Diagnosis and Management of Catheter Associated Urinary Tract Infection

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ABSTRACT

Catheter associated Urinary Tract Infection (CAUTI) is predominant type of Hospital acquired infection causing antimicrobial resistance. The main objective for it to elaborate those points which cause catheter associated urinary tract infection. The main program features were dissemination of information to sponsor organizations and hospitals, data collection, and guidance on key technical and socio-adaptive factors in the prevention of catheter-associated UTI. As the management and prevention of catheter associated urinary tract infections have become a priority and challenge for most of hospitals. So, the present review article is prepared to provide information about the CAUT'S Infection. Management involve, aseptic insertion of catheter, prevent longer catheterization, and timely removal of catheter. Staff training and education related to catheterizations play a major role to manage CAUTIs. Uses of intermittent, condom catheter, antimicrobial catheter, limiting the placement or alternative of catheterization base on specific indications are significance to prevent CAUTIs.

Key words: Catheter; Urinary Tract Infection; pyelonephritis; bacteriuria; hospital acquire infection.

INTRODUCTION:

Indwelling urinary catheters (IUCs) are most used medical invasive device[1], so it is most important health related quality procedure to insert, remove and maintenances of urethral urinary catheter carefully for prevention of catheter associated urinary tract infections (CAUTIs). Every year, about 4 million people receive an indwelling urinary catheter (IUC). And about 5-20% patients receive indwelling urinary catheter, diagnose as urinary tract infection[2].

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Moreover catheter is major risk factor of nosocomial UTIs, particularly in elder patients[3]. However, it is indistinct that how many patients have preexisting bacteriuria prior to IUC placement especially in elder patients. But bacteriuria $\geq 10^5$ organisms/ml is indicating preexisting UTIs[4]. Arrangement and improvement in IUCs related education to staff can improve catheter associated practice. Prevalence study on preexisting UTIs prior to Indwelling urinary placement verified that there are strong relation between IUC and UTIs[5].

The catheter consists of a drainage canal with two tips, one in the bladder and second connected to drainage bag outside the body. A 10ml retention balloon is located in the bladder to avert catheter coming out. Two types of catheters like Nitro furanzone-impregnated silicone catheter and Silver polyurethane thyrogel catheter are mostly used.[6] Nitro furanzone-impregnated silicone catheters are mostly useable than silver polyurethane thyrogel catheter. PTFE (Poly Tetra Fluoro Ethylene) coated latex catheters also use as about 36%. Catheter should be inserting by

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skilled person, using a-septic procedure and lubricating anesthetic gel. IUC should be eliminate when patient is satisfactorily recovered[7].

Urinary tract infection is a most common health associated, hospital acquire infection (HAI) correspond up to 40%[8,9], out of this 70% UTIs occur due indwelling catheter. But 95% CAUTIs occur in intensive care unit (ICU). Moreover it is a most common source of blood stream infection (BSI). Age, gender and duration of catheterization have greatly impact on CAUTI. Other common factors can contribute to UTI such as functional abnormalities including heart disease, lung cancer, chronic diabetes, neurodegenerative disease, enlarge prostate gland ,obstructions, certain medications (immune suppressive therapy) and socio-economic conditions. Fever, flank pain, rigor, dysuria, urgency, frequency, leukocytosis are sign and symptoms of CAUTI . But there is not consequence difference between patients with or without CAUTIs with respect to signs and symptoms. Blind antibiotic therapy can enhance antibiotic resistance. About 69% of CAUTI can be prevented .Mostly studies present that there are strongly relation between CAUTI and UTI. Moreover CAUTIs are main sources of antibiotic resistive organisms`s infections as hospital acquire infections and these cause infrequently symptomatic UTI and blood stream infection. Management and prevention of CAUTIs have become a priority and challenge for most of hospitals.[10,11]

Epidemiology:

CAUTIs comprise the generally 40% recurrent hospital acquire infection of the world and out of UTIs, 70% occur due to indwelling urinary catheters[10]. Mostly epidemiological studies reveal that there is greater association of UTIs with elders patients in term of morbidity and mortality [3]. There are 3 %to 8% incidences of urinary catheter associated bacteriuria occur each day[12]. A research study reveals that there are 33% prevalence of CAUTIs occur due to use of open circuit draining system. But the use of close circuit system cannot lessen the estimated decline of disease rate up to 40%. Moreover development in assist method (disposable lubricant catheterization, disinfection and use of fixed urine bag system) did not decrease the estimated CAUTIs up to 40%[13]. 1-5% CAUTIs took under diagnose as blood stream infections. The fatality rate is 32.8% due to blood stream infection through urinary source. About 15% CAUTIs happen through patient to patient transmission during hospital stay[11]. Some of studies have proved that IUC use is not directly associated with UTIs for decreasing prevalence. Manage-ment and prevention of CAUTIs have become a priority and challenge for most of hospitals. [14]

Causes of CAUTIs:

Normally, urinary tract is sterile up to upper part of urethra. CAUTIs happen due to endogenous normal flora ascend from outer part of urethra to bladder and further to kidney. 34% microorganisms initiate infection from exogenous sources through intra urinary catheters, these organisms may be coming from hands of health care human being[15]. About 15% CAUTIs happened through patient to patient transmission during hospital stay. E.coli is a most frequent caustic agent of primary UTIs and other agents include Proteous, Pseudomonas, Enterobacter, Klebsiella, Entero-cocci and Staphylococcus species are related to secondary UTIs[10]. E.coli and Klebsiella spp. are most common caustic agents of CAUTIs. [11,13]

Mostly 94% CAUTIs are uni-microbial and 6% are poly microbial. There are many caustic agents to cause CAUTIs, most commonly 34% caused by entero-cocci and gram negative bacilli, 27% by Candida species. Gram negative bacilli including Klebsiella pneumoniae and Enterobacter cloacae also cause CAUTIs. Many Enterobacter resist to extensive variety of beta lactamases drugs[11]. E.coli typically involve as community acquire pyelonephritis. About 13% E.coli infections are related to CAUTIs, others agents are Entero-cocci, Pseudomonas aeroginosa. E.coli and Klebsiella pneumoniae 12.3% and 26.9% respectively resist to broad spectrum cephalosporin and 12.5% species of Klebsiella resist to carbapenems.[5]

Short-term catheterizations typically cause single microbial infection than long term catheterization where poly microbial infections are frequent[8]. In case of long term catheterization, 77% to 95% CAUTIs happen due to 2 or more

than 2 organisms. On the other hand, 10% CAUTIshappen due to more than 5 organisms [6,7].

Caustic Agents	CAUTIs%
E.Coli	13%
Entero-Cocci and Strep. spp.	26%
Candida	30%
Ply Microbial	5%
Gram Negative Bacilli	26%

Risk factors of CAUTIs:

Longer duration of catheterization is a major risk factor of CAUTIs[16]. Elderly female patients have more risk factors than male patients, 73% and 27% correspondingly. Moreover female patients have 4% and male patients have 3% chances to develop hospital acquire infection (HAI) after urinary catheter placement[17]. Frequent uses of IUCs extend bacteriuria and candiduria, cause anti-biotic resistive infections. Older age (more than 50 years age), female sex, severity of illness, impaired immunity, hospital services, recent surgery and medications (immune suppressive drugs) use are major risk factors of CAUTIs[18]. Moreover, longer uses of catheterization, lack of anti-biotic treatment, insertion of catheter aseptically by poorly trained person and divergence from catheter preventive protocols are included in care route risk factors.[19]

simply colony count in urine culture, but some declare positive outcome in base of signs and symptoms and positive urine culture[14]. Some authors term UTIs as 10^3 organisms per ml without having other potential site of infection [20] and consider that >90% patients are a-symptomatic[4,5]. Mostly urine leukocyte counts along with quantitative urine culture are done but fever and peripheral leukocyte counts have little values for diagnose of CAUTIs [4]. More than 10^5 CFU (Colony Forming Unit) per ml (24-48 hours catheterization) is considered CAUTIs if anti-microbial therapy is not given to patients and level will be consistently lift[6]. Urine can be culture on CLED agar (cystinelactoseelectrolyte-deficient agar) or on sheep`s blood agar plate[16]. Any type of antimicrobial therapy should stop atleast 48 hours before taking urine culture sample [17].

