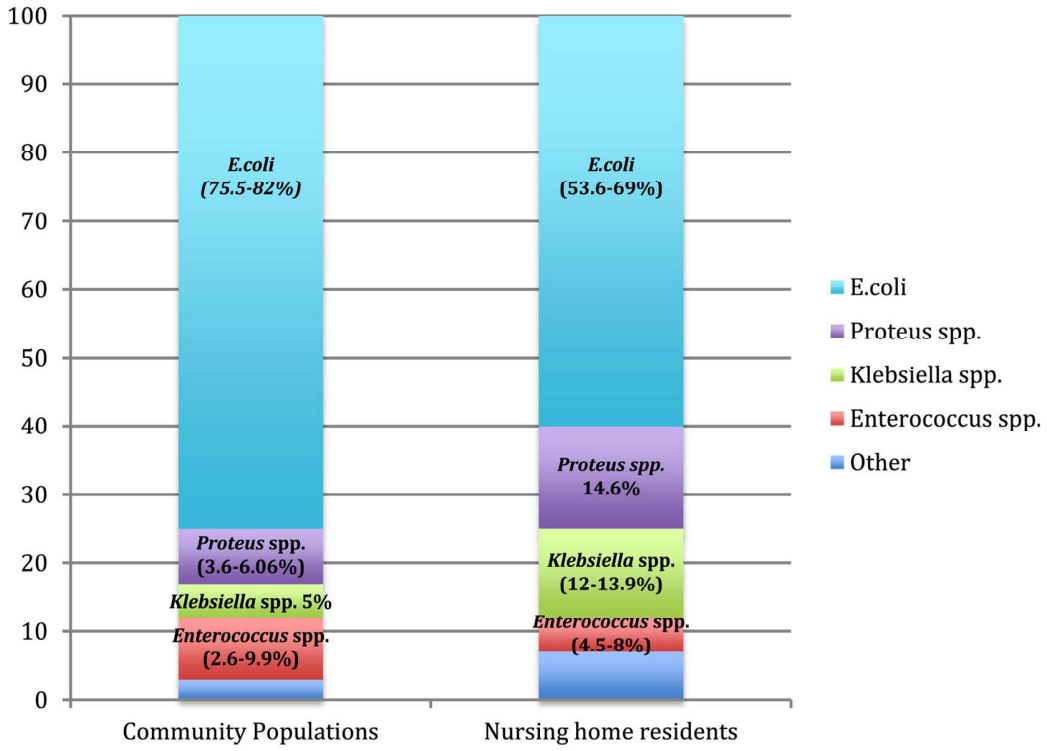

Fig. 1.
The most common organisms isolated from urinary cultures in older adults.

