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Urinary Tract Infection in the Elderly

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ABSTRACT

Urinary tract infections (UTIs) are common and carry significant morbidity and subsequent healthcare costs. Urinary tract infection describes a spectrum of disease from bacteriuria to pyelonephritis. This article will explore the terminology, clinical presentation and treatment of this common disorder in the elderly.

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EPIDEMIOLOGY

Urinary tract infections (UTIs) are more common in the elderly than younger adults. The prevalence of bacteriuria increases from 2-4% in young women to 6-8% in women over 60 years of age and to 20% in those over 80. Bacteriuria in men increases from 1-3% in those aged 60-65 years to 10% in those over 80.¹ The predominance of female UTI also falls in the elderly— from 30:1 (female:male) in younger adults to 2:1 in those over the age of 65.¹

Bacteriuria is a dynamic process and there is a high incidence of spontaneous recovery and subsequent recurrence so that the cumulative prevalence of bacteriuria is higher than that seen in cross-sectional studies.² Approximately 6% of women and 1% of men have persistent bacteriuria with the same organism over 18 months.² The prevalence of bacteriuria is higher in the institutionalised group with a reported incidence of 30-50% for women and 25-30% for men.³ Patients with indwelling catheters are always bacteriuric.

PATHOGENESIS

Ascending infection accounts for most UTIs but a number of other factors may contribute to the increased incidence of UTI in the elderly. In community-based females, oestrogen insufficiency (causing a loss of vaginal acidity and easy colonisation by coliforms), increased residual volumes and other genitourinary abnormalities have all been implicated.⁴ In older men,

an increased prevalence of prostatic hypertrophy and bacterial prostatitis are contributors. The elderly have a high incidence of chronic disease such as diabetes, other immunosuppressive disorders and medications that predispose to bacterial colonisation. In the institutionalised elderly the increase in functional dependence as a result of neurological, cardiorespiratory and musculoskeletal diseases is associated with increased bacteriuria.

As well there are a number of age-related factors which reduce host defence to colonisation. There is a reduction in Tamm Horsefall glycoprotein which is known to coat bacterial pilli⁵ and therefore reduce adherence. Prostatic secretions are also reduced in males and these have a bacteriostatic function. Finally, because of moderate renal impairment the kidneys are unable to generate a bladder environment that inhibits bacterial growth, such as urines of low pH or extremes of osmolarity or high urea concentration. This poor urinary concentrating performance is often aggravated by treatment with diuretics.

TERMINOLOGY

Bacteriuria describes the presence of bacteria in the urine which is normally sterile. This bacteriuria may either be a result of contamination or a significant infection.

The term *significant bacteriuria* has been coined to differentiate between true infection and contamination. A significant bacteriuria is always associated with a degree of pyuria and a predominant culture of a recognised uropathogen; however, the colony count may differ depending on the clinical syndrome (Table 1).

Table 1. Criteria for defining significant bacteriuria⁶

≥ 10² CFU coliforms/mL or ≥ 10⁵ CFU non coliforms/mL in a symptomatic woman.

≥ 10³ CFU bacteria/mL in a symptomatic man.

≥ 10⁵ CFU bacteria/mL in asymptomatic individuals on two consecutive specimens one week apart

Any growth of bacteria on suprapubic catheterisation in a symptomatic patient

≥ 10² CFU bacteria/mL in catheterised patients

CFU - colony forming units

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It is important to note that a significant bacteriuria does not necessarily define the need for treatment.

CLINICAL PRESENTATION

UTI may present as cystitis, pyelonephritis, asymptomatic bacteriuria or chronic UTI.

Cystitis is the syndrome of dysuria, urgency, frequency and suprapubic discomfort. This textbook description of a lower UTI is still a common presentation in the elderly but clinically significant UTI may also present atypically with confusion, behavioural disturbance or falls.

Pyelonephritis presents more atypically in the elderly. In one study of uncatheterised elderly, the diagnosis of pyelonephritis was delayed in 21% of cases; pulmonary and gastrointestinal disease were the most common misdiagnoses.⁷ Pyelonephritis in the elderly is associated with shock in 26% of cases and bacteraemia in 61% of cases.³

Asymptomatic bacteriuria is the presence of a significant bacteriuria in the absence of symptoms. It has been identified in community surveys and represents the opposite end of the spectrum to cystitis. Most elderly people with significant bacteriuria do not have symptoms and in one longitudinal study of patients over 85 years of age, there was no change in symptom frequency as bacteriuria occurred and abated.⁸ There is a consensus that asymptomatic bacteriuria in the elderly has no increased morbidity or at least that antibiotics do not improve morbidity.⁹ The only caveat is that the studies on which this conclusion is based were conducted in unselected populations and it may be that in high risk groups (diabetes, immunocompromised) an increased morbidity may yet be demonstrated. In high risk patients with bacteriuria for whom instrumentation is planned, there is an increased risk of bacteraemia. The key clinical relevance of asymptomatic bacteriuria, particularly as it is a very common disorder in institutional elderly, is that a positive urine culture in a non-specifically unwell older person may be an incidental finding and lead the clinician away from the true diagnosis.

