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Microbiological profile of catheter associated urinary tract infection in ICUs of a tertiary care hospital Bhubaneswar, Odisha, India

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ABSTRACT

Introduction: Among nosocomial infections catheter associated urinary infection (CA-UTI) is one of the most common infection. Uro- pathogens isolated from CAUTI were more multi-drug resistant than from community acquired urinary tract infection (UTI).
Aim of the study: To isolate micro-organisms responsible for CA-UTI in ICUs, to find out antibiotic sensitivity pattern of the isolates and to know the Impact of CAUTI care bundle on reducing CAUTI rate.
Materials and Methods: A retrospective study was conducted from September 2017 to August 2018, urine samples were collected from 300 catheerised patients which were processed microbiologically and antimicrobial sensitivity test was performed.
Results: Out of 300 catheterised paients , 76 patients developed CAUTI. So the incidence rate of CAUTI is 21.7%. A sum total of 38,067 catheter days were obtained in the study period from the month of September 2017 to August 2018. CAUTI rate was found to be 1.9 per 1000 catheter days over a period of 1 year
Out of 76 total isolates 56 were Gram negative and 20 were Gram positive bacteria. Gram negative bacteria included Escherichia coli 19(25%), followed by Klebsiella 14(19%), Proteus8 (11%) Pseudomomas 6(8%), Acinetobacter 4(8%). Among gram positive Enterococcus species is 17(22%) followed by staphylococcus spp.03 (4%). Enterobacteriaceae showed high resistant to commonly used antimicrobials like Gentamycin, Ceftriaxone, Ofloxacin, Ciprofloxacin but were highly sensitive to Amikacin, ceftazidime, pipercillin Tazobactum, Imepenem, Meropenem.
Enterococcus and staphylococcus were sensitive to Tigecyclin , Vancomycin, Teicoplanin and linezolid.
Conclusion: The most common organism responsible for CAUTI is Escherichia coli followed by Klebsiella spp. and Enerococcus spp. Members of enterobacteriaceae are highly sensitive to Amikacin, ceftazidime, pipercillin Tazobactum, Imepenem, Meropenem. Enterococcus and staphylococcus are sensitive to Tigecyclin, Vancomycin, Teicoplanin and linezolid. Strict insertion and maintainance CAUTI care bundle reduces CAUTI rate. Prevention of infections attributable to these devices should be an important goal of health-care infection prevention

1. Introduction

Nosocomial infections, or hospital-acquired infections (HAI), are important cause of morbidity and mortality, hospital cost and length of stay in healthcare settings especially among patients admitted in intensive care units (ICUs).[1,2] CAUTI as defined by CDC is an UTI where an indwelling urinary catheter was in place for more than 2 calendar days on the date of event, with day of device placement being Day 1, and an indwelling urinary catheter was in place on the date of event or the day before. Urinary catheter acquired infection is usually manifested as asymptomatic bacteriuria (CA-ASB). The term catheter associated urinary tract infection (CA-UTI) is used to refer to individuals with symptomatic infection.[3]

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Urinary tract infection attributed to the use of an indwelling urinary catheter is one of the most common infection acquired by patients in health care facilities. . CAUTI accounts for over 1 million cases annually.[4] or over 40% of all nosocomial infections in hospitals and nursing homes.[5–7] and constitute 80% of all nosocomial UTIs.[8]

2. Aims and Objective

1. To find out organisms causing catheter associated urinary tract infection.
2. To find out antimicrobial sensitivity pattern of the isolates.
3. To calculate CAUTI rate and its reduction by implementing CAUTI care bundle for every catheterized patient.

3. Materials and Methods

The present study was carried out in a tertiary care hospital , Bhubaneswar, Odisha for a period of 1 year from September 2017 to August 2018. It is a retrospective study. About 300 urine samples were collected from catheterized patients admitted to different ICUs of this hospital.

3.1. Inclusion criteria

All patients who were catheterized were included in this study, where an indwelling urinary catheter was in place for more than 2 calendar days on the date of event, with day of device placement being Day 1.

