

## ACUTE GERIATRICS

# Diagnosis of urinary tract infection in older persons in the emergency department: To pee or not to pee, that is the question

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*Doreen is a 79-year-old woman referred by her general practitioner to the ED for intravenous antibiotics for a urinary tract infection (UTI). She lives in a residential aged care facility (RACF) and staff report malodorous and cloudy urine. She denies dysuria or frequency. On examination Doreen is frail with vital signs of: temperature 37.7°C, pulse 87 bpm, blood pressure 130/70; there is no suprapubic or flank tenderness. Do you perform a dipstick test on Doreen's urine for a suspected UTI?*

## UTI in older persons

Accurate diagnosis of UTI in older persons is hindered by high rates of asymptomatic bacteriuria (ASB); lack of a definitive test to support accurate timely diagnosis; and comorbidities, such as immunosuppression and cognitive impairment, which impede assessment for symptoms and signs of UTI.

Both under-diagnosis and over-diagnosis<sup>1–3</sup> is common, but over-

diagnosis seems the more pressing problem in geriatric emergency medicine and is the focus of this article. A retrospective study of emergency admissions of those aged 75+ years treated with intravenous antibiotics for a UTI found that 43% did not meet defined criteria for that diagnosis. Myriad problems then result: 8% of those treated developed *Clostridium difficile* diarrhoea;<sup>3</sup> emerging evidence shows the urinary microbiome helps to prevent overgrowth of pathogenic bacteria, so inappropriate antibiotics actually promote UTI;<sup>4–6</sup> and multi-resistant antimicrobial resistance is promoted. Multiple studies show that antibiotics do not provide any benefit in older persons with ASB, and in fact expose them to risks of allergies, multi-resistant organisms and *Clostridium difficile* infection.<sup>7–10</sup>

## Definitions

UTI is defined as the presence of both urinary tract symptoms (e.g.

suprapubic tenderness, costovertebral angle pain or tenderness, urinary urgency or frequency or dysuria) and isolation of a urinary pathogen at  $\geq 10^5$  colony forming units/mL in a freshly voided mid-stream urine specimen.<sup>11,12</sup> Some definitions also include reference to one of the following additional criteria:<sup>13–15</sup>

- no more than two species of organisms identified on urine culture;
- pyuria ( $>10$  white blood cells/mm<sup>3</sup> per high-power field);
- growth of only  $\geq 10^3$  colony forming units/mL of a urinary pathogen on urine culture, in those with a catheter-acquired UTI.

ASB is defined as  $\geq 10^5$  colony forming units/mL in a correctly collected urine specimen from an individual with no typical symptoms or signs of urinary system disease.<sup>12</sup> ASB is associated with pyuria to no less an extent than in UTI.<sup>16</sup> Table 1 describes the prevalence of ASB in older people.

These definitions, together with the high prevalence of ASB in older persons, present the following challenges in the ED:

1. Definitive diagnosis of a UTI requires results of a urine culture that is not available at the time of ED discharge.
2. Culture results need interpretation based on the clinical symptoms and signs of a UTI, usually

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**TABLE 1.** Prevalence of asymptomatic bacteriuria in older persons<sup>43–45</sup>

Sub-population of older persons	Gender	
	Female	Male
Community-dwelling	6–16%	4–7%
Aged care facility	25–55%	15–37%
With urodome catheter	Not applicable	85%
With indwelling catheter	98%	

by a down-stream provider who did not order them.

Studies of the diagnosis of UTI are associated with significant risk of misclassification bias due to their lack of use of established definitions of UTI.<sup>17</sup>

## Microbiology

*Escherichia coli* is the most commonly isolated organism in urine cultures from both community-dwelling older persons and RACF residents.<sup>18</sup> Antibiotic resistance in *E. coli* is a significant problem. The prevalence of extended spectrum beta-lactamase-producing *E. coli* is growing, most particularly in hospital-acquired UTI, where prevalence is up to 44%.<sup>19</sup> Extended-spectrum cephalosporin-resistant *E. coli* prevalence in Australia and New Zealand is reported at 3%.<sup>20</sup>

## Clinical assessment

The first two aims in assessing an older person with a suspected UTI are to look for evidence of sepsis, before determining the likelihood of UTI. Given the high prevalence of ASB in older persons, considering the probability of UTI based on history and examination findings prior to ordering a urine microscopy and culture may be the most important step we can take to reduce over-diagnosis.

