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To Study The Occurrence Of Catheter Associated Urinary Tract Infections (CAUTI) In Intensive Care Unit Patients

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Abstract

Title**:** A prospective study to determine the occurrence of catheter associated urinary tract infections (CAUTI) in intensive care unit patients in a tertiary care hospital.

Methods: After obtaining institutional ethics committee clearance and written informed consent, the patients getting admitted at our tertiary care hospital, Sapthagiri Institute of Medical Sciences and Research Centre,during the period from November 2019 to May 2021, were taken up for the study. 100 patients admitted as inpatients to the ICU under the departments of General Medicine, General Surgery, Nephrology, Neurosurgery, and Pulmonary Medicine fulfilling the inclusion criteria were included in this study. Urine for culture and sensitivity was sent on the day of presentation before catheterization and at the end of 48-72hrs after catheterization and reports were compared.

Results: Out of 100 subjects, 19 had CAUTI in which 9 were male and 10 were female. Majority of the patients were in the age group between 50-59years.The most common risk factor for CAUTI in this study was diabetes. The most common organism isolated was Candida followed by E. coli (Escherichia coli). The most sensitive antibiotic was Nitrofurantoin.

Conclusion: CAUTI is one the most common Hospital Acquired Infections. The risk factors, proper catheter insertion techniques and catheter maintenance need to be followed and kept in mind for all catheterised patients to prevent complications. The cultures need to be sent promptly to diagnose initial stages of CAUTI. The antibiogram of these cultures need to be checked and appropriate antibiotic needs to be initiated to prevent antibiotic resistance.

Keywords: CAUTI, Catheterisation, Urine Cultures, Antibiotic sensitivity

Introduction

Indwelling catheter is defined as any tube that is inserted into the urinary bladder through the urethra and does not include supra pubic catheters and nephrostomy tubes by The National Health Care Safety Network (NSHN)[(3)]. Catheter associated urinary tract infection (CAUTI) is the most common nosocomial infection accounting for nearly 30-40% of all acquired infections [(4), (5), (6)]. Urinary tract catheterization is one of the most frequently performed procedures nowadays and the indications may be for diagnostic such as obtaining a sample of urine for analysis, bladder distension prior to ultrasound of pelvis, monitor urine output or therapeutic purposes such as acute or chronic retention of urine following a surgery. 80% of all urinary tract infections are associated with an indwelling catheter. In 2015 CDC (Centre for Disease Control) defined CAUTI as clinical symptoms and laboratory evidence of UTI (Urinary Tract Infection) in a patient with an indwelling

urethral catheter in place for more than 2 days or within 48hrs prior to onset of infection [7]. CAUTI is clinically diagnosed by >10^3CFU (Colony Forming Units)/ml of bacterial species in a single catheter urine specimen or in a midstream voided urine specimen from a patient whose urethral, suprapubic, or condom catheter has been removed within previous 48hrs.

CAUTI can range from asymptomatic bacteremic urinary tract infection to symptomatic urinary tract infection. CAUTI is associated with major morbidity and can lead to genitourinary complications such as cystitis, pyelonephritis, prostatitis, epididymo-orchitis and other systemic complications such as vertebral osteomyelitis, septic arthritis, endocarditis, and meningitis. The importance of CAUTI with regards to economic status is shown by the CMS data in the United States that estimated the annual cost due to CAUTI was between $340 to $450 million [8], [9], [10], [11]. The infectious agents migrate into the bladder through the catheter tubing due to the improper insertion of the catheter, obstruction of the flow of urine, or accumulation of urine in the bladder that increases the growth of microbes. The role of indwelling catheter in urinary tract infections was first reported by Kass in 1957[12] and most studies were done in the 1970's and 1980's to understand the pathogenesis of CAUTI. From 1990 to 2002, 32% of all HAIs were accounted to CAUTI. 75% of acquired UTIs in the hospital were noted to be associated with an indwelling catheter.it is estimated that 6 lakh patients develop UTI annually out of which 80% is CAUTI and associated complications. There was a 3% increase in CAUTI between 2009-12. In this modern era with innovative technologies and improved health care, CAUTI still forms bulk of nosocomial infections. This study aims to evaluate the factors contributing to catheter related urinary tract infections and understand the risk factors for implementing prevention strategies in daily care of patients to help in decreasing the burden of hospital acquired infections.

