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STUDY ON MICROBIOLOGICAL ANALYSIS OF CATHETER ASSOCIATED URINARY TRACT INFECTIONS IN ICU PATIENTS.

Microbiology

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ABSTRACT

Introduction: Catheter associated urinary tract infection is one of the most common infection among nosocomial infections especially in patients admitted under Critical care units (ICUs). It is one of the important quality indicator to know about the standards and implementation of hospital infection practices in a particular hospital. We tried to project the catheter associated urinary tract infection epidemiology and antibiotic sensitivity pattern of these pathogens.

Materials And Methods: A total of 110 catheter associated urinary tract infections samples were collected and processed for culture.Urine samples were incubated and organisms were identified based on colony characteristics, lactose fermentation and other biochemical tests. Sensitivity to common antibiotics was done in all positive cultures.

Results: Among 60 organisms isolated in CAUTI patients, all were monomicrobial isolation. Escherichia coli (53.3%) was the predominant pathogen isolated followed by Klebsiella pneumoniae (20%), Klebsiella oxytoca (13.3%). Enterobacteriaceae were shown 75% above sensitivity to penems, tigecycline and colistin.

Conclusion: Prophylactic use of antibiotics in critically ill patients is more helpful to patients but it has to be administered based on hospital antibiogram. Proper catheter care such as reducing duration of catheterization, adherence to infection control protocols plays a vital role to reduce the incidence of catheter associated urinary tract infections.

KEYWORDS

Catheter associated urinary tract infection, ICU patients

INTRODUCTION

Urinary tract infections are of two types based on clinical symptoms : symptomatic and asymptomatic. Symptomatic urinary tract infection can be a uncomplicated or complicated type. Uncomplicated urinary tract infection has symptoms of urgency, dysuria, supra pubic pain, whereas, complicated urinary tract infection is usually symptomatic and often noticed with patients having functional or structural abnormalities of genitourinary tract [1].

Catheter associated urinary tract infection is one of the most common infection among nosocomial infections especially in patients admitted under Critical care units (ICUs) [2]. It is one of the important quality indicator to know about the standards and implementation of hospital infection practices in a particular hospital. CAUTI can be a very serious problem, can also leads to a significant mortality and morbidity of about 15% [3]. CAUTI has to be calculated separately in a each hospital unit, to decrease the incidence rate of CAUTI and indirectly to reduce hospital costs to patients.

Usually significant bacteriuria is considered if the colony count is $>10^5$ cfu/mL. Colony count of 10^5 cfu/mL to 10^3 cfu/mL is considered as significant only in certain conditions like pyuria, chronic urinary tract infection, obstruction in urinary tract, prostatic secretions etc. CAUTI is usually deemed present if there are at least 103 colony-forming units (cfu)/mL of 1 or 2 micro-organisms identified by urine culture.[4]

CAUTI accounts for up to 40% of all the nosocomial infections in which 80% of them contribute to UTI [5]. Multidrug resistant pathogens has been on rise in recent decades due to various risk factors such as biofilm formation, frequent hospitalization, prolonged hospitalization, increase in survival rate immunocompromised patients and also due to irrational antibiotic usage. Biofilm formation is mainly responsible for repeated or chronic infections and poor response to the treatment.

In the way to control health care associated infections and to reduce the health care costs to patients along with responsible to alleviate the economic burden on hospitals, we tried to project the catheter associated urinary tract infection epidemiology and antibiotic sensitivity pattern of these pathogens.

The objectives of the study are:
1. To know the aerobic bacterial pathogens responsible for CAUTI
2. To study the antibiotic sensitivity pattern of pathogens isolated from CAUTI samples.

MATERIALS AND METHODS

A cross-sectional descriptive study was undertaken in the Department of Microbiology at Gandhi Medical College/Gandhi General Hospital, Secunderabad. A total of 60 culture positive catheter associated urinary tract infections samples were collected during the study period from May 2019 to March 2020 after obtaining consent from patients.

Inclusion Criteria:
1. All ICU patients
2. Samples included according to CAUTI CDC definition [6] - A UTI where an indwelling urinary catheter was in place for > 2 consecutive days in an inpatient location 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.

Exclusion Criteria:
1. History of prior usage of antibiotics
2. Patients on continuous indwelling catheter
3. Menstruating women

Detailed history regarding patient identification, comorbidities, presenting complaints such as abdominal pain, fever, supra pubic pain, haematuria, turbidity in urine, burning or pain during micturition, fatigue were noted. Past history of urinary tract instrumentation or catheterization were also noted. Findings relevant to systemic examination which were correlating with urinary tract infection such as costovertebral angle tenderness, supra pubic pain, tenderness on abdominal palpation were noted. Body temperature, Catheter date of insertion, day of the event were noted by searching in patient medical records.

Collection of urine from catheter were asked nurses to do it properly under aseptic precautions by keeping a clamp on urinary tube or making a bent of urinary catheter tube. After clamping of tube or collection of urine at bent, a place to collect urine is selected and cleaned with surgical spirit, later urine is collected in a sterile container or uricol container using sterile syringe. Make sure that urine container should be leak proof, sterile and should be $3/4^{th}$ full. If sample collection port is available then nurses were advised to collect urine from sample collection port under aseptic precautions.

