Section: Microbiology

Original Research Article

A STUDY ON CATHETER ASSOCIATED URINARY TRACT INFECTIONS IN A TERTIARY CARE HOSPITAL OF NORTH BIHAR

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Abstract

Background: Urinary tract infection (UTI) is one of the most common infections in humans, accounting for more than 150 million cases worldwide. Most common bacteria causing UTI includes, E. coli, K. pneumonia, P. mirabilis, Ps. aeruginosa, S. aureus, E. faecalis and S. saprophyticus. **Objectives:** To find out organisms causing catheter associated urinary tract infection and to find out antimicrobial sensitivity pattern of the isolates. **Materials and Methods:** A cross-sectional study was conducted involving 125 patients who were catheterized after admission to surgical wards and surgical intensive care unit at a tertiary care hospital, Collection of urine sample was done from Foley's catheter after clamping the catheter near the urethral meatus and disinfecting the outer surface of catheter with sterile cotton soaked in povidone iodine followed by 70% ethyl alcohol. The specimens were cultured and the isolates were identified using standard microbiological techniques. The antibiotic susceptibility was determined by disc diffusion technique. Simple percentage method was used in analyzing data. **Results:** From 125 urine specimens, 41 urine specimens yielded significant bacterial growth accounting for 32.8%. Males (72%) are more commonly affected than females (53%). development of CAUTI with duration of catheterization Out of 41 CAUTI case i.e within 3 days 07 (17.07%), within 5 days 15(36.85%) and within 19 (46.34%). Escherichia coli 18 (43.980%) was the most frequent organism isolated followed by Klebsiella species 07(17.07%), Proteus 03(7.31%) Pseudomonas 05(12.19%). Among the Enterobacteriaceae members, E.coli, Klebsiella pneumoniae, Enterobacter spp were uniformly sensitive (100%) to Colistin whereas E.coli &Enterobacter spp were 100% sensitive to Amikacin. Klebsiella pneumoniae differed in this aspect by only 28.57% and Pseudomonas aeuruginosa 03 (7.31%) being sensitive to Amikacin. Among the five Pseudomonas aeuruginosa isolates, one was resistant to colistin. Imipenem-resistance was seen in sensitive to 07 (38.88%) in Escherichia coli (18) isolates, 02 (28.57%)sensitive to Klebsiella pneumoniae where as 02 (28.57%) (07) sensitive to Pseudomonas aeruginosa. **Conclusion:** High isolation rate was observed among males. E. coli was the predominant bacteria causing UTI followed by Klebsiella species. Very high resistance rates were observed towards commonly used antibiotics in community. Appropriate health education, strict infection control practices, appropriate antibiotic policy, proper guided bundle care of catheter are need of the hour to prevent the CAUTI.

INTRODUCTION

Urinary tract infection (UTI) is one of the most common infections in humans, accounting for more than 150 million cases worldwide. Beyond the initial urinary infection, catheter-associated UTIs (CAUTIs) can lead to complications including bacteremia, endocarditis, osteomyelitis, septic arthritis, and meningitis. The susceptibility of an individual to CAUTI is mediated by several risk factors, including older age, female gender, diabetes, and impaired immunity.[16] Urinary tract infection (UTI) is defined as invasive disease by microorganisms, inducing an inflammatory response and symptoms and signs such as fever > 38 C, urgency, frequency, dysuria without any other

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cause. Nosocomial urinary tract infection (NUTI) refers to an UTI acquired in a hospital setting. In two thirds of the cases, the bacteria causing these infections are endogenous.[17]

Most common bacteria causing UTI includes, E. coli, K. pneumonia, P. mirabilis, Ps. aeruginosa, S. aureus, E. faecalis and S. saprophyticus. Usage of antimicrobial agents extensively resulted in the development of multi drug resistance bacteria, which in recent years has become a major problem.[6]

Aims and Objective

1. To find out organisms causing catheter associated urinary tract infection.
2. To find out antimicrobial sensitivity pattern of the isolates.