Materials And Methods

Source Of Data:

IPD of GENERAL MEDICINE Dept. SAPTHAGIRI Hospital, SIMS&RC, BENGALURU -560090

Methods Of Collection Of Data:

Study Design:

Prospective Observational Study.

Study Period: 18 months

Place Of Study: SIMS&RC Hospital, BENGALURU-560090

Sample Size:

Formula- N= Za4pq/d2.

Drp out rate: 0

Total sample size -100 Sample size is calculated using the formula: η = (Zα)2pq/d2

η is sample size.

p=prevalence (66%). q =100-p = 34%

d=allowable error. Taken here as 15% of prevalence Zα=1.96 (95% CI).

Sample Size =4x66x34/98.01

The sample size obtained is 91.5 Rounded off to 100.

Thus, the total sample size is 100.

Inclusion Criteria:

1. All subjects admitted into the ICU above the age of 18yrs.
2. Subjects requiring catheterization for more than 48-72hrs.

Exclusion Criteria:

1. Subjects not willing to give informed consent.
2. Subjects presenting in Urosepsis / UTI.
3. Subjects previously catheterized or referred from an outside hospital

Methodology:

After obtaining approval and clearance from the institutional ethics committee,all the patients fulfilling the inclusion criteria are enrolled for the study after obtaining written informed consent.

Urine for culture and sensitivity is sent on the day of presentation before catheterization and also at the end of 48-72hrs after catheterization and reports are compared. Clinical outcomes are recorded.

Statistical Analysis:

The data collected is entered in MS Excel sheet and analysed statistically using statistical package for social sciences version 20.0.

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Descriptive and inferential statistics are used to modify the data. Appropriate Parametric and non-parametric tests are also used.

Results

Out of the 100 patients fulfilling the inclusion criteria, 19 patients developedCAUTI.

Among the 19 CAUTI patients, 10 were Females and 9 were Males.

Table 1 Total Organisms Isolated

Organism isolated	Number
Candida	10
E. Coli	4
Klebsiella	3
Enterococcus	2
No growth	81

Table 2 Most Common Risk Factor for UTI

Co morbidity	Number
Diabetes	8
Chronic Kidney Disease	4
Hypertension	4

Table 3 Most Common Causative Organism of UTI in Diabetics and CKD

Organism Isolated	Number in Diabetics	Number in CKD
Candida	6	1
E. coli	1	2
Klebsiella	1	1

Table 4 Best Suited Antibiotic

Total Antibiotic Sensitivity	
Nitrofurantoin	6
Amikacin	4

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Norfloxacin	3
Meropenem	3
Tigecycline	3
Cotrimoxazole	2
Colistin	2
Piperacillin-Tazobactum	2
Imipenem	2
Linezolid	2
Vancomycin	2
Amoxicillin-Clavulanic acid	1

Discussion

The Centre for Disease Control (CDC) defines Health Care Associated Infections (HAIs) as those that develop during hospitalisation but are neither present nor incubating upon the patient's admission to the hospital, typically those infections that occur more than 48-72hrs after admission [(28), (29)]. HAI directly reflect on the quality care of the healthcare settings.

CAUTI is one of the commonest HCAIs with 70-80% of infections being attributable to use of an indwelling urethral catheter [(30), (31), (32)]. The benefits of catheters must be weighed against the potential adverse effects. Most of the infections follow instrumentation of the urinary tract making it the most common site of nosocomial infections causing significant morbidity, sepsis, and death [(33)]

Among the 100 people taken for this study, 19 patients developed CAUTI which shows that the incidence rate of CAUTI in this study is 19%. The incidence of CAUTI as reported in literature varies from 8.7-59% [(34), (35)].

In a study conducted by Verma S et al, the incidence of CAUTI was reported to be 15.95% [(36)], while the incidence of CAUTI conducted by Ramesh A et al [(37)], was 16% which are like our study.

Among the 19 positive CAUTI patients, 10 were Female and 9 were male. In general females have a stronger prelidiction for CAUTI than males [(38), (39), (40), (41)].