### Establish the pre-test probability of UTI

Assessing pre-test probability of UTI should include assessment for:

1. Features of past history that increase risk for UTI (Table 2): presence of one or more of these features increases probability of UTI;

**TABLE 2.** Features of past history that increase risk for UTI<sup>24,46,47</sup>

Domain	Feature
Past medical history	Immunocompromise
	Diabetes
	Cognitive impairment
	Immobility
	Impairment in activities of daily living, particularly disability in drinking and feeding self and disability in washing hands and face
Past urological history	Prior antibiotic treatment for UTI
	Urinary incontinence
	Cystoceles (women)
	Prostatic hypertrophy (men)
	Recent instrumentation of urinary tract
	Renal stones

2. History and examination findings of UTI (Table 3);
3. Absence of an alternate cause of symptoms.

Definitions of UTI mandate the presence of genitourinary symptoms. However, the accuracy of genitourinary symptoms alone (Table 3) is poor. This may in part, be contributed to by lack of precision in defining the symptoms examined in these studies. For example, dysuria is widely described as a symptom of UTI. However, in older people, it is critical to establish whether the dysuria is acute or chronic. Chronic dysuria may be due to atrophic vaginitis in females and chronic prostatitis in males, or bladder malignancy.<sup>21</sup>

Isolated malodorous<sup>22–24</sup> or cloudy urine<sup>23,24</sup> are not represented in Table 3. Australian Therapeutic Guidelines: Antibiotics<sup>25</sup> state that there is no indication to test urine in RACF residents on the basis of isolated malodour or cloudiness.

A significant proportion of urine tests in ED occur in the context of non-specific symptoms, altered mental state and falls.<sup>1</sup> Delirium alone does not increase the likelihood ratio for UTI, but it should be considered in the entire context of assessing UTI risk, including assessment for alternative causes of delirium.<sup>26,27</sup> Falls may be associated with UTI in the setting of urinary urgency, frequency, nocturia and incontinence.<sup>28</sup> However, there is no routine indication for urine testing in those presenting with a fall without localising urinary symptoms.<sup>12,29</sup>

A history of rigors or shaking chills is a predictor of bacteraemia in older persons (adjusted odds ratio 3.06, 95% confidence interval [CI] 1.3–7.19), with UTI being the most common cause of bacteraemia in this cohort;<sup>30</sup> therefore those presenting to ED with rigors and no obvious alternative aetiology should have UTI considered as a potential cause.

## Testing

### Urine collection method

Most mid-stream urines collected in ED are collected from older patients with no staff assistance and receiving no instructions on urine collection.<sup>31</sup>

**TABLE 3.** Likelihood ratios for positive urine culture of features found on history and examination in adults with suspected UTI<sup>24,48–50</sup>

Study population (setting)	Feature	Positive LR (95% CI)		Negative LR (95% CI)	
		Female adults (ED)†	Older adults (outpatients and RACF)	Female adults (ED)	Older adults (outpatients and RACF)
History	Dysuria	2.1 (1.4–3.3)	2.06 (1.18–3.59)	0.2 (0.0–0.6)	0.91 (0.84–0.98)
	Urinary urgency	1.3 (0.8–2.1)	1.06 (0.37–3.04)	0.9 (0.8–1.1)	1.0 (0.96–1.04)
	Urinary frequency	2.3 (1.4–3.6)	0.10 (0.01–1.7)	0.2 (0.0–0.6)	1.03 (1.01–1.06)
	Change in voiding pattern		9.33 (3.03–28.7)		0.56 (0.41–0.76)
	Incontinence (in older adults – self-reported)		1.65 (1.37–2.0)		0.61 (0.49–0.77)
	Flank pain		31.2 (1.87–521)		0.76 (0.64–0.91)
	Haematuria	1.4 (0.6–3.4)		1.0 (0.9–1.0)	
	Previous UTI	1.4 (0.9–2.0)		0.9 (0.7–1.0)	
Examination	Temperature‡	1.9 (1.2–3.0)	1.25 (0.77–2.04)	0.8 (0.6–0.9)	0.96 (0.87–1.06)
	Costovertebral angle tenderness	1.4 (0.8–2.4)		0.9 (0.8–1.0)	
	Confusion		0.33 (0.10–1.11)		1.05 (1.01–1.09)

†Where more than one study results reported, that with highest positive LR and/or lowest negative LR presented. ‡In female adults' temperature >37.2°C reported; in older adults' temperature >37.9°C reported. CI, confidence interval; LR, likelihood ratio; RACF, residential aged care facility.