Chronic UTI

This term describes a diverse group of patients with significant bacteriuria that is symptomatic and prolonged despite treatment. Patients may have:

1. an unresolved infection—a persistent symptomatic significant bacteriuria despite treatment;
2. relapsing infection—where the same bacterial strain is cultured with each recurrence of symptoms suggesting an infection not accessible by antibiotics; or
3. reinfection—a new infection after eradication.

Reinfection is more likely when there is vaginal colonisation by bowel flora. This may be because of either atrophic vaginitis or frequent soiling of the perineum because of confusion or other factors. This colonisation will more readily cause infection if urine pools in the bladder as a result of a diverticulum or poor emptying.

In women, chronic UTIs are usually associated with

upper UTIs; in men bacterial prostatitis should be considered.

DIAGNOSIS AND INVESTIGATIONS

Investigation aims to confirm clinical suspicions and ensure appropriate antibiotic management at minimum cost and patient inconvenience. Urine examination can be performed by using urinary reagent strips, microscopy, and culture.

Most urinary reagent strips identify the presence of nitrites, leucocytes, blood and protein. Blood and protein are non-specific findings but nitrites and leucocytes have particular relevance to UTI.

Nitrites indicate the presence of urea splitting bacteria and although the sensitivity is low (about 39%) the specificity is high (93%),¹⁰ so positive nitrite on a urine dip stick is almost invariably associated with bacteriuria. The sensitivity is low because enterococci, *Staphylococcus aureus* and pseudomonas are non urea splitting bacteria but are common urinary pathogens in the elderly. The negative predictive value may be reduced because of a low nitrogen concentration in the urine, diuretics diluting the urine, ascorbic acid, a low urinary pH or a high specific gravity.

The presence of leucocytes identifies a colony count of 10^5 CFU/mL with a sensitivity of 75-96% and specificity of 94-96%.¹¹

Microscopy is rarely done as an office procedure but may be helpful especially when using undiluted, unspun urine in a haemocytometer to measure pyuria. Using this technique leucocytes of $>10/mm^3$ correlate closely with cultures of 10^5 of a single specimen irrespective of symptoms.

The presence of pyuria, however measured, is an indicator of host response and it invariably occurs with a significant bacteriuria even when the colony count is low. The presence of bacteria of any number without pyuria suggests colonisation or contamination. Pyuria without bacteriuria is most commonly associated with renal interstitial diseases but may also be seen in atypical infection such as tuberculosis.

Red blood cells on microscopy are present in 50% of patients with cystitis. When present without bacteriuria they require further investigation. Squamous cells are also identified on microscopy and a high count suggests poor collection technique which will invariably result in contamination.

Urine culture and sensitivity are performed to confirm urinary tract infection and establish sensitivities to ensure appropriate antibiotic treatment. They are expensive and time consuming and should not necessarily be requested in all cases.

Further investigations of the urinary tract should be considered in patients with recurrent or chronic urinary tract infections, acute pyelonephritis, bacteraemia, or persistent bacteriuria in men. In this group a plain abdominal X-ray plus either intravenous pyelogram or ultrasound of the kidney and bladder, and residual volume are necessary.

Table 2. Suggested treatment regimens for urosepsis

Types of urosepsis	Antibiotic dose & frequency	Route	Duration (days)	Notes
Uncomplicated acute cystitis in women	trimethoprim 300 mg daily	oral	5	
	amoxicillin/clavulanate 250 mg/125 mg 8 hourly	oral	5	
	cephalexin 500 mg 12 hourly	oral	5	
Complicated acute cystitis in women and cystitis in men	trimethoprim 300 mg daily	oral	7	'Complicated' = recurrence in ≤ 3 weeks, hospital-acquired, institutionalised, or diabetic.
	amoxicillin/clavulanate 250 mg/125 mg 8 hourly	oral	7	
	cephalexin 500 mg 12 hourly	oral	7	
Pyelonephritis - mild	amoxicillin/clavulanate 875 mg/125 mg 12 hourly	oral	14	
	cephalexin 500 mg 6 hourly	oral	14	
	trimethoprim 300 mg daily	oral	14	
Pyelonephritis - severe	cefotaxime 1 g 8 hourly	IV	Until symptoms controlled then oral treatment for a total of 14 days.	Needs trough monitoring.
	ceftriaxone 1 g daily	IV		
	gentamicin 4 mg/kg/d as a once daily dose	IV		
Symptomatic recurrent urinary tract infection	trimethoprim 150 mg nocte	oral		Consider appropriate investigations, non-antibiotic treatment, bacterial prostatitis in men.
	cephalexin 250 mg nocte	oral		
Symptomatic catheter-associated urinary tract infection	as per pyelonephritis			Remove or replace catheter.