In a study done by Li F et al in 2019, patients at high risk for catheter-associated urinary tract infection were female, had a prolonged duration of catheterization, had diabetes, had previous catheterization, and had longer hospital and ICU stays [(42)].

In a study done by Maha Talaat et al in Alexandira hospitals, Egypt important risk factors associated with acquiring CAUTI were female gender [(43)]. Female gender is a significant risk factor for developing UTI [(44), (45), (46), (47), (48)]. The most common age group to develop UTI is the geriatric age group due to the immunocompromisation. UTI is the second most common infection associated with the geriatric population [(49)]. If not detected in time, it can lead to long term sequelae.

Elderly females are more prone to UTI due to post-menopausal estrogen deficiency and significant increase in postvoidal urine and incontinence due to cystoceles or uterine prolapse. In our study the most

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common age group which developed CAUTI was 50-59years.

In a study conducted by Ramesh A et al, patients aged >80years developed UTI [37], which is similar tto the study done by Chanda R et al[50]. In a study done by Anggreiny et al to evaluate risk factors in developing CAUTI in ICU Indonesia, Patients aged > 50 years old (P < 0.03) is significantly associated with increased risk of developing UTI [51].

The most common risk factor predisposing CAUTI in our study is Diabetes Mellitus followed by chronic kidney disease (CKD) and Hypertension (HTN).

Patients with diabetes have impaired granulocyte function, increased adherence of uropathogens to epithelial cells of bladder. Consumption of few newer oral hypoglycemic agents also causes glucosuria which also serves as a medium for growth of uropathogens. Diabetic patients with indwelling catheter affect the synthesis of biofilms and these are more susceptible to urosepsis.

This is also reported by the study conducted by Ramesh et al [37], and also similar studies [41], [52] ,[53]. A study by Verma S et al observed that the risk of CAUTI increases by 1.8 times in diabetics [36], [54], [55], [56], [57], [58]. Strict glycemic control should be targetted to prevent CAUTI recurrence and progression in diabetics. In a study done by Derya Katen et al in Turkey, urinary catheter utilization rates, the causative agents for catheter-associated urinary tract infection (CAUTI) and their antimicrobial susceptibilities in intensive care units (ICUs) in 2009 were investigated at Gazi university hospital. The most common etiological agents of CAUTIs were *Candida spp*. (34.7%). The most frequently

isolated *Candida spp*. was *C. albicans* (52.4%). All *C. albicans spp*. were sensitive to Fluconazole [59].

In a study conducted by Mladenovic et al, out of 64 CAUTI patients, Candida was found to be the most common isolate followed by Pseudomonas and Klebsiella[48].

According to the studies by the NHSN in 2006-2007, the most frequent pathogens associated with CAUTI were E.coli, Candida , Enterococcus and. Pseudomonas[60]

An independent study conducted by Tay et al in singapore also showed predominant growth of Candida species in ICU[61].

In the current study the most common causative organism of CAUTI is Candida followed by E.colo, Enterococcus and Klebsiella. Although Candida is not included in the CDC list of common uropathogens, high percentage of candida causing CAUTI cannot be ignored. This can as well be attributed to the COVID-19 pandemic.

In a study by Tashtoush et al in Wayne state university, of 99 patients with CAUTI and fever, 44 (44.4%) had Candida spp. as a pathogen and 55 (55.6%) had bacteria. The mean age of patients was 57.3 ± 17.2 and 58.59% were female.

43.2% of Candida CAUTI patients had diabetes compared to 25.5% of bacterial CAUTI (p= 0.09)[62].

In the current study, the most common organism isolated in diabetes with CAUTI is Candida.

In a study done by SG Kulkarni et al in MGM medical college Aurangabad, Out of 204 patient 44 were having Renal failure and out of them 22 patient (50%) had CAUTI, with P value <0.001. The most common organisms isolated are E.coli in (47.36%) cases each, Klebsiella (19.20%), Pseudomonas (14.10%) and Candida in (8.70%) cases[63].

In the current study the most comon organism isolated from CKD patients is E.coli.

