

Catheter-associated urinary tract infections in adults

Catheter-associated urinary tract infections are a significant health burden in both the community and hospital setting. The European Association of Urology defines them as a 'urinary tract infection occurring in a person whose urinary tract is currently catheterised or has had a catheter in place within the past 48 hours' (Gould et al, 2010). Although there are extensive international guidelines, surveys have shown that these are poorly understood by junior doctors (Paras et al, 2015). A large part of the confusion arises from difficulty in discriminating between asymptomatic bacteriuria and symptomatic urinary tract infection. This article highlights these differences and delineates when to prescribe and when to withhold antibiotics in the management of catheter-associated urinary tract infection.

Epidemiology and pathophysiology

Catheter-associated urinary tract infections are the most common health-care-associated infections, representing at least 10% of hospital-acquired bacteraemias (Gould et al, 2010). Approximately 12–16% of inpatients are catheterised, and up to a quarter of these develop catheter-associated urinary tract infections during admission (Abnerthy et al, 2017). Catheters increase the infection risk by disturbing natural host defence mechanisms, traumatising the urothelium

and encouraging colonisation and adhesion of uropathogens. The main risk factor is the duration of catheterisation, with the risk of acquisition of bacteriuria increasing by 3–7% per day of catheterisation (Lo et al, 2014). Other risk factors are shown in *Table 1*.

Consequences of catheter-associated urinary tract infection

A single healthcare-associated, catheter-associated urinary tract infection has been calculated to cost the NHS £1968 (Loveday et al, 2014).

Health consequences include septicaemia or sepsis, epididymo-orchitis, prostatitis, delirium, prolonged hospital admission, further catheter changes or instrumentation, and the need for antibiotics. Patients with long-term catheters and recurrent urinary tract infections may also develop strictures and other permanent anatomical damage. Meanwhile, antimicrobial use can lead to resistance, hypersensitivity, toxicity and disturbance of commensals leading to further infections such as vulval Candidiasis or *Clostridioides difficile* colitis.

Diagnosis

Medical school teaches clinicians the importance of urine dip as the first step

to diagnosing a urinary tract infection. However, up to 90% of patients with long-term catheters have positive urine dip as a result of asymptomatic bacteriuria from colonised catheters (Beech, 2016). The National Institute of Health and Care Excellence (2018) guidance states that asymptomatic bacteriuria does not warrant either investigation or treatment, as the risks of antibiotic exposure (resistance, *C. difficile* infection) far outweigh the potential benefits. Importantly, antibiotics are unable to eradicate microbes that have colonised the catheter. Asymptomatic bacteriuria in pregnant women is a unique exception where antibiotics do in fact need to be prescribed.

For these reasons, urine dipstick is of no use whatsoever in a catheterised patient, whether the patient has infective symptoms or not (Trautner et al, 2015). Similarly, the presence of odorous or cloudy urine or pyuria in an otherwise asymptomatic catheterised patient should not prompt investigations for a urinary tract infection (Geerlings et al, 2006). The National Institute of Health and Care Excellence (2018) guidelines recommend only investigating catheterised patients with infective symptoms; in these patients, the first-line investigation should be to send a urine sample for culture. A proposed algorithm for the diagnosis and basic management of a catheter-associated urinary tract infection is shown in *Figure 1*, adapted from National Institute of Health and Care Excellence (2018) guidelines and work by Hooton et al (2010) and Trautner et al (2015).

Management

As stated, the National Institute of Health and Care Excellence (2012) guidelines advise only treating symptomatic patients. Symptoms include but are not limited to: fever, acute haematuria, rigors, suprapubic or flank pain, dysuria and delirium. Before starting antibiotics, a urine sample must be obtained in an appropriate manner, using aseptic technique via the catheter sampling

Table 1. Risk factors for catheter-associated urinary tract infections

Patient factors	Impaired renal function
	Female sex
	Diabetes mellitus
Factors related to catheterisation	Immunosuppression or immunocompromise
	Prolonged duration of catheterisation
	Repeat instrumentation or traumatic insertion
	Non-adherence to aseptic non-touch technique and infection control measures