3.2. Exclusion criteria

Patients who were earlier treated with UTI, Patients already suffering from cystitis and prostatic enlargement, Patients on suprapubic catheter, nephrostomy tube and condom catheter.

3.3. Sample collection

Fresh urine samples were collected in a sterile, leak-proof universal container from patients under aseptic technique from sampling port of sterile closed urinary drainage system which was transported to the microbiology laboratory for immediate processing.[9]

Samples were collected on first day of catheterization, and processed to rule out prior urinary tract infection. Follow up of catheterized patients was done meticulously on daily basis and observed for local and systemic signs of UTI. On clinical suspicion of UTI in catheterized patients, urine sample was sent to microbiology laboratory along with prompt documentation.

The samples were processed on CLED and Blood agar by using standard calibrated loop. Samples which had colony count $\geq 10^5$CFU/ml were processed further for biochemical reactions and antimicrobial sensitivity test. Antimicrobial sensitivity test was done on Muller Hinton agar according to CLSI guidelines and antimicrobial sensitivity pattern was recorded.[10] Staphylococcal ATCC 25923, Escherichia coli ATCC 25922 and Pseudomonas aeruginosa 25873 were used as control strains.The isolated organisms were also confirmed in automated VITEC system.

Total no. of CAUTI was calculated by taking into account the different factors defining CAUTI.

The CAUTI rate was calculated as total no. of CAUTI in a given month/ total no of catheter days$\times$1000.

To control the CAUTI rate in the hospital, the infection control team have implemented. urinary catheter care bundle among all catheterized patients as per Healthcare Infection Control Practices Advisory Committee (HICPAC) guidelines.[4] Prevention of catheter acquired urinary tract infection Guidelines:

Several evidence-based guidelines provide recommendations for the development and maintenance of prevention programs for CA-UTI.[4,10,11] 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.

Catheter insertion and maintenance bundle were advised which includes.[11–13]

Catheter insertion bundles like, Appropriate hand hygiene, Choice of catheter(lumen), use of Aseptic techniques/sterile equipment, Barrier precautions, Antiseptic meatal cleanings.

Catheter maintenance was done by Appropriate hand hygiene, Securing catheter Closed drainage system, Obtaining urine samples aseptically, Replacement of the system if any breaks in asepsis.

4. Result

Out of 300 catheterized patients, 76 patients developed CA-UTI. So the incidence rate of CA-UTI is 25.33%.A sum total of 38,067 catheter days were obtained in the study period. From the month of September 2017 to August 2018. Among the study subjects, 76 patients developed clinical signs or symptoms of UTI after 2 calendar days from the time of insertion of indwelling urinary catheter. CAUTI rate was 1.9 per 1000 catheter days over a period of 1 year. Single significant pathogen with colony count of $\geq 10^5$ colony forming units(CFU) was obtained from each culture positive sample. From the month of September 2017 to August 2018, CAUTI rate per 1000 catheter days varies from 1.38- 4.04 But in the month of Jan.18 CAUTI rate increased to 4.04. All the parameters of CAUTI care bundle were strictly followed after January and CAUTI rate was gradually decreased in successive months.

Spectrum of causative agents of CAUTI is depicted in Table 1. Out of 76 total isolates 56 were Gram negative bacilli and 20 were Gram positive bacteria. Gram negative

bacteria included Escherichia coli 19(25%), followed by Klebsiella spp.14(19%), Proteus spp. 8(11%) Pseudomomas spp. 6(8%), Acinetobacter spp. 4(8%). Among gram positive bacteria , Enterococcus spp. is 17(22%) followed by staphylococcus spp. 3(4%). Enterobacteriaceae showed high resistant to commonly used antimicrobials like Gentamycin, Ceftriaxone, Ofloxacin, ciprofloxacin and were sensitive to Amikacin, ceftazidime, pipercillin tazobactum, imepenem, Meropenem.

In our study, both the pseudomonas as well as Acinetobacter were multidrug resistant. They were resistant to commonly used antibiotics like Ciprofloxacin, Imipenem, Meropenem, Ceftazidime, Cefopeazone-sulbactam and Piperacillin-Tazobactam. Pseudomonas is highly sensitive colistin (83%) followed by Amikacin whereas Acinetobacter is maximally sensitive to colistin followed by Tigecyclin (75%).