MATERIALS AND METHODS

The present study was carried out in a tertiary care hospital skmc, muzaffarpur for a period of 6 months january 2024 to june 2024. A cross-sectional study was conducted involving 125 patients who were catheterized after admission to surgical wards and surgical intensive care unit at a tertiary care hospital, over a period of six months. Patients less than 18 years of age and patients already receiving antibiotics priorly were excluded from the study. After obtaining proper consent, urine samples were collected just after catheterization and as and when required depending on occurrence of symptoms of CAUTI.

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.[15] Collection of urine sample was done from Foley's catheter after clamping the catheter near the urethral meatus and disinfecting the outer surface of catheter with sterile cotton soaked in povidone iodine followed by 70% ethyl alcohol. A 2-c.c. syringe was used to aspirate the urine from prepared site. The aspirated samples were immediately sent to Microbiology Department maintaining all aseptic precautions for routine microscopy, culture and sensitivity. Reports obtained were compared in relation with the type of bacteria, resistance and sensitivity profile. CAUTI was diagnosed as per CDC criteria with the presence of at least two of the following features with no other recognized cause: fever, urgency of micturition, dysuria or suprapubic tenderness, and pyuria or positive urine culture.[5]

Sample Processing: The urine was cultured in CLED agar by a Semi Quantitative method – calibrated 1 µL loop with a diameter of 1.3 mm without intermittent flaming and incubated at 35–37°C for 24 h. The diagnosis of UTI was made by means of a significant positive urine culture count of >105 colony forming units (CFU) per ml. Antibiotic sensitivity test was done using Kirby Bauer disc diffusion method as per CLSI guideline.

RESULTS

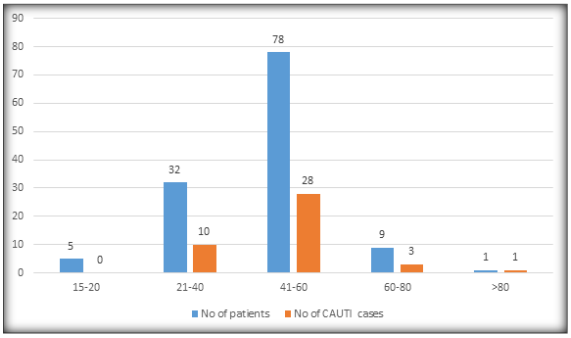

Figure 1: Incidence of CAUTI with Age

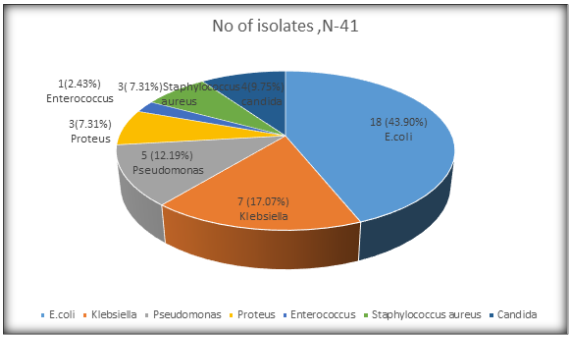

Figure 2: Showing microorganisms causing CAUTI

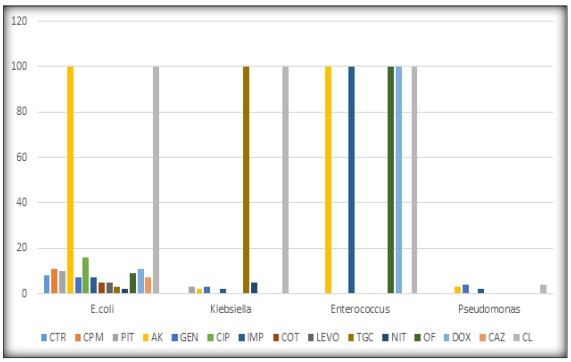

Figure 3: Shows antibiotic sensitivity pattern of CAUTI isolates

Table 1: Table showing relationship of development of CAUTI with duration of catheterization

Sr.no	Duration of Catheterization	Development of CAUTI (N-41)	Percentage (%)
1.	Within 3 days	07	17.07%
2.	Within 5 days	15	36.85%
3.	Within 7 days	19	46.34%