In a study by Oumer et al in southern Ethiopia, the overall incidence of symptomatic CAUTIs was 39/231 (16.8%). Independent predictors of CAUTIs were prolonged (≥7 days) catheterization (AOR = 3.6, 95% CI = 1.0–12.2), diabetes mellitus (AOR = 5.3, 95% CI = 1.4–19.6) and insertion of catheter in surgical ward (AOR = 3.6, 95% CI = 1.08–12.28). The most common bacterial isolates were *E. coli* 17/42 (40.5%), *Klebsiella* species 9/42 (21.4%) and *Enterococcus* species 5/42 (11.9%). High (>80%) drug resistance was observed against cotrimoxazole, cefoxitin and tetracycline. Ciprofloxacin and nitrofurantoin were the most active drugs. The overall prevalence of MDR among isolates was 37/42 (88.1%). Most bacterial isolates 30/42 (71.4%) were biofilm producers [64].

The organisms E. coli, Klebsiella and Enterococcus antibiotic sensitivity ad resistance pattern was studied

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which showed majority of the E. coli and Enterococcus showed sensitivity to Nitrofurantoin but only a few Klebsiella were sensitive to Nitrofurantoin.

In the current study the most sensitive antibiotic for CAUTI after Fluconazole was Nitrofurantoin.

Conclusion

CAUTI is the leading cause of nosocomial infections with significant mortality and morbidity.

This study provides a baseline data on incidence of CAUTI in our set up, knowledge on risk factors of CAUTI and causative organisms with their susceptibility pattern.

Risk factors such as Female gender, Diabetes should be considered among the patients admitted in the ICU to reduce the incidence of CAUTI.

Attention to infection control practices such as catheter hygiene, proper catheter insertion protocol should be followed by training the paramedical staff to decrease CAUTI.

This study highlights the need for sterile techniques and catheter maintenance which must be considered in planning of preventive measures against UTIs.

Candida is an unusual cause of UTI in healthy individuals but in a hospital setting it is one of the most common causes. It is also the most common cause of CAUTI in diabetics.

The susceptibility patterns of the organisms will help in the selection of appropriate antibiotic for therapeutic use and prevent the indiscriminate and irrational use of antibiotics which will further prevent the emergence of drug resistant strains.

Bibliography

1. Weiner LM, Webb AK, Limbago B, Dudeck MA, Patel J, Kallen AJ, Edwards JR, Sievert DM. Antimicrobial-resistant pathogens associated with healthcare-associated infections: summary of data reported to the National Healthcare Safety Network at the Centers for Disease Control and Prevention, 2011–2014. infection control & hospital epidemiology. 2016 Nov;37(11):1288-301
2. Abiodun KO. *Catheter-Associated Urinary Tract Infection in New York and North Carolina* (Doctoral dissertation, Walden University).
3. Garner JS, Javis WR, Emori TG, Horan, TC, Hughes JM., 1988. CDC definitions for nosocomial infections, 1988. American Journal of Infection Control 16 (3), 128–140.
4. Stamm WE. Catheter-associated urinary tract infections: Epidemiology, pathogenesis, and prevention. Am J Med 91(3B):65S-71S.
5. Burke JP, Riley DK. Nosocomial urinary tract infection. In: Mayhall CG, editor. Hospital epidemiology and infection control. Baltimore: Williams and Wilkins; 1996. p. 139-53.
6. Warren JW. Catheter-associated urinary tract infections. Infect Dis Clin North Am 1997;11:609-22.
7. Kunin CM. Care of the urinary catheter. In: Urinary tract infections: detection, prevention and management. Fifth ed. Baltimore: Williams and Wilkins; 1997. p. 227-99.
8. Litwin MS, Saigal CS, Yano EM, Avila C, Geschwind SA, Hanley JM. Urologic diseases in America project: analytical methods and principal findings. J. Urol 2005;173:933-937.
9. Scott II RD. 2009. The direct medical costs of healthcare associated infections in US hospitals and the benefits of their prevention. http://www.cdc.gov/HAI/pdfs/hai/Scott_CostPaper.pdf
10. Saint S. Clinical and economic consequences of nosocomial catheter-related bacteriuria. Am J Infect Control. 2000;28(1):68-75.
11. Tambyah PA, Knasinski V, Maki DG. The direct costs of nosocomial catheter-associated urinary tract infection in the era of managed care. Infect Control Hosp Epidemiol. 2002;23(1):27-31.
12. Kass EH, Schneiderman LJ. Entry of bacteria into the urinary tracts of patients with in lying catheters. N Engl J Med 1957;256:556-7.
13. Lapides J et al. Clean, intermittent self-catheterization in the treatment ofurinary tract disease. J Urology1972;107(3): 458-461.

