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Review Article

Catheter-Associated Urinary Tract Infections (CAUTIs)

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Abstract

Catheter-Associated Urinary Tract Infection (CAUTI) is a commonly occurring type of Healthcare Associated Infection (HAI), and it is associated with increased patient morbidity and costs. Since many major insurance payers no longer reimburse hospitals for the cost of treating CAUTIs, this has created an impetus for the development of strategies that will reduce their occurrence. It has been proposed that a substantial proportion of CAUTIs should be preventable. Therefore, it may be feasible to achieve a significant reduction in the CAUTI rate by implementing prevention strategies that have confirmed efficacy.

Keywords: Catheter-associated; Healthcare-associated infection; Urinary tract infection

Introduction

Urinary Tract Infections (UTI) account for up to 40 percent of Healthcare Associated Infections (HAIs) [1,2], and 70-80 percent of these are attributable to the use of indwelling urinary catheters [2,3]. These are termed catheter-associated urinary tract infections (CAUTIs).Since 12 to 25 percent of hospitalized adults will have an indwelling urinary catheter placed at some time during their admission [4,5,6], there is substantial risk for the development of CAUTIs. For every day that an indwelling urinary catheter remains inserted, there is a 3 to 7 percent risk for the development of bacteriuria [7,8]. In fact, after an indwelling urinary catheter has been inserted for 30 days, there is a nearly 100 percent likelihood of the development of bacteriuria [9]. Increased morbidity, mortality, and costs are associated with CAUTIs. CAUTIs are responsible for 0.5 to 4% of secondary bloodstream infections [10]. In 2007, as many as 139,000 CAUTIs were diagnosed in US hospitals [11].The cost of treating a CAUTI is $600, but if there is an associated bloodstream infection, then this amount increases to $2800 [12]. The annual cost of treating CAUTIs in the United States is estimated to be $131 million [11]. As of October 2008, the Centers for Medicare and Medicaid Services stopped reimbursing hospitals for the cost of treating CAUTIs, as well as some other types of HAIs [13].This has created an incentive for hospitals to develop strategies to reduce their CAUTI rates. A significant reduction in the CAUTI rate should be feasible, since it has been estimated that it may be possible to prevent 65 to 70 percent of them [14]. The implementation of an intervention to reduce the rate of catheter-related bloodstream infections in the intensive care unit was very successful, leading to a sustained 66% reduction [15]. To specifically address CAUTI prevention, a "bladder bundle" has also been implemented [16], but some barriers to its widespread use have been identified [17]. The duration of catheterization plays a crucial role in the development of CAUTIs [2].Therefore, it is important to limit the use of indwelling urinary catheters to only instances for which they are truly indicated. Unfortunately, clinicians are often unaware of the appropriate indications for placement of an indwelling urethral catheter. In acute care hospitals, between 21 to more than 50 percent of the time, an indwelling urethral catheter is placed inappropriately [10]. Also, it is not uncommon for indwelling urethral catheters to be placed without a doctor's order [18].

Pathogens Causing CAUTIs

Escherichia coli belong to the Enterobacteriaceae family, and this is the organism that most commonly causes CAUTIs in patients who are not in an Intensive Care Unit (ICU) setting [10]. Other organisms that commonly cause CAUTIs include Enterococci, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae* and Candida *spp* [8,10]. Particularly in the Intensive Care Unit (ICU), *Candida* spp is a common cause of CAUTIs [10]. The organisms that cause a CAUTI are usually present on a patient's perineum, and they typically migrate along the outer surface of the indwelling urethral catheter, until they enter the urethra [2,8]. Migration of the organisms along the inner surface of the indwelling urethral catheter occurs much less frequently, compared with along the outer surface [2,8]. Promptly after an indwelling urethral catheter is inserted, the microorganisms form a biofilm (which consists of extracellular matrix and the microorganisms themselves) along the inner and outer surfaces of the catheter tubing. The microorganisms use the biofilm to facilitate their migration into the urethra [19,20]. The presence of the biofilm reduces the efficacy of antimicrobial agents, since they are unable to enter the biofilm well, and the microorganisms that comprise it tend to have a reduced growth rate. Because of these characteristics, the biofilm reduces the efficacy of antimicrobial agents.