Enterococcus and staphylococcus were sensitive to Tigecyclin, Vancomycin, Teicoplanin and Linezolid.

Out of 76 CAUTI patients, 40 (52%) had developed CAUTI after 7 days of catheterization.

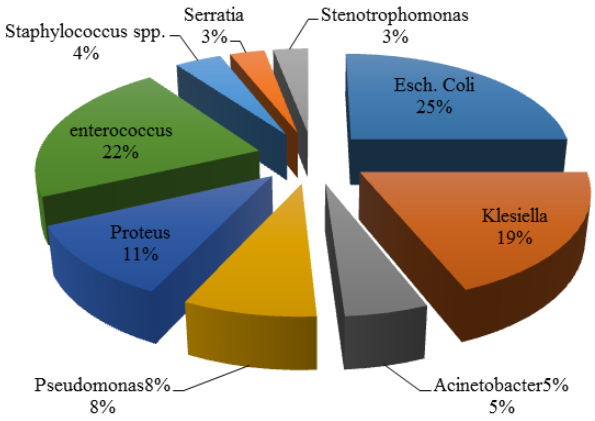

Fig. 1: Isolation rate of different microorganisms causing CA-UTI

5. Discussion

CAUTI is the common Hospital acquired infection (HAI) among ICU patients. Risk factors associated with the development of CAUTI include prolonged duration of urinary catheterization, lengthy hospital stay, female gender, prior systemic antimicrobial therapy and co-morbid conditions in critical care patients.[12] Common signs and symptoms include fever, dysuria, rigors, lower back pain, suprapubic pain/tenderness .

The present study was carried out in a tertiary care hospital, Bhubaneswar, Odisha for a period of 1 year from September 2017 to August 2018. About 300 urine samples were collected from catheterized patients admitted to different ICUs of the hospital.

The present study reported incidence rate of CA-UTI is 25.33%. Bagchi et al. reported incidence rate of CAUTI to be be 29.09%.[14] The incidence rate of CAUTI ranged from as low as 5% to as high as 73% among catheterized patients.[15,16]

In present study the CAUTI rate was 1.9 per 1000 catheter days which correlates with pooled mean CAUTI rate of 0 to 4 per 1000 catheter days of NHSN report.[17] Duszyńskaet al[18] reported a CAUTI rate of 6.44, 6.84, 7.16 per 1000 catheter days for the years 2012, 2013 and 2014, respectively from Poland. CAUTI rate of 9.6 per 1000 ICU days was found at Calgary by Laupland and colleagues.[19]

In this study lower rate of CAUTI was due to compliance towards adherence of infection control practices, hand hygiene, implementation of catheter care bundle and it also could be due to exclusion of asymptomatic bacteriuria from catheterized patients.[17]

Present study revealed most frequent pathogen responsible for CAUTI is Escherichia coli 19(25%), followed by Klebsiella 14(19%), Proteus 8(11%) Pseudomomas 6(8%) , Acinetobacter 4(8%). Among gram positive Enterococcus species is 17(22%) followed by staphylococcus spp.03 (4%)

Patients were followed upto 11 days post catheterisation, and was found that 40(52.63%) patient developed CAUTI after 7 days of catheter insertion, which correlated with earlier studies by kulkarni et al and[20] Bagachi et al[15] . Duration of catheterization is strongly associated with CAUTI, hence proper maintainence and care of catheter is required to reduce the incidence of CAUTI. Among the uropathogens isolated from CAUTI Gram negative bacilli were predominant than Gram positive cocci. Escherichia coli was the most common organism 18 (34.61%) followed by Klebsiella spp. 11(21.15%), Pseudomonas spp. 9 (17.30%), Proteus 4 (7.69%) . This finding was comparable to the studies conducted by Bagachi et al.[15] , Kazi et al.[20] , Jayashri et al.[21] . Staphylococcus aureus and Enterococci were Gram positive organism isolated from CAUTI.