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14. Forbes BA, Sahm DF, Weissfeld AS, editors. Bailey& Scott's Diagnostic Microbiology. 12th ed. St. Louis (USA): Mosby Elsevier;2007. Infections of the urinary tract; p. 842-54.
15. Barford JMT, Coates ARM. The pathogenesis of catheter-associated urinary tract infection. British Journal of Infection Control 2009; 10: 50–56.
16. Hooton TM. Pathogenesis of urinary tract infection: an update. J Antimicrob Chemother 2000;46(S1):1-7.
17. Eden CS, Hanson LA, Jodal U, Lindberg U, Akerlund AS. Variable adherenceto normal human urinary-tract epithelial cells of Escherichia coli strains associated with various forms of urinary-tract infection. Lancet 1976;1(7984):490-2.
18. Schaeffer AJ. Infections of the Urinary Tract. In Wein AJ, Kavoussi LR, Novick AC, Partin AW, Peters CA editors. Campbell-Walsh Urology. 10th edition. Philadelphia:Elsevier-Saunders;2012.p.257-326.
19. Gatermann SG. Bacterial infections of urinary tract. In:Borriello SP, Murray PR, Funke G, editors. Topley & Wilson's microbiology and microbial infections.10thed.Vol 1. London: Hodder Arnold;2005. p. 672-80.
20. Jack DS, Donald K. Urinary tract infection. In:Gerald L, Mandell, John E, Bennett, Raphael D editors. Mandell, Douglas and Bennett's principles and practice of infectious diseases. 6thed. Philadelphia (USA):Elsevier Churchill Livingstone; 2005.p.875-905.
21. Savage T, Wang JZ, Vo TX, Ko G, Karmali RJ, Siu J, Spano S, You D, Kolar M, Winthrop A, Mann S. A technical skills elective program for pre-clerkship medical students reduces levels of high anxiety for performing technical skills. The American Journal of Surgery. 2020 Jul 1;220(1):90-4.
22. Anita J, Doyle GR, McCutcheon JA. 1.7 Sterile Procedures and Sterile Attire. Clinical Procedures for Safer Patient Care. 2015.
23. Centers for Disease Control and Prevention. Modified HICPAC Categorization Scheme for Recommendations.
24. Mota ÉC, Oliveira AC. PREVENÇÃO DE INFECÇÃO DO TRATO URINÁRIO ASSOCIADA A CATETER: QUAL O GAP NA PRÁTICA CLÍNICA?. Texto & Contexto-Enfermagem. 2019 May 20;28.
25. Collee JG, Duguid JP, Fraser AG, Marmion BP, Simmons A. Laboratory strategy in the diagnosis of infective syndromes. In:Collee JG, Marmion BP, Fraser AG, Simmons A, editors. Mackie & McCartney Practical medical microbiology.14th ed. New Delhi:Churchilll Livingstone;2006. p. 53-94.
26. Porter IA, Brodie J. Boric Acid Preservation of Urine Samples. Br Med J 1969;2(5653):353-55.
27. Clinical and Laboratory Standards Institute (CLSI). M100-S24. Performance standards for antimicrobial susceptibility testing; 24th informational supplement: Wayne, PA:CLSI;2014.
28. Lujan M, Gallego M, Rello J. Healthcare-associated infections. A useful concept? Curr Opin Crit Care. 2009;15(5):419-24. DOI:10.1097/mcc.0b013e32832e9956
29. .Hansen S, Sohr D, Geffers C, Astagneau P, Blacky A, Koller W, et al. Concordance between European and US case definitions of healthcare-associated infections. Antimicrob Resist Infect Control. 2012;1(1):28. DOI:10.1186/2047-2994-1-28
30. Rosenthal VD, Maki DG, Salomao R, Moreno CA, Mehta Y, Higuera F, et al. Device-associated nosocomial infections in 55 intensive care units of 8 developing countries. Ann Intern Med. 2006;145(8):582-91. DOI: 10.7326/0003-4819-145-8-200610170- 00007
31. Richards MJ, Edwards JR, Culver DH, Gaynes RP. Nosocomial infections in combined medical-surgical intensivecare units in the United States. Infect Control Hosp Epidemiol. 2000;21(8):510-5. DOI:10.1086/501795
32. Aly NYA, Al-Mousa HH, Al Asar ESM. Nosocomial infections in a medical-surgical intensive care unit. Med Princ Pract. 2008;17(5):373-7. DOI:10.1159/000141500.
33. Linda AMHW, Pam H. Preventing Catheter-Associated Urinary Tract Infections in Acute