Risk Factors for CAUTI Development

The primary risk factor for CAUTI development is a prolonged period of catheterization [2]. Therefore, it is important to limit the use of indwelling urethral catheters to instances of true necessity, and to remove them as soon as they are no longer needed. Unfortunately, physicians are often unaware of which of their patients have an indwelling urethral catheter in place [21]. Not surprisingly, this lack of awareness can result in an extended period of catheterization. In addition to the duration of catheterization, there are other modifiable risk factors that play a role in CAUTI development. These include lack of adherence to aseptic catheter care, and insertion of the indwelling urethral catheter in a location other than an operating room. The presence of a urethral stent also increases CAUTI risk [2,8,10]. Non-modifiable risk factors that increase the likelihood of CAUTI development include renal disease (i.e. serum creatinine > 2 mg/dL), diabetes mellitus, older age (i.e. age > 50 years old), and female sex

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[2,8,10]. Malnutrition and severe underlying illness also increase the risk for CAUTI development [2,8,10]. Risk factors associated with the development of secondary bloodstream infections caused by CAUTI include male sex, neutropenia and renal impairment [2,22].

Treatment of CAUTIs

As is true for patients with asymptomatic bacteriuria (ASB), those who have asymptomatic catheter-associated bacteriuria do not benefit from treatment, except in a few specific instances [23]. These exceptions are pregnant women, and patients who will undergo a genitourinary procedure during which mucosal bleeding is likely to occur [23]. Asymptomatic candiduria should only be treated in patients who are neutropenic, or are otherwise at increased risk [24]. Seven days of antimicrobial therapy is an adequate duration of treatment for symptomatic CAUTIs, as long as there is a prompt response to treatment [25]. For patients who have a slower response to antimicrobial therapy, the treatment course may be extended to 10 to 14 days [25]. The selection of empiric antimicrobial therapy should be based on the susceptibility patterns of the organisms in the local community. When urine culture results become available, then the antimicrobial agent that is selected should be the one with the narrowest range of coverage, and to which the causative pathogen is susceptible. Since the presence of a biofilm on the indwelling urethral catheter considerably reduces the efficacy of antimicrobial therapy, the catheter should be either removed or replaced before initiating treatment, particularly if it has been inserted for more than 2 weeks [25,26].

Prevention of CAUTIs

Several guidelines are available that make recommendations for CAUTI prevention, and many of these have been either developed or updated within the past decade. The organizations responsible for promulgating these guidelines include the Infectious Diseases Society of America (IDSA), and the Association for Professionals in Infection Control (APIC) [25,27]. The Healthcare Infection Control Practices Advisory Committee (HICPAC), which is part of the Centers for Disease Control (CDC), formulated the "Guideline for prevention of catheter-associated urinary tract infections 2009," which provides detailed recommendations for CAUTI reduction, with an indication of the strength of evidence that supports each one [28]. Implementation of a multi-faceted approach is necessary to have a meaningful impact on the CAUTI rate. Below are strategies that were recommended by HICPAC for CAUTI prevention. These are concordant with recommendations made in other guidelines.

Appropriate use of indwelling urinary catheters, and only for the minimal time that they are needed, are essential for reducing the CAUTI rate. According to HICPAC, examples of appropriate indications for use of an indwelling urethral catheter are as follows:

- Acute urinary retention or bladder outlet obstruction
- To aid the healing of open sacral or perineal wounds in incontinent patients
- Increasing comfort for patients for end of life care
- Preoperative use for some surgical interventions (especially those involving the genitourinary tract). A prolonged duration of surgery, the administration of large volumes of fluids or diuretics during surgery, or the requirement for urinary output monitoring during surgery, are all appropriate indications for placement of an indwelling urinary catheter.
- Monitoring urinary output in a patient who is in critical condition
- A patient who must remain immobilized for a prolonged period, e.g. after sustaining traumatic injuries, such as a pelvic fracture, or if there is concern for an unstable thoracic or lumbar spine

Conversely, according to HICPAC, inappropriate indications for use of an indwelling urethral catheter are as follows:

- for an extended postoperative period for which there is no clear indication (e.g. surgery on the genitourinary tract)
- as an alternative for nursing care of an incontinent patient
- as a way to collect a urine specimen that is needed for diagnostic testing, from a patient who can void when instructed to do so

HICPAC advises that additional strategies to prevent CAUTIs include the following:

- Use of alternatives to indwelling urethral catheters when it is reasonable to do so, e.g. intermittent catheterization is preferred over an indwelling urethral catheter [29,30]. For male patients who do not have either urinary obstruction or urinary retention, use of an external (i.e. condom) catheter rather than an indwelling urethral catheter should be considered [31].
- Utilizing proper techniques for indwelling urethral catheter insertion. This includes the timely use of hand hygiene, and ensuring that only appropriately trained individuals insert urethral catheters. Use of a portable bladder ultrasound can be used to assess urine volume, and this will help to reduce unnecessary urinary catheterization.
- Utilizing proper techniques for maintenance of an indwelling urethral catheter. This includes maintenance of a closed drainage system after aseptic catheter placement, and maintenance of an unobstructed flow of urine.
- Implementation of quality improvement programs or strategies to promote the proper use of indwelling urethral catheters. These include the use of alerts or reminders that help to distinguish patients who have an indwelling urethral catheter, and prompts clinicians to consider whether or not ongoing urinary catheterization is needed.
- A good administrative infrastructure must be in place to ensure that hospital staff are provided with evidence-based guidelines, and also have proficiency in catheter insertion and maintenance. This is also necessary to confirm that necessary supplies are available, and to ensure that there is good documentation about the indwelling urethral catheter in each patient's medical record.

It has been determined that there is no definite long term advantage to using antimicrobial/antiseptic-impregnated catheters over standard catheters, in terms of reducing the CAUTI rate [32].

Conclusion

CAUTIs commonly occur, and they may be associated with significant morbidity, mortality, and costs. However, since a large percentage of CAUTIs are preventable, it should be feasible to significantly reduce the rate at which they occur. This goal should be achievable by implementation of the recommendations that are delineated in well-formulated guidelines that specifically address CAUTI prevention.