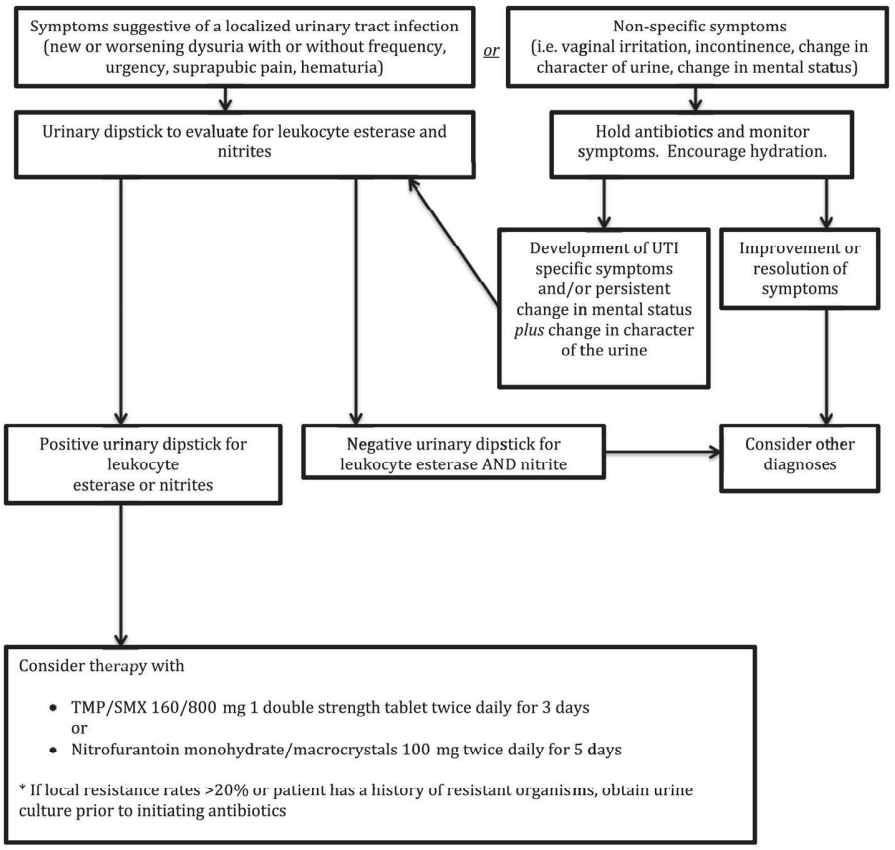

Fig. 2.

Proposed diagnostic and empiric treatment algorithm for UTI in community-dwelling older adults.

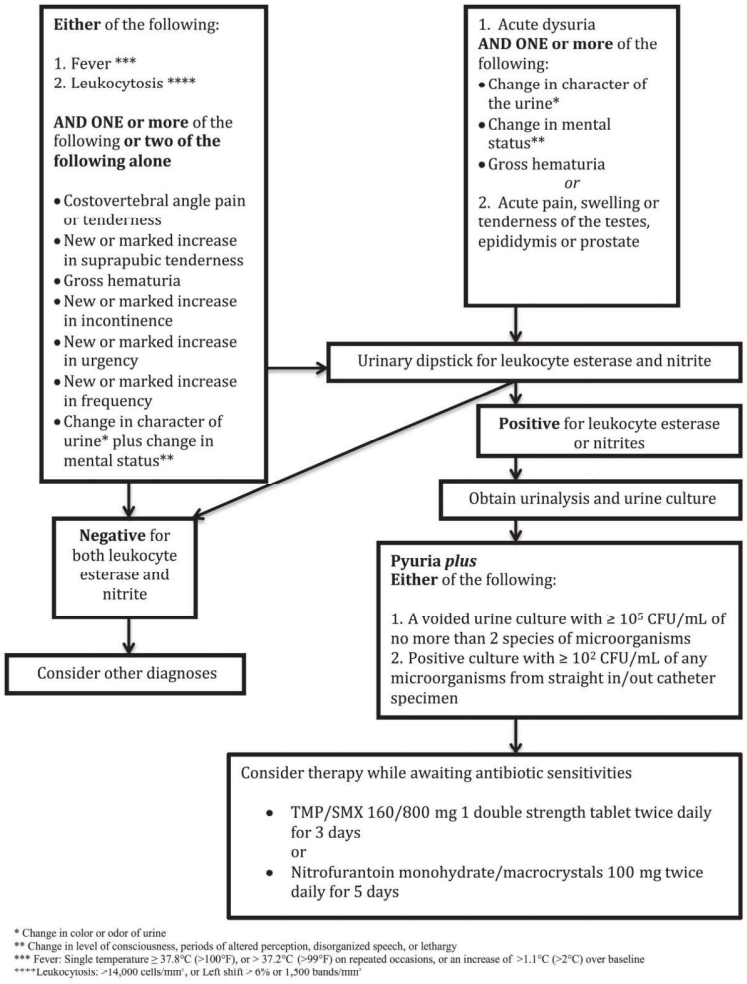

Fig. 3.

Proposed diagnostic algorithm for UTI in long-term care facilities for residents without an indwelling catheter.

Table 1

Definition of common terms

Pyuria	>10 white blood cells (WBC)/mm^3 per high-power field (HPF)
Bacteriuria	Urinary pathogen of $\geq 10^5$ colony-forming units (cfu) per mL
Laboratory-confirmed UTI	Pyuria (>10 WBC/mm^3 per HPF) plus bacteriuria ($\geq 10^5$ cfu/mL)
Asymptomatic bacteriuria	Bacteriuria in the absence of genitourinary signs or symptoms
Symptomatic UTI	Bacteriuria in the presence of genitourinary symptoms (ie, dysuria, suprapubic pain or tenderness, frequency, or urgency)
Uncomplicated UTI	Genitourinary symptoms (ie, dysuria, suprapubic pain or tenderness, frequency, or urgency) with evidence of pyuria plus bacteriuria in a structurally normal urinary tract
Complicated UTI	UTI occurring in a patient with a structural or functional urinary tract abnormality