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Urinary Tract Infections in Older People with Long-Term Indwelling Catheters

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Editorial

Catheter-associated urinary tract infection (CA-UTI) is a relatively common infection, especially among older people with long-term indwelling urethral catheter. The term CA-UTI is used to refer to symptomatic urinary tract infection in individuals with indwelling catheters [1]. In general, less than 30 days with an indwelling urinary catheter is considered short term while 30 days or more is deemed as long term or chronic. Older people with chronic indwelling catheters have significantly increased risk of morbidity from CA-UTI compared to those with bacteriuria without long-term catheters.

In long-term-care facilities, an estimated 5-10% of residents require chronic indwelling catheters [2,3]. Indwelling catheters are used more commonly in men than in women living in these facilities, with urinary retention being the most common reason [4]. In a survey of nursing homes, the overall incidence and prevalence of symptomatic CA-UTI were found to be 29% and 2%, respectively [5]. In one study, CA-UTI rate of 3.2 per 1,000 catheter-days (range: 0-7.3) have been reported in people with chronic urinary catheters [6]. CA-UTI is a common source of bacteremia (50%) among long-term care residents [7]. The risk of bacteremia in people with long-term indwelling catheters is significantly higher than those without [8]. However bacteremia has not been associated with urinary catheter replacement [9]. The use of long-term indwelling catheters is associated with an increased mortality but this observation is confounded by other prognostic factors [10]. Other infectious complications including catheter obstruction, bladder urolithiasis, purulent urethritis, gland abscesses and prostatitis in males, can occur with long-term indwelling catheters in older people [11].

Clinical presentation and microbiological patterns can vary considerably between short and long term catheter uses because the duration of catheterization is an important determinant of bacteriuria [1]. This observation is partly related to biofilm formation on the catheter surface [12]. The biofilm consist of a complicated organic material formed by microbes growing in colonies within an extracellular mucopolysaccharide layer produced by these organisms [12]. Other components in the biofilm may include Tamm-Horsfall protein, magnesium and calcium ions [13]. Biofilm formation begins soon after the catheter is inserted and organisms adhere to this film which coats the catheter surface [13]. The biofilm with associated microorganisms can be found on both exterior and interior catheter surfaces. In this biofilm environment, microorganisms are relatively protected from antimicrobials and host defenses [12].

With long-term urinary catheterization, the development of a biofilm is associated with polymicrobial bacteriuria. As a result, older people with long-term indwelling catheters often have a biofilm consisting of three to five organisms [14]. Furthermore the microbiology of biofilm is turning over continuously while these catheters are in place [15]. New organisms are acquired at a rate of 3-7% per day with long-term catheterization [15].

Microorganisms in CA-UTI are mostly fecal microbes or can originate from the individual's own native microflora colonizing the periurethral area. In addition, CA-UTI can also be caused by gram-positive cocci and yeasts [16]. The most common organism of CA-UTI is *Escherichia coli* [1]. Other gram negative microorganisms like *Klebsiella* species, *Enterobacter* species, *Serratia* species and *Pseudomonas aeruginosa* may also be isolated [17]. Gram positive cocci including coagulase-negative *staphylococci* and *Enterococcus* Spp. have also been isolated [18]. Colonization of the urinary catheter with methicillin-resistant *Staphylococcus aureus* (MRSA) among older people living in residential facilities with endemic MRSA [19]. *Providencia stuartii* has also been isolated in people with long-term indwelling catheters [20]. *Proteus mirabilis* has been isolated from about 40% of urine samples collected from people with long-term indwelling catheters but this organism is less common after short-term catherisation [21]. *P. mirabilis* has been isolated from about 80% of obstructed catheters [21]. *P. mirabilis* has been observed to produce more biofilm than other bacteria, which tend to persist for longer duration [22]. This may be related to the faster hydrolysis of urea by urease of *P. mirabilis* compared with the urease of other organisms [23].

The urine of older people with chronic indwelling catheters has emerged as one of the most common site for isolating resistant gram negative organisms including carbapenemase resistant enterobacteriaceae (CRE) and extended spectrum beta-lactamase (ESBL) producing enterobacteriaceae [24,25]. In one study, 61% of CRE were isolated from urine cultures, and 48% of these cases were related to the use of urinary catheters [26]. The emergence of these resistant organisms in relation to long-term urinary catheterization is a reminder that the use of these catheters cannot be ignored and appropriate treatment of CA-UTI is required.

CA-UTI is often difficult to distinguish from asymptomatic bacteriuria but the distinction is important to avoid unnecessary antimicrobial therapy. Fever is often the only sign to suggest CA-UTI in older people with chronic urinary catheters. Diagnosing CA-UTI in a febrile older person is more difficult in the absence of localizing features such as suprapubic pain, acute haematuria, obstructed catheter or flank pain or tenderness. Under such circumstances, other causes of fever should be excluded before CA-UTI is considered. If an identical

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organism is isolated simultaneously from both urine and blood culture, a diagnosis of CA-UTI is presumed unless there is an alternative explanation. If CA-UTI is suspected, the urinary catheter should be removed and a new one inserted followed by collection of a urine specimen from the newly placed catheter. This should be performed before any antimicrobial therapy is initiated [1].

Treatment and prevention of CA-UTI should be based on existing guidelines [1]. The diagnosis of CA-UTI should be made according to clinical and microbiological assessment. If CA-UTI is confirmed then appropriate antimicrobial antimicrobial therapy should be administered. Empirical antimicrobial therapy should be avoided before the diagnosis of CA-UTI is confirmed, whenever possible.

To effectively prevent CA-UTI, the use of chronic indwelling catheters should be restricted to appropriate indications or when alternative drainage options are not possible [18]. Prevention of symptomatic CA-UTI is best achieved by early recognition and replacement of obstructed catheters as well as prevention of catheter trauma. Treatment of asymptomatic bacteriuria with long-term catheter should be avoided to prevent inappropriate antimicrobial use and the emergence of resistant microorganisms. Silicone or hydrogel-coated catheters are usually recommended for long-term use [1]. There is no evidence to support regular use of antimicrobial coated catheters [27].

In addition to these preventive strategies, advances in catheter material and urine drainage system are required to reduce the rates of CA-UTI with chronic catheter use. Ultimately more research is required to develop biofilm resistant catheter materials.

CA-UTI with long-term indwelling catheters is a device-associated infection that can lead to bacteraemia and hospitalisation. The emergence of resistant organisms with CA-UTI highlights the need to minimize infections associated with catheters especially chronic usage and appropriate antimicrobial treatment for symptomatic infection, which should be distinguished from asymptomatic bacteriuria.

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