References

1. Klevens RM, Edwards JR, Richards CL, Horan TC, Gaynes RP, Pollock DA, et al. Estimating healthcare associated infections and deaths in U.S. hospitals, 2002. Public Health Rep. 2007; 122: 160-166.
2. Chenoweth C, Saint S. Preventing catheter-associated urinary tract infections in the intensive care unit. Crit Care Clin. 2013; 29: 19-32.
3. Saint S, Chenoweth CE. Biofilms and catheter-associated urinary tract infections. Infect Dis Clin North Am. 2003; 17: 411-432.
4. Weinstein JW, Mazon D, Pantelick E, Reagan-Cirincione P, Dembry LM, Hierholzer WJ. A decade of prevalence surveys in a tertiary-care center: trends in nosocomial infection rates, device utilization, and patient acuity. Infect Control Hosp Epidemiol. 1999; 20: 543-548.
5. Saint S, Lipsky BA. Preventing catheter-related bacteriuria: should we? Can we? How? Arch Inter Med. 1999; 159: 800-808.
6. Warren JW. Catheter-associated urinary tract infections. Int J Antimcrobial Agents. 2001; 17: 299-303.
7. Lo E, Nicolle L, Classen D, Arias KM, Podgorny K, Anderson DJ, et al. Strategies to prevent catheter-associated urinary tract infections in acute care hospitals. Infect Control Hosp Epidemiol. 2008; 29: 41-50.
8. Maki DG, Tambyah PA. Engineering out the risk of infection with urinary catheters. Emerging Infect Dis. 2001; 7: 342-347.
9. Warren JW, Tenney JH, Hoopes JM, Muncie HL, Anthony WC. A prospective microbiologic study of bacteriuria in patients with chronic indwelling urethral catheters. J Infect Dis. 1982; 146: 719-723.
10. Greene L, Marx J, Oriola S. An APIC guide to the elimination of catheter-associated urinary tract infections (CAUTIs): developing and applying facility-based prevention interventions in acute and long-term care settings 2008.
11. Burton DC, Edwards JR, Srinivasan A, Fridkin SK, Gould CV., et al. Trends in catheter-associated urinary tract- infection in adult intensive care units-United States, 1990-2007. Infect Control Hosp Epidemiol. 2011; 32: 748-756.
12. Saint S, Meddings JA, Calfee D, Kowalski CP, Krein SL. Catheter-associated urinary tract infection and the Medicare rule changes. Ann Intern Med. 2009; 150: 877-884.
13. Milstein A. Ending extra payment for "never events" – stronger incentives for patients' safety. N Engl J Med. 2009; 360: 2388-2390.
14. Umscheid CA, Mitchell MD, Doshi JA, Agarwal R, Williams K, Brennan PJ.. Estimating the proportion of healthcare-associated infections that are reasonably preventable and the related mortality and costs. Infect Control Hosp Epidemio. 2011; 32: 101-114.
15. Pronovost P, Needham D , Berenholtz S , Sinopoli D, Chu H, Cosgrove S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. N Engl J Med. 2006; 355: 2725-2732.
16. Saint S, Olmsted RN, Fakih MG, Kowalski CP , Watson SR , Sales AE, et al. Translating healthcare-associated urinary tract infection prevention research into practice via the Bladder Bundle. JtComm J Qual Patient Saf. 2009; 35: 449-455.
17. Krein SL, Kowalski CP, Harrod M, Forman J,Saint S. Barriers to reducing urinary catheter use: a qualitative assessment of a statewide initiative. JAMA Intern Med. 2013; 173: 881-886.
18. Gokula RRM, Hickne JA, Smith MA. Inappropriate use of urinary catheters in elderly patients at a Midwestern community teaching hospital. Am JInfect Control. 2004; 32: 196-199.
19. Djeribi R, Bouchloukh W, Jouenne T, Menaa B. Characterization of bacterial biofilms formed on urinary catheters. Am J Infect Control. 2012; 40: 854-859.
20. Hola V, Peroutkova T, Ruzicka F. Virulence factors in Proteus bacteria from biofilm communities of catheter-associated urinary tract infections. FEMS Immunol Med Microbiol. 2012; 65: 343-349.
21. Saint S, Wiese J, Amory JK, Bernstein ML, Patel UD, Zemencuk JK, et al. Are physicians aware of which of their patients have indwelling urinary catheters? Am J Med. 2000; 109: 476-480.
22. Greene MT, Chang R, Kuhn L, Rogers MA, Chenoweth CE, Shuman E,, et al. Predictors of hospital-acquired urinary tract-related bloodstream infection. Infect Control Hosp Epidemiol. 2012; 33: 1001-1007.
23. Nicolle L, Bradley S, Colgan R, Rice JC, Schaeffer A, Hooton TM. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. Clin Infect Dis. 2005; 40: 643-654.
24. Pappas PG, Kauffman CA, Andes D, Benjamin DK Jr, Calandra TF, Edwards JE Jr, et al. Clinical practice guidelines for the management of candidiasis: 2009 update by the Infectious Diseases Society of America. Clin Infect Dis. 2009; 48: 503-535.
25. Hooton TM, Bradley SF, Cardenas DD, Colgan R, Geerlings SE, Rice JC, et al. Diagnosis, prevention and treatment of catheter-associated urinary tract infection in adults: 2009 international clinical practice guidelines from the Infectious Disease Society of America. Clin Infect Dis. 2010; 50: 625-663.
26. Raz R, Schiller D, Nicolle LE. Chronic indwelling catheter replacement before antimicrobial therapy for symptomatic urinary tract infection. J Urol. 2000;164: 1254-1258.
27. Rebmann T, Greene L. Preventing catheter-associated urinary tract infections: an executive summary of the Association for Professionals in Infection Control and Epdemiology. Am J Infect Control. 2010; 38: 644-646.
28. Gould CV, Umscheid CA, Rajender K, Kuntz G, Pegues DA, and the Healthcare Infection Control Practices Advisory Committee (HICPAC). Guideline for prevention of catheter-associated urinary tract infections, 2009.
29. Hakvoort RA, Nieuwkerk PT, Burger MP, Emanuel MH, Roovers JP.. Patient preferences for clean intermittent catheterization and transurethral indwelling catheterization for treatment of abnormal post-void residual bladder volume after vaginal prolapse surgery. BJOG. 2011; 118:1324-1328.
30. Hakvoort RA, Thijs SD, Bouwmeester FW, Broekman AM, Ruhe IM,,, et al. Comparing clean intermittent catheterization and transurethral indwelling catheterization for incomplete voiding after vaginal prolapse surgery: a multicenter randomized trial. BJOG. 2011; 118:1055-1060.
31. Saint S, Kaufman SR, Rogers MA, Baker PD, Ossenkop K, Lipsky BA.. Condom versus indwelling urinary catheters: a randomized trial. J Am GeriatrSoc. 2006; 54: 1055-1061.
32. Pickard R, Lam T, MacLennan G, Starr K, Kilonzo M, McPherson G, et al. Antimicrobial catheters for reduction of symptomatic urinary tract infection in adults requiring short-term catheterization in hospital: a multicenter randomized control trial. Lancet. 2012; 380: 1927-1935.

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