TREATMENT

Treatment regimens are summarised in Table 2.

Acute Cystitis

Older and younger adults share *Escherichia coli* as a common causative organism in acute cystitis but *Staphylococcus saprophyticus*, which is commonly found in the young, is uncommon in older people. *Proteus*, *klebsiella*, *enterobacter*, *serratia*, *pseudomonas*, *enterococcus* and other Gram-negative organisms are more common.¹¹ Institutionalised elderly are more likely to have a non-*E. coli* infection, with *Proteus mirabilis* being the most common organism. In elderly men there appears to be an increase in Gram-positive infections such as *Staphylococcus epidermidis* and streptococcal species.¹²

Older people are less likely to be cured by single dose therapy.⁴ For uncomplicated acute cystitis, a 3-day regimen will produce a cure in most women. However, in one study only 68% of an ambulant elderly female population with symptomatic UTI were cured at two weeks. No optimal duration of therapy in older women therefore has been determined but seven days has been suggested.¹³

As antibiotic treatment is associated with a number of complications such as vaginal candidiasis, drug interactions, hypersensitivity and gastrointestinal upset, the minimum effective duration of treatment is ideal. In Australia a 5-day course would be a practical suggestion considering how antibiotics are packaged.

A minimum of seven days treatment should be given to women with the following complications:

- an early recurrence of their UTI (three weeks or less); or
- infection acquired while in hospital or institutionalised; or
- diabetes or immunosuppression.

Men should be treated for at least seven days whether the UTI is complicated or uncomplicated. Men who have an early recurrence should be assumed to have bacterial prostatitis and be treated for a minimum of fourteen days.

Pyelonephritis

In both males and females, the treatment of invasive UTI involving the upper urinary tract requires higher dose antibiotic therapy, either orally if mild or IV if severe. A minimum treatment of 14 days is necessary.

Severe and Resistant UTI

Tertiary cephalosporins are increasingly used for significant sepsis of unknown aetiology. However, where the urinary tract is a known source of sepsis, gentamicin is a highly cost-effective and microbiologically effective treatment. It can be used with adequate safety in the elderly for 24–48 hours or with appropriate monitoring if needed for longer periods. In the elderly a once daily dose of 4 mg/kg with adequate monitoring of trough levels will minimise the risk of ototoxicity and nephrotoxicity.

Chronic UTI

Chronic UTIs may require long-term treatment after appropriate investigation and consideration, in men, of