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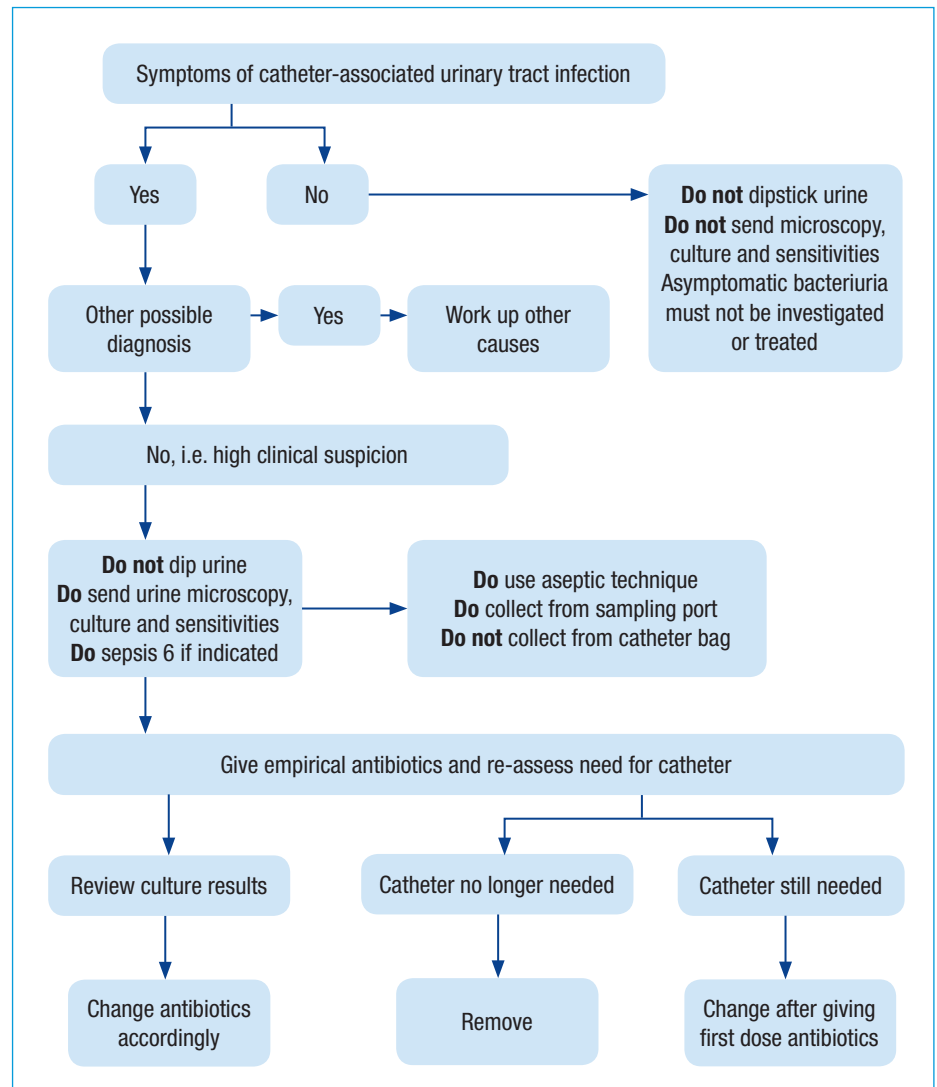
port and never from the catheter bag. If the catheter has been in situ for over 30 days but the patient still needs a catheter, the sample should be collected only after a catheter change. If the catheter can be removed, a mid-stream urine specimen should be taken instead (National Institute of Health and Care Excellence, 2018) (Figure 1).

Empirical antibiotics should be given as per the hospital guidelines, and National Institute of Health and Care Excellence (2018) guidelines, with consideration for the severity of symptoms, risk of complications, previous urine culture and susceptibility results, as well as previous antibiotic use. The National Institute of Health and Care Excellence (2018) has published clear guidelines on antibiotic choice in treating catheter-associated urinary tract infections. Note that first-line antimicrobial choice is different for children and pregnant women. This article purely focuses on the management of catheter-associated urinary tract infection in non-pregnant adults; asymptomatic bacteriuria in pregnant women is a unique exception where antibiotics do need to be prescribed, and beyond highlighting this difference, this article will not cover the management of catheter-associated urinary tract infection in these patients.

As with any infection, oral antibiotics should be given first line if the condition is not severe and oral intake can be tolerated. Patients with signs of sepsis should be treated as per the sepsis protocol and given the hospital's first-line antibiotics intravenously without delay. Intravenous antibiotics should be reviewed by 48 hours to consider switching to oral antibiotics, and all antibiotics should be reviewed if either the patient is not responding, or culture and susceptibility results are back (National Institute of Health and Care Excellence, 2018) (Figure 1).