Correct midstream clean-catch technique, in one study, was used in only 6% of collected specimens.<sup>31</sup> In both men and women, it is recommended that midstream urine collection with prior cleansing be used.<sup>32</sup> A prospective study, albeit in younger women, found that instructions to hold labia apart during sampling halved contamination rates of urine samples.<sup>33</sup> Use of catheterisation to obtain urine specimens is associated with a significantly lower proportion of contaminated urines on both microscopy and culture, bearing in mind the procedure may cause harm and distress.<sup>1</sup> This is the preferred approach for urine collection in those with significant cognitive impairment.

For patients with a long-term indwelling catheter, it is imperative to remove it and collect urine from a freshly inserted catheter to test for UTI.

### The dipstick urine

ED studies of the utility of dipstick urine in older persons are limited by

inclusion of those with contaminated urine samples and/or ASB, with resultant significant misclassification bias. In a study that included patients with UTI associated with bacteraemia, dipstick urine was 96.9% sensitive (95% CI 93.7–98.6) when both leucocyte esterase and nitrites were positive, with a false-positive rate of 42.4% (95% CI 41–43.8).<sup>34</sup> Addition of urine microscopy with a cut-point of >10 white blood cells per high power field, decreased sensitivity to 78.1% (95% CI 72.2–83.0) but false positives decreased to 20.1% (95% CI 19–21.3). In a prospective observational study of older ED patients without focal urinary symptoms, dipstick urine had a positive predictive value of 37% and a negative predictive value of 92%.<sup>26</sup> Therefore, the value of a negative urinalysis in ruling out UTI is greater than the rule-in value of a positive result, but neither should be relied on in isolation of history and examination findings.

### Urine microscopy

Urine microscopy for leucocyte counts in those aged 60 years and older has a 80% sensitivity and 67% specificity for positive urine culture, with an associated 40.5% positive predictive value and 92.2% negative predictive value.<sup>35</sup> Pyuria on microscopy is generally defined as >10 leucocytes per high powered field.<sup>14</sup> In contrast, bacterial counts on microscopy have a sensitivity of 92.3% and specificity of 91.4% with a positive predictive value of 75% and a negative predictive value of 97.4% for positive culture.<sup>35</sup> These results must still be interpreted in the complete context of initial likelihood of UTI and severity of current illness when determining whether to proceed with empiric antibiotic treatment, because pyuria is found in 94% of those with ASB.<sup>36</sup>

### Urine culture

Jones *et al.* developed a protocol, which entailed reflex urine culture

cancellation on the basis of low-risk findings for infection on urinalysis, with a reduction in performance of cultures by 39.1%, with 1.8% of those cultures identified to be suitable for cancellation, subsequently being positive for an organism.<sup>37</sup> Validation studies of this protocol have identified a 34.6% absolute reduction in number of urine cultures completed, with 2.3% of cultures suitable for cancellation in males and 6.9% in females being positive for an organism.<sup>38</sup>

### Additional assessment to guide management

If UTI is deemed likely, the next steps are to determine:

1. Is the UTI uncomplicated or complicated? A complicated UTI is one with structural or functional

abnormality in the urinary tract; a history of urinary instrumentation; or concurrent systemic diseases such as renal impairment, transplantation or immunodeficiency.<sup>39</sup>

2. Is this a lower UTI (cystitis) *versus* upper UTI (pyelonephritis)?
3. In older men with lower UTI symptoms, is the prostate tender on rectal examination, suggesting potential prostatitis?<sup>40</sup>
4. Are there risk factors for multi-resistant organisms, such as recent travel to developing countries, antibiotic usage or hospitalisation?