Urine samples were sent to laboratory immediately within half an hour for routine evaluation and for culture. For culture, urine samples were incubated at 37^0C for 24 to 48 hrs in Nutrient agar, Blood agar and MacConkey agar plate.

Identification of organisms was based on colony characteristics, lactose fermentation and other biochemical tests. Sensitivity to common antibiotics was done in all positive cultures. Other investigations included Complete blood count, and USG abdomen for evaluating urinary tract and post voidal residue.

All the data collected were entered into a excel sheet. Data was analyzed using in excel and presented as numbers and percentages for clear description.

RESULTS

In this study, a total of 60 patients with positive cultures were enrolled as ICU CAUTI Patients and included in the final analysis. We have predicted the organisms prevalent in CAUTI among ICU patients and its antibiotic sensitivity pattern.

Table 1 shows the age distribution of CAUTI patients in Intensive Care Units. Out of 60 patients, majority of the patients were noted in the age group of 31-60 years i.e., 46 patients with percentage of 76.6%. Male predominance was observed in this study, out of 60 patients 45 (75%) were males and 15 (25%) were females.

Table 1. Age Distribution Of CAUTI Patients

Age in years	No. of patients	Percentage
18-30	5	8.3
31-40	10	16.6
41-50	16	26.6
51-60	20	33.3
61-70	7	11.6
>70	2	3.3

Among 60 organisms isolated in CAUTI patients, all were monomicrobial isolation. Escherichia coli (53.3%) was the predominant pathogen isolated followed by Klebsiella pneumoniae (20%) and thirdly, it is Klebsiella oxytoca (13.3%) among intensive care units CAUTI patients (Fig 1).

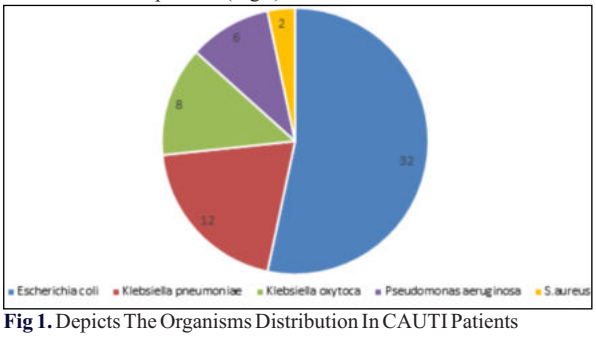

Fig 1. Depicts The Organisms Distribution In CAUTI Patients

Out of 60 isolates, we got 2 Staphylococcus aureus from urine samples which were sensitive to cefoxitin. Among gram negative bacilli 32 were Escherichia coli,12 were Klebsiella pneumoniae, 8 were Klebsiella oxytoca and 6 were Pseudomonas aeruginosa; all these isolates were sensitive to tigecycline and colistin.

75% of Escherichia coli isolates were sensitive to piperacillin+tazobactum, ceftazidime+clavulanic acid, imipenem, meropenem, ciprofloxacin, amikacin, tigecycline and colistin.75% of Klebsiella species were sensitive to piperacillin+tazobactum, ceftazidime+clavulanic acid, imipenem, meropenem, amikacin, tigecycline and colistin.75% of Pseudomonas aeruginosa isolates were sensitive to imipenem, meropenem, ciprofloxacin, amikacin, tigecycline and colistin (Table 2).

Table 2. Antibiotic Sensitivity Pattern Of Gram Negative Isolates

Antibiotics	Escherichia coli (n=32)		Klebsiella pneumoniae (n=12)		Klebsiella oxytoca (n=8)		Pseudomonas aeruginosa (n=6)	
	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%
Amoxyclav	18	56.2	6	50	4	50	-	-
Piperacillin+tazobactum	24	75	8	66.6	6	75	3	50
Ceftazidime	22	68.7	6	50	4	50	3	50
Ceftriaxone	21	65.6	6	50	4	50	-	-
Cefipime	22	68.7	7	58.3	4	50	3	50
Ceftazidime +clavulanic acid	24	75	8	66.6	6	75	3	50
Imipenem	28	87.5	10	83.3	7	87.5	5	83.3
Meropenem	30	93.7	10	83.3	7	87.5	5	83.3
Ciprofloxacin	25	78.1	8	66.6	6	75	6	100
Amikacin	30	93.7	10	83.3	8	100	5	83.3
Tigecycline	32	100	12	100	8	100	6	100
Colistin	32	100	12	100	8	100	6	100

DISCUSSION

Urinary tract infections are the fourth most common type of health care associated infection worldwide. It accounts for 12% of the infections as reported by the acute care hospitals[7]. Almost most of the health care associated UTI are caused due to the instrumentation of the urinary tract. The term CAUTI has been used for Catheter associated urinary tract infections.

CAUTI can produce a wide range of complications. These include fever, urethritis and cystitis in mild cases and acute pyelonephritis, renal scarring, calculi formation and bacteremia in severe cases. It can also cause prostatitis, epididymitis, and orchitis in males. Other less common complications include septic arthritis, endocarditis, vertebral osteomyelitis, septic arthritis, etc [6].