Symptomatic UTI is characterizing on the base of presence of signs and symptoms along with bacteriuria[21]. In serious ill or spinal cord injured patients, fever or other symptoms may be critical indication of UTI[16]. With related to signs and symptoms, 10^2 CFU per ml may be consider CAUTI and these counts quickly rise to more than 10^5 CFU per ml during 1 to 2 days[21]. National Institute on Disability and Rehabilitative Research define significance bacteriuria in 10^2 CFU per ml of catheterized patients. Some guidelines prefer significance bacteriuria in 10^3 CFU per ml of catheterized patients. Without signs

Risk Factors for CAUTIs	
Modifiable Risk Factors	*Non Modifiable Risk Factors*
Catheterization Period	Female Gender
Non Adherence to Aseptic Catheterization	Several Illness
Insert by Unskilled person	Non-Surgical Disease
Catheterization outside the operating room	Aged >50y
	Diabetes
	Creatinine more than 2mg per ml

Diagnosis of CAUTIs:

Centers for Disease Control and Prevention (CDC) guidelines are followed to diagnose CAUTIs[113]. Patients`s age, sex, diagnoses of disease, outcome of cultures and reason of catheter use are integrated in data collection[3]. Some authors use

and symptoms related to UTI will consider asymptomatic bacteriuria. Asymptomatic UTIs do not often require treatment. Only symptomatic UTIs should be treated[22].

Management of CAUTIs:

IUSs should be use appropriately in

particular clinical conditions[23]. Approximately, 50% elder female patients have more chances of improper uses of IUCs than elder male patients, have 25 % chances[21]. Nurse should place IUC to patients follow by physician orders. IUCs should remove immediately after they are no longer required to reduce hazard of CAUTIs. It should advice to order stop catheterization automatically in case of improper urinary catheterization. DSA (Infectious Disease Society of America) guidelines should be followed for management of CAUTIs[22].

Physician or nurse should terminate the catheter on base of indications at period of instant such as renovate catheter after 24 to72 hours. It also directs the nurse to remove or renovate catheter after limited period without directions of physicians. The criteria of catheter remainder and stop orders reduce the rate of CAUTIs up to half[24,25]. Mostly CAUTIs are a-symptomatic, while it is recommended to treat disease if they are symptomatic. However, CAUTIs do not have clearly defined symptoms (9). Additionally, patients with genitor- urinary infection should treat asymptomatic CAUTIs. Fever and frequency in hospitalized patients are poor indications of CAUTIs because these symptoms may occur due to other reasons. So, it is recommended to treat hospitalized pregnant woman with asymptomatic UTI to prevent complications after removing of urinary catheter. After removing of urinary catheter, it is important to start antimicrobial therapy of 3 to 7 days base on culture results for treating of asymptomatic bacteriuria. Candida species should treat for 14 days by antifungal drugs [26]. However, long term antimicrobial therapy in catheterized patients is a consequence risk of colonization with multiple drugs resistive organisms [27]. So understanding the suitable use of anti-microbial therapy is very important. Recent study proved that 1 hour education and training session of staff reduced blind use of therapy in this regards [28]. Management measures include removing or renovate catheters as a minimum within 2 weeks. Moreover these measures should follow at level of treatment and prevention [17].

IUCs should insert aseptically by sterile technique to manage CAUTIs. Moreover, it should insert by trained and professional person. It is recommended to use sterile lubricant jelly for insertion of catheter. Use of antiseptic lubricant jelly is not necessary. It is recommended to clean meatus before inserting the catheter. This meatal cleaning with antiseptic is not useful as contrast to regular care with soap and water[29].