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Care: The Bundle Approach. J Nurs Care Qual. 2012;27:8. DOI: 10.1097/ncq.0b013e318248b0b1

34. Mohanasoundaram KM. Retrospective Analysis Of The Incidence Of Nosocomial Infections In The ICU -Associated Risk Factors And Microbiological Profile. J.Clin Diagn Res. 2010 December;4(6):3378-82.
35. Khan MD, Venkateshwarlu C, Sreenivas G, Rahul P.Study of incidence and risk factors of urinary tract infection in catheterized patients admitted at tertiary carehospital, Nizamabad, Telangana State, India.International Archives of Integrated Medicine 2016 August;3(8):83-92.
36. Verma S, Naik S A, Deepak Ts, Etiology and risk factors of catheter associated urinary tract infections in ICU patients. IP Int J Med Microbiol Trop Dis 2017;3(2):65-70.
37. Ramesh A, Janagond A B, Raja S, Gobinathan S P, Charl J, Microbiological profile, comorbidity, incidence and rate analysis of catheter associated urinary tract infections in adult intensive care. Indian J Microbiol Res 2018;5(1):38-43
38. Kamat U, Fereirra A, Amonkar D, Motghare D, Kulkarni M. Epidemiology of hospital acquired urinary tract infections in a medical college hospital in Goa. Indian J Urol. 2009 Jan;25(1):76.
39. Foxman B. Epidemiology of urinary tract infections:Incidence, morbidity and economic costs. Am J Med.2002;113:5s–13s.
40. Platt R, Polk BF, Murdock B, Rosner B. Mortality associated with nosocomial urinary-tract infection. N Engl J Med. 1982 Sep;307(11):637-42.
41. Graves N, Tong E, Morton AP, Halton K, Curtis M, et al.Factors associated with health care-acquired urinary tract infection. Am J Infect Control. 2007;35:387–92.
42. Li F, Song M, Xu L, Deng B, Zhu S, Li X. Risk factors for catheter-associated urinary tract infection among hospitalized patients: A systematic review and meta-analysis of observational studies. Journal of advanced nursing. 2019 Mar;75(3):517-27.
43. Talaat M, Hafez S, Saied T, Elfeky R, El-Shoubary W, Pimentel G. Surveillance of catheter-associated urinary tract infection in 4 intensive care units at Alexandria university hospitals in Egypt. American journal of infection control. 2010 Apr 1;38(3):222-8.
44. van der Kooi TII, de Boer AS, Manniën J, Wille JC, Beaumont MT, Mooi BW, et al. Incidence and risk factors of device-associated infections and associated mortality at the intensive care in the Dutch surveillance system. Intensive Care Med 2007; 33(2): 271−8.
45. Bochicchio GV, Joshi M, Shih D, Bochicchio K, Tracy K, Scalea TM. Reclassification of urinary tract infections in critically III trauma patients: A time-dependent analysis. Surg Infect 2003; 4(4):379−85.
46. Leone M, Albanèse J, Garnier F, Sapin C, Barrau K, Bimar M, et al. Risk factors of nosocomial catheter-associated urinary tract infection in a polyvalent intensive care unit. Intensive Care Med 2003; 29(7): 1077−80.
47. Tissot E, Limat S, Cornette C, Capellier G. Risk factors for catheter-associated bacteriuria in a medical intensive care unit. Eur J Clin Microbiol Infect Dis 2001; 20(4): 260−2
48. Mladenović JL, Veljović M, Udovičić I, Lazić S, Jadranin Ž, Šegrt Z, Ristić P, **Šuljagić** V. Catheter-associated urinary tract infection in a surgical intensive care unit. Vojnosanitetski pregled. 2015 Sep 29;72(10).
49. Gavazzi G, Herrmann F,Krause HK. Aging and infectious diseases in the developing world. Clin Infect Dis 2004;39:83–91.
50. Vyawahare CR, Gandham NR, Misra RN, Jadhav SV, Gupta NS, Angadi KM. Occurrence of catheterassociated urinary tract infection in critical care units. Med J Dr Patil Univ. 2015 Sep 1;8(5):585.
51. Anggi A, Wijaya DW, Ramayani OR. Risk factors for catheter- associated urinary tract infection and uropathogen bacterial profile in the intensive care unit in hospitals in Medan, Indonesia. Open access Macedonian journal of medical sciences. 2019 Oct 30;7(20):3488.
52. Greene MT, Fakih MG, Fowler KE, Meddings J, Ratz D, Safdar N, et al. Regional variation in urinary catheter use and catheter-associated