Enterobacteriaceae showed multidrug resistant, earlier studies[12,15,16] also showed similar results. Higher resistant were found for fluoroquinolones which is the commonly used drug for urinary tract infection. Pseudomonas and Proteus species showed 100% sensitivity for imipenem, meropenem, ceftazidime, and ceftazidime - clavulanic acid, and pipercillin - tazobactum combination.

6. Conclusion

The most common organism responsible for CAUTI is Escherichia coli followed by Klebsiella spp. and Enerococcus spp. Members of enterobacteriaceae are highly sensitive to Amikacin, ceftazidime, pipercillin Tazobactum, Imepenem, Meropenem. Enterococcus and staphylococcus are sensitive to Tigecyclin, Vancomycin, Teicoplanin and linezolid. Strict insertion and maintainance CAUTI care bundle reduces CAUTI rate.

Table 1: Monthwise Distribution of CAUTI rate

Month	No. of cauti	Total Catheter Days (TCD)	Cauti rate = CAUTI/TCD x1000
Sept.-17	04	2891	1.38
Oct.-17	05	2961	1.68
Nov.-17	05	2920	1.7
Dec.-17	07	3185	2.19
Jan.-18	13	3213	4.04
Feb.-18	05	2929	1.7
March-18	07	3657	1.9
April-18	02	3102	0.64
May-18	09	3646	2.4
June-18	07	3127	2.2
July-18	08	3279	2.4
August-18	04	3157	1.26
Total	76	38,067	1.99

Table 2: Antimicrobial Sensitivity Pattern Of members of Enterobacteriaceae

Antibiotics	E.coli oli	klebsiella	Proteus spp
Amikacin	90%	**83%**	78%
Gentamicin	89%	72%	**78%**
Ofloxacin	30%	72%	56%
Ciprofloxacin	28%	**73%**	56%
Amoxyclav	24%	17%	78%
Norflox	29%	62%	45%
Nitrofurantoin	91%	23%	11%
Levofloxacin	31%	**75%**	56%
Ceftriaxone	34%	60%	67%
Cefpodoxime	7%	27%	67%
Cefepime	27%	55%	67%
Cefadroxil	23%	43%	45%
Cefuroxime	28%	47%	67%
cotrimoxazole	51%	62	45%
	117(38%)	11(14.66%)	2(23%)

Table 3: Antimicrobial Susceptibility Pattern Of Non- Fermenters

Antibiotics	Pseudomonas	Acinetobacter
Amikacin	58%	10%
Gentamycin	45%	32%
Ciprofloxacin	38%	36%
Imipenem	37%	25%
Meropenem	37%	25%
Ceftazidime	30%	7%
Colistin	83%	86%
Cefoperazone-sulbactam	42%	39%
Piperacillin-tazobactam	33%	18%
Tigecyclin	2%	75%

Table 4: Antibiotic Sensitivity Pattern Of Gram Positive Cocci

Antibiotics	Enterococcus spp	Staphylococcus spp
Ciprofloxacin	10%	**17%**
Nitrofurantoin	56%	94%
Gentamycin	35%	62%
Levofloxacin	11%	22%
Linezolid	**76%**	85%
Penicillin	45%	2%
Tetracyclin	25%	82%
Teicoplanin	**84%**	88%
Tigecyclin	**100%**	**100%**
Vancomycin	77%	**89%**

The old age, prolonged catheterization, are the significant risk factors for CAUTI. Indwelling urethral catheters should be avoided whenever possible and should never be resorted to unless with absolute indications. Insertion of catheter should be done in strict asepsis by trained personnel. Closed catheter drainage system should be employed in all cases. The entire system should be replaced in an event where a break is present. The catheter should be inspected frequently to ensure that no obstruction in flow of urine. Emphasis should always be placed on good catheter management rather than the use of prophylaxis to reduce the incidence of CAUTI. Infection control programs in health care facilities must implement and monitor strategies to limit catheter-acquired urinary infection, including surveillance of catheter use, appropriateness of catheter indications, and complications. Prevention of infections attributable to these devices should be an important goal of healthcare associated control programme.

7. Source of Funding

None.

8. Conflict of Interest

None.

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