Antiseptic and anti-microbial catheters have been considered to prevent CAUTIs. Studies proved; that silver impregnated catheters are recognized to decrease the occurrence of asymptomatic bacteriuria in adult catheterized patients less than 7 days, but are not effective for more than 7 days. Most recent studies proved that both silver alloys coated and nitrofural-impregnated catheters are not significance to decrease bacteriuria during more than 14 days catheterization. Some studies appraise for use of anti-microbial catheters for long term catheterization. Therefore antimicrobial catheters are not suggested for routine use of catheterization to prevent CAUTIs. Anti-microbial catheters are not effective to reduce the rate of bacteriuria[15,17].

Prevention of CAUTIs:

Several studies revealed that long duration of IUCs use proportionally increase the risk of UTIs. The uses of anti-microbial urinary catheter can prevent CAUTIs[6]. Infectious Disease Society of America (IDSA) guidelines guide us to lessen the threats of CAUTIs[23]. Use of close circuit system for IUC, development and organization of catheter associated practice and staff training can reduce the risk of CAUTIs. Proper use, insertion and maintenance of catheter and other socio-economical factors such as culture and behavior of hospital staff and patients are important for prevention of CAUTIs. About 69% CAUTIs can be preventable follow by infection control practice[30], some says 65% to 70% can be prevented[17]. Preventions include proper use, aseptic insertion and well-timed exclusion of IUC. Other related practices such as hand hygiene, quality measures have greatly fact for prevention[29]. Moreover focus on change in behavior and culture cooperate a quality progress. Use of close catheterization system, reduction the duration of catheterization, earlier removal of catheter base on cases, use antibiotic prophylaxis for insertion on high risk group, find alternative for catheterization or avoid catheterization[30].

REFERENCES:

1. Lietard C, Lejeune B, Metzger MH, Thiolet JM, and Coignard B. National point prevalence survey of health care-associated infections: Result for people aged 65 and older, France, 2006. Journal of the American Geriatrics Society. 2011; 59(4):763-5.

2. Gokula RRM, Hickner JA, Smith MA. Inappropriate use of urinary catheters in elderly patients at a Midwestern community teaching hospital. American journal of infection control. 2004; 32(4):196-9.

3. Brosnahan J, Jull A, Tracy C. Types of urethral catheters for management of short-term voiding problems in hospitalized adults. The Cochrane Library. 2004.

4. Hazelett SE, Tsai M, Gareri M, Allen K. The association between indwelling urinary catheter use in the elderly and urinary tract infection in acute care. BMC geriatrics. 2006; 6:15.

5. Tatham M, Macfarlane G, McRae M, Tully V, Craig K. Development and Implementation of a Catheter Associated Urinary Tract Infection (CAUTI) 'Toolkit. BMJ quality improvement reports. 2015; 4(1).

6. Pickard R, Lam T, MacLennan G, Starr K, Kilonzo M, McPherson G, et al. Types of urethral catheter for reducing symptomatic urinary tract infections in hospitalized adults. Health technology assessment (Winchester, England). 2012; 16(47):1-197.

7. Johnson JR, Kuskowski MA, Wilt TJ. Systematic review: Antimicrobial urinary catheters to prevent catheter-associated urinary tract infection in hospitalized patients. Annals of internal medicine. 2006; 144(2):116-26.

8. Chenoweth C, Saint S. Preventing catheter-associated urinary tract infections in the intensive care unit. Critical care clinics. 2013; 29(1):19-32.

9. Nicolle LE. Urinary catheter-associated infections. Infectious disease clinics of North America. 2012; 26(1):13-27.

10. Chenoweth CE, Gould CV, Saint S. Diagnosis, management, and prevention of catheter-associated urinary tract infections. Infectious disease clinics of North America. 2014; 28(1):105-19.

10. Chenoweth CE, Gould CV, Saint S. Diagnosis, management, and prevention of catheter-associated urinary tract infections. Infectious disease clinics of North America. 2014; 28(1):105-19.