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Table 2: Incidence of CAUTI with Age

Sr.no	Age group (Years)	No. of patients enrolled	No. of CAUTI cases N (41)	Percentage (%)
1.	15-20	5	0	0%
2.	21-40	32	10	28.12%
3.	41-60	78	28	35.89%
4.	60- 80	09	03	33.33%
5.	>80	01	01	100%
6.	TOTAL	125	41	32.8%

Table 3: Table showing micro-organisms casing CAUTI

Sr.no	Organism isolated	No of isolates ,N -41	Percentage%
1.	E. coli	18	43.90%
2.	Klebsiella	07	17.07%
3.	Pseudomonas	05	12.19%
4.	Proteus	03	7.31%
5.	Enterococcus	01	2.43%
6.	Staphylococcus aureus	03	7.31%
7.	Candida	04	9.75%

Table 4: Antibiotic Sensitivity pattern of CAUTI isolates

Sr.no	Uropathogen (No.)	Escherichia coli (18)	Klebsiella pneumoniae (07)	Enterobacter spp (01)	Pseudomonas aeruginosa (05)
1.	CTR	08 (44.44%)	0	0	-
2.	CPM	11 (61.11%)	0	0	0
3.	PIT	10 (55.55%)	03 (42.85%)	0	0
4.	AK	100	02 (28.57%)	100	03 (7.31%)
5.	GEN	07 (38.88%)	03 (42.85%)	0	04 (9.75%)
6.	CIP	16 (88.88%)	0	0	0
7.	IMP	07 (38.88%)	02 (28.57%)	100	02 (28.57%)
8.	COT	05 (27.77%)	0	0	-
9.	LEVO	05(27.77%)	0	0	-
10.	TGC	03 (16.66%)	100	-	-
11.	NIT	02 (11.11%)	5 (71.42%)	0	-
12.	OF	09 (50%)	0	100	0
13.	DOX	11(61.11%)	0	100	-
14.	CAZ	07 (38.88%)	0	0	0
15.	CL	100	100	100	04 (9.75%)
	CTR- Ceftriaxone; CPM- Cefepime; PIT- Piperacillin-Tazobactum; AK- Amikacin; GEN- Gentamicin; CIP- Ciprofloxacin; NET- Netilmicin; IMP- Imipenam; CO- Cotrimoxazole; CL- Colistin; LE- Levofloxacin; TGC- Tigecycline; NIT- Nitrofurantoin; OF- Ofloxacin; DOX- Doxycycline ; CAZ- Ceftazidime.				

DISCUSSION

In the present study, out of 125 case studied ,41 developed CAUTI. table 1 shows relationship between development of CAUTI with duration of catheterization Out of 41 CAUTI case i.e within 3 days 07 (17.07%), within 5 days 15(36.85%) and within 19 (46.34%).Our study is in accordance with the study done by Vasundhara Gawande et al (2021 (1) which shows the relationship of development of CAUTI with duration of catheterization, i.e within 3 days 04(12.50%), within 5 days 10(31.25%) and within 7 days 18 (56.25%) development of CAUTI. In a study done by Arunagiri Ramesh et al (2018),[2] also shows relationship between duration of catheterization and appearance of CAUTI.in 3-5 days11.7%,in 6-10 days60%, in 10-15 days 66.6%.The presence of indwelling catheter creats an ideal environment for pathogenic growth by providing a surface for the attachment of microbial adhesion. Such infections may ascend to bladder, ureters, and kidney.[3)] In the present study among the total 125 catheterized adult ICU patients, 72% were males and 53% were females. In a study done by Simaranjit Kaur et al (2021),[4] Out of the 52 diagnosed CAUTI cases, 19 (9.5%) were males and 17 (8.5%) were females. In females, IT is observed a higher incidence of CAUTI in females as compared to males. This increased risk in women is likely to be due to easier access of the perineal flora to the bladder along the outside of the catheter as it traverses the shorter female urethra. In addition, a woman's urethra is closer to anus. This makes it easier for bacteria to spread into her urethra and cause an infection.[5]