### Who to treat, and when, if diagnosis is not definitive?

As we have noted, the definition of UTI requires a culture result mostly unavailable in ED. In older community-dwelling adults, the

decision to prescribe antibiotics for a presumptive diagnosis of UTI should be individualised against the following criteria (summarised in Fig. 1):

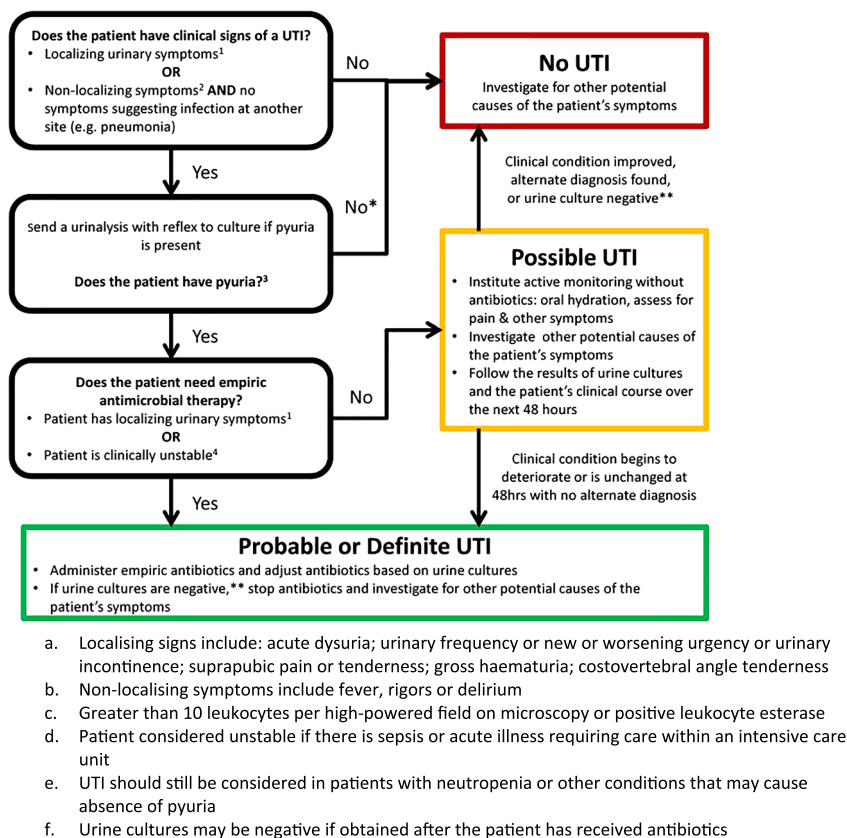
1. The presence or absence of localising symptoms;
2. Where non-localising symptoms alone are present, including results of an assessment to identify infection at an alternate site;
3. Results of the non-definitive urine test you have done in ED (dipstick or microscopy);
4. Presence of clinical instability.

In RACF residents, a cluster randomised controlled trial identified that implementation of a diagnostic algorithm for UTIs in RACFs was associated with fewer courses of antibiotics, with no significant increase in admissions to hospital or mortality.<sup>41</sup> The Australian Therapeutic Guidelines: Antibiotics suggest a similar algorithm for UTI diagnosis in RACF residents (Fig. 2), where urine testing is selective.<sup>25</sup>

### Transitional communication and risk minimisation

Transitional communication to the general practitioner when discharging an older person from ED with a diagnosis of UTI may emphasise recommendations to reduce recurrent UTI, including where relevant:

