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Catheter Associated Urinary Tract Infections (CA-UTI).

Kiran Madhusudhan[1]*, B Pujita[2], and B Madhusudhan[2].

[1]Department of Microbiology, Sree Balaji Medical college and hospital, Bharat University, Chennai,Tamil Nadu, India.
[2]Department of Surgery, BRS Hospital, Chennai, Tamil Nadu, India.

ABSTRACT

Catheter acquired urinary tract infection (CA-UTI) is the source of about 20% of health care acquired bacteremia in acute care and 50% and more in long term care facilities. As biofilm forms in all these devices, development of bacteriuria depends on the duration of catheterization. Therefore the most important way to prevent CA-UTI is to avoid or limit indwelling catheter use; proper selection, insertion, & maintenance of catheter; surveillance of CA-UTI and catheter use; monitor infections and other complications. Use of technically advanced Catheter materials prevents biofilm formation and reduces CA-UTI.

Keywords: Indwelling catheter, Bacteriuria, urinary tract infection, biofilm,bacteremia, CA-UTI, Health care acquired infection.

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Corresponding author

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INTRODUCTION

Catheter acquired urinary tract infection is one of the most common healthcare acquired infection. It accounts for more than 30% of all healthcare associated infection [1,2]. Indwelling urinary catheter use in acute care facilities is usually short term (when insitu for less than 30 days) and long term (when insitu for 30 days or more). Urinary catheter associated infection is usually manifested as CA-ASB(i.e) asymptomatic bacteriuria or as CA-UTI (i.e) with sysmptomatic urinary tract infection.

Precedence of symptomatic Catheter Acquired Urinary Tract Infection is CA-UTI rate / 1000 catheter days [3]. The daily risk of acquisition of bacteriuria with an indwelling catheter in situ is 3-7% and is higher in women and old persons [4,5]. It is defined as a hospital acquired infection if a patient develops positive urine cultures from 3 days upto one month after catheter insertion. CA-UTI cause an prolonged length of stay, morbidity and mortality and increase in bacterial resistance to antibiotics leading to increase in health care costs for patients.

Types Of CA-UTI

1. Asymptomatic Bacteriuria (CA-ASB):

   Bacteriuria is universal, once a catheter remains insitu for several weeks. These are generally antimicrobial Resistant organisms (eg) carbapenemase Resistant Enterobacteriaceae (CRE) due to antimicrobial exposure of the patient for infections other than UTI[6].

2. Symptomatic Bacteriuria (CA-UTI): Is likely the most common adverse event associated with indwelling catheter use [7].
3. Bacteremia: CA-UTI is one of the most common causes of bacteremia with a risk of 3-36times that of patients without an indwelling catheter. The outcome of CA-UTI and bacteremic infection are described using a denominator of device days.
4. Others: other complications in patient with chronic indwelling catheter, include urinary catheter obstruction, bladder urolithiasis, purulent urethritis, gland abscess and prostatitis for males.Non infectious complications include non bacterial urethral inflammation, urethral strictures, mechanical trauma and mobility impairment [8].

Pathogenesis & Microbiology of infection:

Biofilm formation along the catheter surface is the most important cause of Bacteriuria. Biofilm is a complex organic material consisting of micro-organisms growing in colonies within an extra- cellular mucopolysaccharide substance which they produce. Urine components, including tamm-Horsfall protein and magnesium and calcium ions, get incorporated into this material. Biofilm formation begins immediately after catheter insertion, when organisms adhere to a conditioning film of host proteins which forms along the catheter surface. Both the interior and exterior catheter surfaces are involved. Bacteria usually originate from the periurethral area or ascend the drainage tubing following colonization of the drainage tubing following bag [9].

Organisms growing in the biofilm are in an environment where they are relatively protected from antimicrobials and host defenses. A single species is usually identified with the initial episode of Bacteriuria following insertion of an indwelling catheter. If the Catheter remains in situ and a mature biofilm develops, polymicrobial Bacteriuria develops.

The most common infecting organism is Escherichia coli. Other Enterobacteriaceae as well as Enterococci spp, coagulase negative staphylococcus, Pseudomonas aerginosa, other non-fermenters, and candida spp are also frequently isolated. Anti microbial-resistant organisms are common. The urine of patients with indwelling catheters is the major site of isolation of resistant gram negative organisms in both acute and long term facilities including extended spectrum beta-lactamase (ESBL) producing Enterobacteriaaceae and CRE [10,11]

Proteus mirabilis is an organism of unique importance for patients with chronic indwelling catheters. This organism is isolated from about 40% of urine samples collected from patients with chronic indwelling catheters[12,13].p. mirabilis produces more copious biofilm than other bacteria, and these strains also tend to persist for longer periods of time.

Diagnosis of CA-UTI

Urine specimens for culture should be collected directly from the catheter or tubing, to maintain a closed drainage system. These may be collected either through the catheter collection port or through puncture of the tubing with a needle [4]. CA-ASB is diagnosed when one or more organisms are present at quantitative counts $\geq 10^5$ cfu/ml from an appropriately collected urine specimen in a patient with no symptoms attributable to urinary infection [4]. Lower quantitative counts may be isolated from urine specimens prior to $\geq 10^5$ cfu/ml being present, but these lower counts likely reflect the presence of organisms in biofilm forming along the catheter, rather than bladder Bacteriuria [6]. Thus, it is recommended that bthe catheter be removed and a new catheter inserted, with specimen collection from the freshly placed catheter, before antimicrobial therapy is initiated for symptomatic infection.

Clinical diagnosis

Fever without localizing findings is the usual presentation of CA-UTI. Localizing signs or symptoms such as catheter obstruction, acute hematuria, Pyuria, recent trauma, suprapubic pain, or costovertebral angel pain or tenderness are helpful to identify a urinary source of fever, but are present in only a minority of episodes of presumed symptomatic infection. If localizing genitourinary findings are not present, fever in bacteriuric patients should be attributed to urinary infection only when there are no other potential sources. When the same organism is isolated from both the urine and a simultaneous blood culture, a diagnosis of CA-UTI is presumed in the absence of an alternate source for the bacteremia.

Prevention of catheter acquired urinary tract infections

Approaches to prevention include avoidance of catheter use, policies for catheter insertion and maintenance, catheter selection, surveillance of CA-UTI and catheter use, and recommendations for quality indicators. Use of antibiotic coated catheter, external catheterization (condom type), intermittent catheterization depending on urine levels in bladder (measured using ultrasound) and doctor / nurse reminder systems used to prompt stop orders and removal of unnecessary urinary catheter have significantly reduced CA-UTI rate. A means for documentation of urinary catheter use, including indications and dates of insertion and removal, should be established. Where an electronic patient record is used, documentation of catheter use and automatic reminders for removal should be incorporated into this record. The development and implementation of “bundles” for prevention of catheter acquired urinary tract infections has been described. Introduction of a urinary catheter bundle which include education, catheter insertion and management guidelines, and CA-UTI Surveillance, in intensive care units in 15 developing countries was followed by a 37% reduction in CA-UTI [14,15]

CONCLUSIONS

CA-UTI is an important device-associated health care acquired infection. The use of an indwelling urethral catheter is associated with an increased frequency of symptomatic urinary tract infection and bacteremia, and additional morbidity from non-infectious complications. Infection control programs must develop, implement, and monitor policies and practices to minimize infections associated with use of these devices.A major focus of these programs should be to limit the use of indwelling urethral catheters,and to remove catheters promptly when no longer required. Ultimately, however, the avoidance of CA-ASB will likely require development of biofilm resistant catheter materials and use of vantibiotic (nitrofurantoin) coated.

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