11. Burton DC, Edwards JR, Srinivasan A, Fridkin SK, Gould CV. Trends in catheter-associated urinary tract infections in adult intensive care unitsUnited States, 19902007. Infection Control & Hospital Epidemiology. 2011; 32(08):748-56.

12. Weber DJ, Sickbert-Bennett EE, Gould CV, Brown VM, Huslage K, Rutala WA. Incidence of catheter-associated and non-catheter-associated urinary tract infections in a healthcare system. Infection Control & Hospital Epidemiology. 2011;32(08):822-3.

13. Izzo I, Lania D, Bella D, Formaini Marioni C, Coccaglio R, Colombini P. Catheter associated urinary tract infection (CA-UTI) incidence in an Internal Medicine Ward of a Northern Italian Hospital. 2015; 23(3):243-6.

14. Tambyah PA, Maki DG. Catheter-associated urinary tract infection is rarely symptomatic: a prospective study of 1497 catheterized patients. Archives of internal medicine. 2000; 160(5):678-82.

15. Donlan RM. Biofilms and device-associated infections. Emerging infectious diseases. 2001; 7(2):277.

16. Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. Disease-a-month. 2003; 49(2):53-70.

17. Huang W-C, Wann S-R, Lin S-L, Kunin CM, Kung M-H, Lin C-H, et al. Catheter-associated urinary tract infections in intensive care units can be reduced by prompting physicians to remove unnecessary catheters. Infection Control & Hospital Epidemiology. 2004; 25(11):974-8.

18. Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. The American journal of medicine. 2002; 113(1):5-13.

19. Meddings J, Saint S. Disrupting the life cycle of the urinary catheter. Clinical infectious diseases. 2011; 52(11):1291-3.

20. Tambyah PA, Maki DG. The relationship between pyuria and infection in patients with

indwelling urinary catheters: a prospective study of 761 patients. Archives of internal medicine. 2000; 160(5):673-7.

21. 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 Diseases Society of America. Clinical infectious diseases. 2010; 50(5):625-63.

22. Saint S, Meddings JA, Calfee D, Kowalski CP, Krein SL. Catheter-associated urinary tract infection and the Medicare rule changes. Annals of internal medicine. 2009; 150(12):877-84.

23. 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 Diseases Society of America. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America. 2010; 50(5):625-63.

24. Meddings J, Rogers MA, Macy M, Saint S. Systematic review and meta-analysis: reminder systems to reduce catheter-associated urinary tract infections and urinary catheter use in hospitalized patients. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America. 2010; 51(5):550-60.

25. Loeb M, Hunt D, O'Halloran K, Carusone SC, Dafoe N, Walter SD. Stop orders to reduce inappropriate urinary catheterization in hospitalized patients: a randomized controlled trial. Journal of general internal medicine. 2008; 23(6):816-20.

26. Pappas PG, Kauffman CA, Andes D, Benjamin DK, Calandra TF, Edwards JE, et al. Clinical practice guidelines for the management candidiasis: 2009 update by the Infectious Diseases Society of America. Clinical infectious diseases. 2009; 48(5):503-35.

27. Gandhi T, Flanders SA, Markovitz E, Saint S, Kaul DR. Importance of urinary tract infection to antibiotic use among hospitalized patients. Infection Control & Hospital Epidemiology. 2009; 30(02):193-5.

28. Trautner BW, Cope M, Cevallos ME, Cadle RM, Darouiche RO, Musher DM. Inappropriate treatment of catheter-associated asymptomatic bacteriuria in a tertiary care hospital. Clinical Infectious Diseases. 2009; 48(9):1182-8.

29. Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Pegues DA. Guideline for prevention of catheter-associated urinary tract infections 2009. Infection Control & Hospital Epidemiology. 2010; 31(04):319-26.

30. Umscheid CA, Rajender Agarwal MD M, Kendal Williams MD M, Brennan PJ. Estimating the proportion of healthcare-associated infections that are reasonably preventable and the related mortality and costs. Infection control and hospital epidemiology. 2011; 32(2):101-14.

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