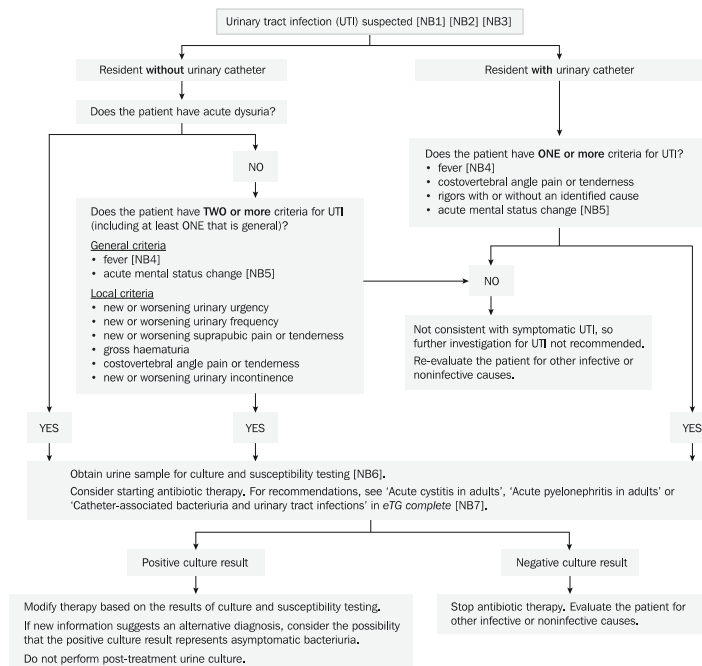
1. Treatment of atrophic vaginitis with vaginal oestrogens – this may reduce recurrent UTIs in post-menopausal women;<sup>42</sup>
2. Assessment for incomplete bladder emptying and addressing causes of high post-void residuals of  $\geq 200$  mL, such as prostatic hypertrophy;<sup>13</sup>
3. Review of the indication for indwelling catheters and arrangement of a trial of void where appropriate;
4. Implementation of a falls risk minimisation plan where the older person is experiencing symptoms such as urinary urgency, frequency, nocturia or incontinence. This may include, for instance, use of continence pads, keeping a commode at the bedside and increased supervision of mobilisation; and
5. It may also be emphasised that if clinical cure has been achieved,



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**Figure 1.** Decision-making process in assessment of community-dwelling older persons for UTI.<sup>14</sup> (Reprinted and adapted from Infectious Diseases Clinics 31(4). Copyright (2017), with permission from Elsevier).



Assessment and treatment of aged-care facility residents  
with suspected urinary tract infection

NB1: Do not investigate or treat cloudy or malodorous urine in aged-care facility residents who do not have other signs or symptoms of UTI.  
NB2: Consider whether an alternative diagnosis is likely. Consider both infective (eg pneumonia) and noninfective (eg medication-related adverse events) causes.  
NB3: Establish whether an advance care plan is in place as it may influence assessment and management (eg whether investigations are performed or antibiotics are given).  
NB4: Fever is defined as a temperature higher than 38°C or an increase of more than 1.5°C above baseline temperature.  
NB5: Acute mental status changes include new change in level of consciousness, periods of altered perception, disorganised speech and lethargy.  
NB6: If the resident has an indwelling urinary catheter, see eTG complete for a guide to collecting urine samples in patients with indwelling urinary catheters.  
NB7: The duration of therapy does not need to be modified for this patient group and should always be stated on the prescription.

\* Reproduced with permission from: Urinary tract infection in aged-care facility residents [published 2019 April]. In: eTG complete [Internet]. Melbourne: Therapeutic Guidelines Limited; 2019.

1. Antibiotic Expert Groups, *Therapeutic Guidelines: Antibiotics*. Vol. Version 16. 2019, Melbourne: Therapeutic Guidelines limited.

**Figure 2.** Assessment and treatment of aged-care facility residents with suspected urinary tract infection.<sup>25</sup> (Reproduced with permission from: Urinary tract infection in aged-care facility residents [published 2019 April]. In: eTG complete [Internet]. Melbourne: Therapeutic Guidelines Limited; 2019).

there is no role for repeat urine testing in the older person after completion of the course of antibiotics for uncomplicated lower UTI.

## Conclusion

There are several critical points for the ED physician to consider in diagnosing UTI in older adults:

1. Urinalysis or urine microscopy should only be ordered where the history and examination suggest likely UTI.
2. Routine indiscriminate urinalysis or urine microscopy is to be avoided.
3. For those unwell with non-localising acute symptoms where UTI is part of the differential diagnosis, err on the side of looking for alternative diagnoses before testing urine, as the risk of detecting ASB that has no causal relationship to the nonspecific symptoms is substantial.
4. Meticulous attention to how the urine is collected is required. However, catheter specimen urine collection of people with

cognitive and sensory impairments is distressing, invasive and only necessary if the pre-test probability for UTI is sufficient.

There is significant room for improvement of ED assessment of UTI in older persons with an imperative to assess clinical probability of UTI prior to ordering urine microscopy and culture. The current practice of widespread, indiscriminate testing of urines for UTI in older persons risks avoidable morbidity for individuals and may contribute to increasing prevalence of multi-resistant organisms. Furthermore, anchoring onto a diagnosis of UTI in settings where this is not clinically supported, means that the true underlying cause of the persons presentation may go unrecognised and untreated.

## Competing interests

None declared.

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