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urinary tract infection: results from a national collaborative. Infect Control Hosp Epidemiol. 2014 Oct;35 Suppl 3:S99–106.

53. Sneka VS, Manonmoney SP. Incidence of Catheter Associated Urinary Tract Infection in Medical ICU in a Tertiary Care Hospital. Int J Curr Microbiol Appl Sci.2017 Apr 15;6(4):662–9.
54. Clec'h C, Schwebel C, Français A, Toledano D, Fosse JP, et al. Does catheter-associated urinary tract infection increase mortality in critically ill patients? Infect Control Hosp Epidemiol. 2007 Dec;28(12):1367-73.
55. Erben N, Alpat SN, Kartal ED, Ozgunes I, Usluer G.Analysis of the risk factors in nosocomial urinary tract infections and effect of urinary catheter use on distribution of the causative agents. Mikrobiyol Bul. 2009 January;43(1):77–82.
56. Geerlings SE, Hoepelman AI. Immune dysfunction in patients with diabetes mellitus (DM). FEMS Immunol Med Microbiol. 1999 Dec;26(3-4):259-65.
57. Platt R, Polk BF, Murdock B, Rosner B. Risk factors for nosocomial urinary tract infection. Am J Epidemiol. 1986 Dec;124(6):977-85.
58. Talaat M, Hafez S, Saied T, Elfeky R, El-Shoubary W, et al. Surveillance of catheter-associated urinary tract infection in 4 intensive care units at Alexandria university hospitals in Egypt. Am J Infect Control. 2010 April;38(3):222–8.
59. Keten D, Aktas F, Tunccan OG, Dizbay M, Kalkanci A, Biter G, Keten HS. Catheter-associated urinary tract infections in intensive care units at a university hospital in Turkey. Bosnian journal of basic medical sciences. 2014 Nov;14(4):227.
60. Hidron AI, Edwards JR, Patel J, Horan TC, Sievert DM, Pollock DA, et al. NHSN annual update: antimicrobial-resistant pathogens associated with healthcare-associated infections: annual summary of data reported to the National Healthcare Safety Network at the Centers for Disease Control and Prevention, 2006-2007. Infect Control Hosp Epidemiol 2008; 29(11): 996−1011
61. Tay MK, Lee JY, Wee IY, Oh HM. Evaluation of intensive care unit-acquired urinary tract infections in Singapore. Ann Acad Med Singap 2010; 39(6): 460−5.
62. Nader Tashtoush MD, Tal Mann MD, Sorabh Dhar MD, Shigehiko Karino MD, Elaine Flanagan CI, Sarit Sharma MD, Vishnu Kesani MB. 870. The Epidemiology of CAUTI due to Candida spp. in the Intensive Care Unit (ICU)-Infection or Colonization?
63. Kulkarni DS, Talib DS, Naik DM, Kale DA. Profile of urinary tract infection in indwelling catheterized patients. IOSR Journal of Dental and Medical Sciences. 2014 Apr;13(4):132-8.
64. Oumer Y, Dadi BR, Seid M, Biresaw G, Manilal A. Catheter- associated urinary tract infection: Incidence, associated factors and drug resistance patterns of bacterial isolates in southern Ethiopia. Infection and drug resistance. 2021;14:2883.

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