Majority of males in elderly age group were more commonly developed UTIs. Higher incidence of UTI in elderly males is probably due to advancing age, prostate enlargement and neurogenic bladder.[6] The incidence of CAUTI was highest among the elderly (>80 years) individuals (100%), followed by 41-60 age group(35.89%). Similar findings was observed in the study done by Arunagiri Ramesh et al (2018).[2] Study done by Yedla Kavitaet al (2016),[6] also found majority of male patients who suffered from UTI were older than 60 years. Higher incidence of UTI in elderly males is probably due to

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advancing age, prostate enlargement and neurogenic bladder.[7]

Duration of catheterization is strongly associated with CAUTI, hence proper maintenance 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.[8] Most commonly isolated uropathogen in our study was E. coli, corresponding to 43.90% of the cases. Gram negative bacilli have multiple virulent factors responsible for their adherence to host's uroepithelium. Bacterial colonization in mucosal epithelium takes place with the help of adhesins, pili, fimbriae, and P 1 blood group phenotype receptor.[7]

In the present study, out of 125 cases studied 41 developed CAUTI. The incidence of CAUTI was 32.8% (41/100). The incidence of CAUTI ranged from as low as 5% to as high as 73% among catheterized patients.[9,10] This result are in corroboration with studies of Garibaldi et al (1974),[11] and Alavaren et al (1993),[12] where Urinary Tract Infection in Patients and factors in predisposing to bacteriuria during indwelling urethral catheterization was observed. 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.[13] Most commonly used antibiotics for treating CAUTIs are quinolones. Excessive usage of these antibiotics led to considerable resistance among uropathogens.[6] In the present study revealed most frequent pathogen responsible for CAUTI is Escherichia coli 18 (43.980%) followed by Klebsiella 07(17.07%), Proteus 03(7.31%) Pseudomonas 05(12.19%). Among gram positive Enterococcus species is 01(2.43%) followed by staphylococcus spp.03 (7.31%) and candida spp. 04(9.75%). This study is in accordance with the study done by Vasundhara Gawande (2020) et al,[1] who reported E.coli (34.37%) followed by Klebsiella (21.87%).

Our study is also similar to the study done by Nirmala poddar et al (2020),[8] who found 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%). imilar findings were observed in the study done by Simaranjit Kaur et al (2021).[4] The common pathogens found in this study are Escherichia coli (46%), Klebsiella (19%), Enterobacter (11%), Pseudomonas (9%), S. aureus (5%), Enterococcus (3%), Candida (1%) and Proteus (1%). This data strongly proves that CAUTI is one of the important nosocomial infections.

Among the Enterobacteriaceae members, E. coli, Klebsiella pneumoniae, Enterobacter spp were uniformly sensitive (100%) to Colistin whereas E.coli & Enterobacter spp were 100% sensitive to Amikacin. Klebsiella pneumoniae differed in this aspect by only 28.57%and Pseudomonas aeuruginosa 03 (7.31%) being sensitive to Amikacin. among the five Pseudomonas aeruginosa isolates, one was resistant to colistin. Imipenem-resistance was seen in sensitive to 07 (38.88%) in Escherichia coli out of 18 isolates, 02 (28.57%) sensitive to Klebsiella pneumoniae out of 7 isolates where as 02 (28.57%) (07) sensitive to Pseudomonas aeruginosa. One Pseudomonas aeruginosa was resistant to colistin, an antibiotic that is considered as a last resort drug. This reveals that our isolates are multidrug-resistant and similar findings were observed by Kazi et al (2015).[14]

CONCLUSION

Catheterized urinary tract provides an ideal environment for bacterial growth. Such infection adds up to the morbidity. It is utmost important to avoid unnecessary catheterization. Replacing the old catheters before antibiotic treatment is a sensible option. All patients who had a catheter for more than 6 days, aged 60 and above, should be checked for UTI symptoms. Clinical variables for CAUTI were both male and female gender, associated disease or comorbidity, and longer duration of stay in hospital. While the history of UTI or previous history of Foley catheter insertion had no significant association with CAUTI. And their urine should be cultured regularly to diagnose and prevent CAUTI and its complications which are very dangerous and difficult to treat.

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