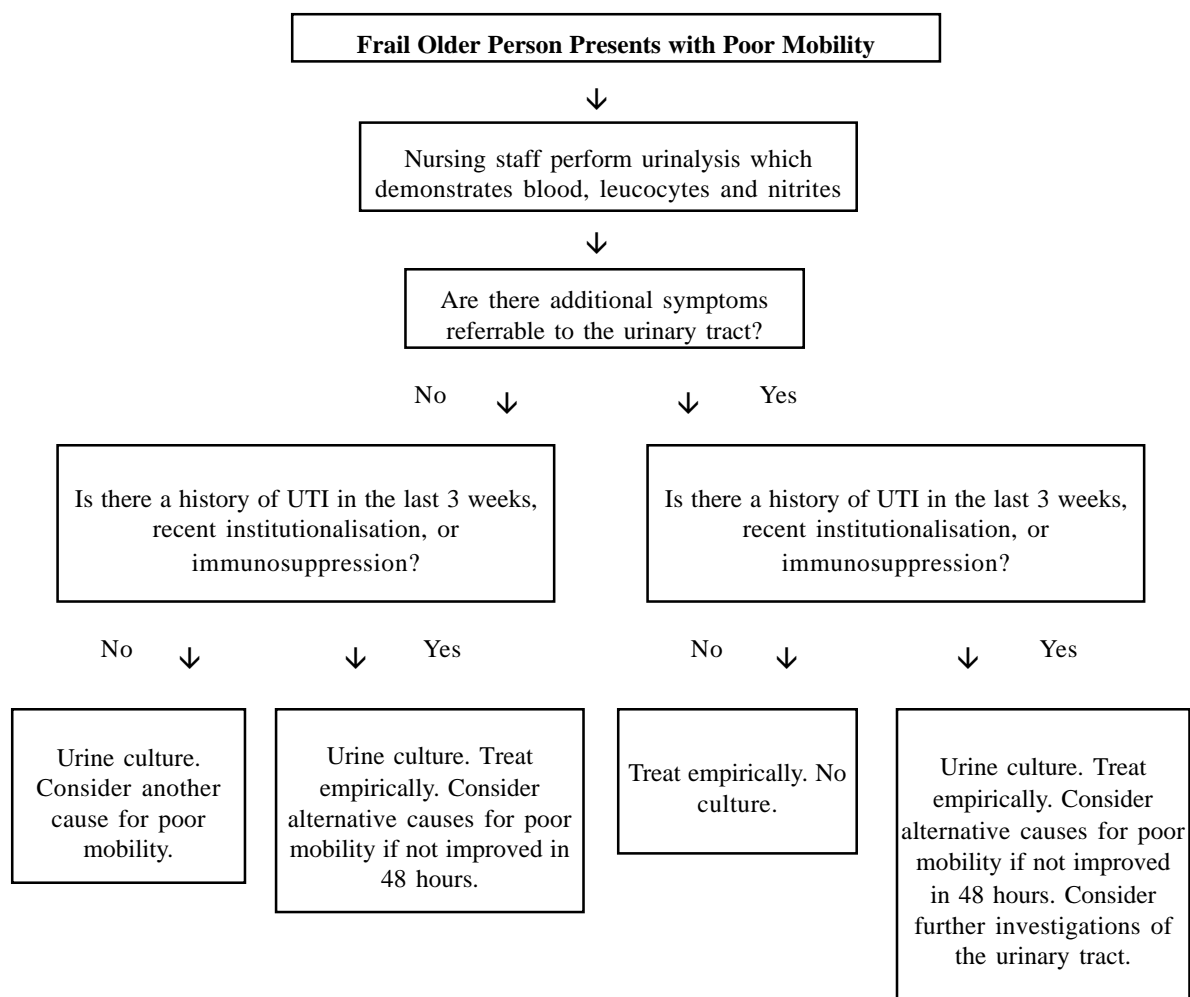


Figure 1. Management options for elderly patient presenting with deterioration of unclear aetiology and positive result on reagent strip testing

bacterial prostatitis. Non-antibiotic management such as maintaining good perineal hygiene, minimising constipation, good hydration and attention to complete bladder emptying should be addressed. Local oestrogen can improve vaginal bacterial resistance and should be considered in women with atrophy of the vaginal mucosa. Urinary antiseptics e.g. hexamine are rarely useful.

Low dose prophylactic antibiotic therapy should be considered for older women who have recurrent symptomatic cystitis. No formal studies have been performed in older people but outcomes similar to those seen in younger adults should be expected.¹⁴ Low dose trimethoprim and cephalexin would be appropriate antibiotics. On empirical grounds it would seem reasonable to discontinue therapy after three months but if symptomatic infection recurs, to continue it indefinitely.

Norfloxacin, although effective, is limited by its authority requirement. Nitrofurantoin is not recommended in this age group because of the potential for

pulmonary and neurological sequelae with long-term therapy, especially in patients with renal impairment.

Asymptomatic Bacteriuria

Consensus would argue that there is no benefit in morbidity or mortality with antibiotic therapy for asymptomatic bacteriuria in the elderly.⁹ Avorn et al. demonstrated that 300 mL/d of a cranberry preparation reduced the prevalence of bacteriuria in institutionalised older people.¹⁵ This effect has not been shown to have any effect on the frequency of symptomatic infections.

In those with non-specific symptoms, the high incidence of asymptomatic bacteriuria especially in the elderly in residential care leaves the clinician on more shaky grounds even if the dip stick or culture is positive. In this situation, if treatment with the appropriate antibiotics has not produced resolution of the symptoms or a marked improvement within 48 hours, another diagnosis needs to be considered (Figure 1).

Catheter-Related UTI

Catheter-related bacteriuria should not be treated unless symptomatic. Ideally the catheter should be removed or at least replaced. Treatment should be based on established sensitivities depending on the severity of infection. There is insufficient data to recommend using antiseptics in recurrent catheter infection but a trial is sometimes warranted when all else has failed.

CONCLUSION

UTI in the elderly is a common disorder and, more often than not, is treated on empirical grounds without investigation. Where there is a high degree of clinical probability of UTI, empirical treatment is most appropriate and testing with a urinary reagent strip, if positive to leucocytes and nitrites, will further reinforce the diagnosis. To go on to urinary culture and sensitivity testing would be excessive. If however the dip stick is negative it may be quite reasonable to culture as the infection may be secondary to one of the non-urea splitting uropathogens which may be more resistant to standard treatment.

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