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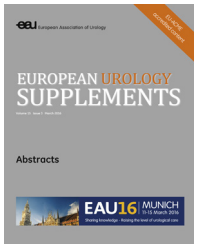

European Association of Urology

Catheter-associated Urinary Tract Infections

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Abstract

Catheter-associated urinary tract infections (CAUTIs) are a major source of nosocomial infections and represent a significant burden in morbidity and costs. Although several different approaches to disease prevention are being investigated, the most effective methods of prevention are to avoid unnecessary catheterisations and to remove catheters as soon as possible. An optimal catheter material or coating is still awaited. The growing number of publications regarding implementation of reminder systems and infection control programs shows the importance of these measures, which can effectively decrease the rate of CAUTIs. Systemic antibiotic prophylaxis is not recommended for long-term indwelling catheterisation. Treatment of catheter-related asymptomatic bacteriuria should be avoided, as this may increase the rate of antibiotic resistance without eradicating the bacteria. Systemic antibiotic treatment is indicated only for symptomatic CAUTIs. Alternative methods of urinary drainage may be preferable to indwelling urethral catheterisation. Evidence-based catheter management and treatment of CAUTIs are mandatory.

Patient summary: This review summarises different management options for the prevention and treatment of catheter-associated urinary tract infections. Treatment for bacteria in catheterised urine in the absence of symptoms should be avoided, as this may increase the rate of antibiotic resistance without eradicating the bacteria. Systemic antibiotic treatment is indicated only for symptomatic infections. The most effective methods of prevention are to avoid unnecessary catheterisation and to remove catheters as soon as possible.

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1. Introduction

Urinary tract infections (UTIs) are among the most common bacterial infections worldwide and represent approximately 40% of hospital-acquired infections [1], with significant consequences for morbidity and mortality and substantial financial implications. The urinary tract is considered one of the most important sources of health care–associated infections [1], and the presence of a urinary catheter is a major risk factor, as it is associated with up to 80% of health care–associated UTIs [2]. Moreover, 30% of initial urinary catheterisations are unjustified in a standard hospital setting. Catheter-associated UTIs (CAUTIs) are the most preventable type of health care–associated infection [3]. Therefore, appropriate prevention and management of CAUTIs are of utmost importance for every urologist and other health care personnel.

The aim of this review is to summarise latest advances in the field and give evidence-based recommendations for the prevention and management of catheter-associated

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bacteriuria and UTIs. The recommendations are rated according to the Oxford Centre for Evidence-based Medicine modification of the US Department of Health and Human Services classification [4].

2. CAUTI pathogenesis

The first step in CAUTI pathogenesis is the development of biofilms on the surfaces of catheters. Biofilms are structured communities of microorganisms encapsulated within a self-developed polymeric matrix that adheres to a surface, and they have a major impact on foreign bodies, implants, and devices placed in the human body [5]. Biofilm bacteria may differ from their planktonic counterparts in antibiotic susceptibility and phenotype, explaining why antimicrobial therapies effective against planktonic bacteria frequently fail to eradicate bacterial biofilms on catheters and other urologic devices. Approximately 20% of patients are colonised immediately at the time of catheter insertion, as bacteria can ascend through the catheter lumen via reflux of urine from contaminated bags (intraluminal route) or from the urethra along the extraluminal catheter-urethral surface. The risk of bacteriuria increases by 3–10% for every day after catheter insertion, and bacteriuria is considered universal after 30 d [6].

3. Definition and diagnosis

In the case of asymptomatic catheter-associated bacteriuria (CAB), bacteria are present in the urine of an asymptomatic catheterised patient. The National Healthcare Safety Network (NHSN), the patient safety surveillance system of the Centers for Disease Control and Prevention (CDC), defines CAUTI as a UTI episode for which an indwelling catheter was in place for >2 d on the date of diagnosis (day of device placement being day 1), and an indwelling urinary catheter was in place on the date of the event or the day before. If an indwelling catheter was in place for >2 d and then removed, the UTI criteria must be met on the day of discontinuation or the next day [7]. In 2009, the NHSN removed asymptomatic bacteriuria removed from the CAUTI definition. This change should be considered in longitudinal monitoring of CAUTI rates, as it can lead to a potential decrease in the incidence of documented CAUTIs and CAUTI-related outcomes in hospital systems [8].

In 2010 the European Association of Urology (EAU) published a new classification of UTIs based on the clinical presentation, availability of appropriate antimicrobial therapy, and risk factors (ORENUC) [9]. In this new classification system, asymptomatic bacteriuria is a urologic risk factor, but is not regarded as a separate type of UTI. Likewise, the presence of a long-term indwelling catheter represents a special risk factor (urinary catheter and nonresolvable urologic risk factors with risk of more severe outcome).

When an indwelling catheter is in place, pyuria and bateriuria are universal, so routine urinalysis or cultures are not recommended, except in cases of symptomatic infections.

4. Prevention of CAB and CAUTI

Great efforts have been invested and many different approaches have been investigated in the last few decades to prevent or at least delay CAB and CAUTI. Although an ideal solution has not yet been identified, many important issues regarding catheter care and catheter-related infections have been clarified. The following general recommendations are commonly used [10] (III):

- A closed catheter system should be used (B).
- The duration of catheterisation should be minimal (A).
- Catheters should be introduced under antiseptic conditions (B).
- There is limited evidence that the risk of bacteriuria is equally high if a sterile or clean technique or an antiseptic gel is used (IIa).
- The drainage bag should be kept below the level of the bladder and the connecting tube (B).
- An indwelling catheter should always be introduced by trained personnel.
- Urethral trauma should be minimised by the use of adequate lubricant and the smallest possible catheter calibre.

4.1. *Reminder systems and infection control programs*

Prevention of CAB and CAUTI starts with prevention of unnecessary catheterisation. In addition, catheters are often left in place in patients without purpose. The use of different reminder systems (eg, electronic, nurse-based) is recommended by the guidelines to decrease catheterisation duration [10,11]. Institutions that have implemented and evaluated such monitoring systems uniformly reported reductions in catheterisation duration and CAUTI incidence [12–14].

Institutional infection control programs and catheter care practice bundles (education for catheter insertion, management, and removal; improving hand hygiene) can effectively reduce the rate of CAUTIs and CAUTI-related complications [12,15,16].

Despite clear guideline recommendations, unnecessary antibiotic treatment of asymptomatic bacteriuria is a common mispractice worldwide and is associated with morbidity and cost. There is evidence showing that implementation of interventional bundles (eg, educational seminars, promotional letters, stickers, pocket cards, vignettes) on this issue as part of an infection control program can effectively reduce inappropriate treatment of asymptomatic bacteriuria and associated costs [17,18].

4.2. *Modifications of catheter materials or surface properties*

Since biofilm formation and biofilm-associated infections represent a major problem for all implants and biomaterial devices, many efforts have been made to modify biomaterial surfaces to effectively delay biofilm formation. Such an ideal coating should be able to prevent bacteria from

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