Out of 60 CAUTI patients in Intensive care units, 20 (33.3%) were in the age group of 51-60 years, 16 (26.6%) were in the age group of 41-50 years, 10 (16.6%) patients noted in 31-40 years, 9 (15%) patients in above 60 years of age and 18-30 years age group were 5 (8.3%) patients. Male predominance was observed in this study, out of 60 patients 45 (75%) were males and 15 (25%) were females. Kulkarni SG et al [8] and Nirmanmoh Bhatia SP [9] found that CAUTI incidence increases with increasing age and more common in the patients age group of > 40 years. Elderly age group individuals are more prone to infections may be because of down regulated immune system, preexisting comorbidities, poor response to treatment, bedridden condition in critically ill persons.

Neha Garg et al [10] and Priya datta et al [11] reported that gram negative bacilli were commonest pathogens causing urinary tract infection in Intensive care units by supporting this study, who reported 80% and 72.6% of GNB infections respectively.

60 CAUTI isolated organisms distribution was noted as first and commonest was Escherichia coli it was 32 (53.3%) out of 60, second predominant pathogen isolated was Klebsiella pneumoniae i.e., 12 (20%) out of 60, third pathogen was Klebsiella oxytoca i.e., 8 (13.3%) out of 60 and other pathogens isolated were Pseudomonas aeruginosa (10%) and Staphylococcus aureus (3.3%) in this study. Our study findings correlated with Neha Garg et al [10], Mahim Koshariya et al [12] (Table 3). Priya Datta et al [11] also reported Acinetobacter (9.5%) and Morganella species(1.1%) in their study. It's a known fact that variation in prevalence of organisms causing infections differs from community to community.

Table 3. Uropathogens Distribution In Various Studies

Study	Escherichia coli	Klebsiella pneumoniae	Klebsiella oxytoca	Pseudomonas aeruginosa	Staphylococcus aureus	Enterococcus
Present Study	53.3	20	13.3	10	3.3	-
Priya Datta et al [11]	10.7	15.4	-	35.7	-	15.4

Neha Garg et al [10]	40	-	10	5	15	5
Angshuman Jana et al [13]	19.4	16.6	-	19.4	11	-
Sayal Pet al [14]	29.7	24.7	-	20.7	10.6	-
Koshariya M et al [12]	53.3	6.7	-	13.3	13.3	2.2
Poddar N et al [15]	25	19		8	4	22

In the present study Staphylococcus aureus isolates were sensitive to cefoxitin and higher antibiotics. 75% of Escherichia coli isolates were sensitive to piperacillin+tazobactum, ceftazidime+clavulanic acid, imipenem, meropenem, ciprofloxacin, amikacin, tigecycline and colistin.75% of Klebsiella species were sensitive to piperacillin+tazobactum, ceftazidime+ clavulanic acid, imipenem, meropenem, amikacin, tigecycline and colistin.75% of Pseudomonas aeruginosa isolates were sensitive to imipenem, meropenem, ciprofloxacin, amikacin, tigecycline and colistin.

Poddar N et al [15] stated that multidrug resistant bacteria were identified in Enterobacteriaceae organims which is also supported by Taiwo et al [16] and Bagchi I et al [17]. Poddar N et al [15] did a study on CAUTI in ICU patients, noted that higher resistant of organisms towards fluoroquinolones which have been using routinely in urinary tract infections. They also reported that Proteus species showed 100% sensitive for imipenem, meropenem, ceftazidime, ceftazidime+clavulanic acid and piperacillin+ tazobactum. Staphylococcus showed sensitive to tigecycline, vancomycin, linezolid and teicoplanin. Sujatha et al [18] in her study revealed that most of the Gram negative bacilli were sensitive to nitrofurantoin (97%), imipenem (95%), amikacin (85%), piperacillin+tazobactam (80%), cefoperazone+sulbactam (80%).

Antimicrobial resistance has been increasing as years progresses especially in developing countries. These Multidrug or Pandrug resistant pathogens can be seen in nosocomial infections very often. Various factors responsible for spreading antimicrobial resistance pathogens from one patient to another patient including improper hygienic practices, improper patient care, fail in adhering to infection control practices, poor health education in many communities, improper infectious waste disposal, irrational use of antibiotics etc.

CONCLUSION

In this study we concluded that according to our geographical epidemiology catheter associated urinary tract infections were commonest in the age group of 41-60 years and in males. Gram negative bacilli were most commonly isolated when compared to gram positive cocci. Escherichia coli was predominant pathogens among CAUTI pathogens in ICU patients followed by Klebsiella species. Enterobacteriaceae were shown 75% above sensitivity to penems, tigecycline and colistin.

Prophylactic use of antibiotics in critically ill patients is more helpful to patients but it has to be administered based on hospital antibiogram. Proper catheter care such as reducing duration of catheterization, adherence to infection control protocols plays a vital role to reduce the incidence of catheter associated urinary tract infections. Strong regulations and implementation of effective strategies and designs of infection control policies and antimicrobial stewardship programme are definitely needed in developing countries.

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