In a patient with confirmed catheter-associated urinary tract infection, it is always better to remove than to change the catheter. If a patient with confirmed catheter-associated urinary tract infection has had a catheter in place for ≥ 7 days but still needs a catheter, National Institute of Health and Care Excellence (2018) guidelines advocate changing the catheter to reduce the risk of bacteriuria and infection. It is tempting to give prophylactic antibiotics on changing catheters, but National Institute of Health

Figure 1. A proposed algorithm for the diagnosis and management of a catheter-associated urinary tract infection. Adapted from Hooton et al (2010), Trautner et al (2015), National Institute of Health and Care Excellence (2018).



and Care Excellence (2018) guidelines advise against this as routine practice. Antibiotic prophylaxis should only be considered in patients with a history of symptomatic urinary tract infections after catheter changes, or who experience trauma during catheterisation (National Institute of Health and Care Excellence, 2012).

Prevention of catheter-associated urinary tract infection

Prevention is always more effective than treatment; the simplest way to prevent a catheter-associated urinary tract infection is to prevent catheterisation. A prospective study found that 41% of patient-days in medical intensive care unit were spent with a catheter that was not clinically indicated, whereas 58% of patients on medical wards

lacked a valid clinical indication for their catheter (Jerkeman and Braconier, 1992). It is therefore essential to improve the education of health-care professionals. A survey of junior doctors at a single institution found that although 60% of respondents reported knowledge of the catheter-associated urinary tract infection guidelines, only 54% correctly identified the daily risk of catheter-associated urinary tract infection, and only 3% of respondents correctly identified the scenarios in which catheterisation was appropriate (Paras et al, 2015).

Other methods to reduce the risk of catheter-associated urinary tract infection are summarized below:

- Improving catheter documentation to facilitate critical assessment and thus prompt removal of catheters when no

KEY POINTS

- Catheter-associated urinary tract infection is one of the biggest infection-related problems faced by hospitals.
- Catheterisation is not a risk-free procedure and must only be undertaken with good indication and documentation.
- Understanding when to investigate and prescribe antibiotics is key to effective catheter-associated urinary tract infection management.

longer indicated. In the aforementioned survey, only 11% of respondents felt they could easily find catheter documentation (Paras et al, 2015).

- Using appropriate catheter equipment (such as selecting a type and size that minimizes urethral trauma and is appropriate for the expected duration of catheterisation) (Loveday et al, 2014). Lubricant plays an important role in catheter insertion to reduce urethral trauma and thus the risk of infection.
- Adherence to aseptic technique and infection control guidelines in the insertion and maintenance of the catheter (Loveday et al, 2014).

Antibiotic prophylaxis

The National Institute of Health and Care Excellence (2018) advises against routine prophylactic antibiotics to prevent catheter-associated urinary tract infection in view of limited supporting evidence. The first meta-analysis (Marshall et al, 2013) on the subject was based on seven eligible studies: five published randomized controlled trials, one unpublished randomized controlled trial and one non-randomized controlled study. The authors reported an overall reduction in catheter-associated urinary tract infection rate associated with antibiotic prophylaxis (risk ratio 0.45 at 95% confidence interval, absolute risk reduction 5.8%). However, they urge caution in its widespread implementation, given the limitations of the studies and the complications of antibiotic prophylaxis.

Despite National Institute of Health and Care Excellence (2018) guidelines, antibiotic prophylaxis is widely administered by clinicians. A survey of 300 health-care professionals found that 60% of respondents had given antibiotics at the time of catheter

removal, while 40% of urologists reported doing this for all their patients (Wazait et al, 2004).

There are times where antibiotic prophylaxis may be appropriate. National Institute of Health and Care Excellence (2012) guidance does suggest considering antibiotic prophylaxis in patients with a history of urinary tract infections at the time of catheter change, or with current or previous urethral trauma. This is particularly relevant in the urology setting, where postoperative patients often undergo catheter changes following urethral instrumentation. In this setting, a one-off prophylactic dose may be justified. Patients with recurrent catheter-associated urinary tract infections may also warrant antibiotic prophylaxis, although this is not to be done lightly (Swain et al, 2012). Before prescribing prophylaxis, the National Institute of Health and Care Excellence (2018) guidance advises:

- Investigating the urinary tract for any underlying, treatable cause of recurrent urinary tract infections (such as bladder stones or incomplete bladder emptying in patients with neurological disease)
- Discussing the risks and benefits of prophylaxis with the patient
- Discussing the individual patient's situation with the microbiologist, so the benefits of antimicrobial prophylaxis may be adequately weighed against the risks.

Conclusions

Catheter-associated urinary tract infections represent one of the biggest infection-related problem faced by hospitals, yet are poorly managed as a result of underrepresentation at trainee teaching sessions. Proper urine sampling methods, avoiding overtreatment and following prevention methods can help reduce the harmful effects of these health-care-associated infections. **BJHM**

Conflict of interest: none.

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