MERIT RESEARCH JOURNALS
www.meritresearchjournals.org

Merit Research Journal of Microbiology and Biological Sciences (ISSN: 2408-7076) Vol. 9(4) pp. 036-043, September, 2021
Available online http://www.meritresearchjournals.org/mbs/index.htm

10.5281/zenodo.5542292

Original Research Article

Incidence of Catheter-associated urinary tract infection in a Tertiary Care Hospital

[1]Dr. Ariyanachi K, [*2]Dr. Lakshmi Jyothi Tadi, [3]Dr. Saranya Mallamgunta, [4]Dr. Praveen Pissude

[1]Assistant Professor, Department of Anatomy, All India Institute of Medical Sciences, Bibinagar

[2]Additional Professor / Covid Nodal Officer, Department of Microbiology, All India Institute of Medical Sciences, Bibinagar

[3]Assistant Professor, Department of Microbiology, Esic Medical College and Amp, Hospital, Hyderabad

[4]Associate Professor, Department of Community Medicine, Esic Medical College and Amp, Hospital, Hyderabad

***Corresponding Author's E-mail: dr.tljyothi@gmail.com**

Abstract

Urinary tract infections (UTIs) after catheterization are the most common infections and account for up to 40% of all health-related infections. With the catheter-associated UI (CAUTI) it was 1.41 / 1000 catheter days. It is estimated that up to 4% of patients with bacteriuria will eventually develop clinically significant bacteriuria with a death rate of 13-30%. After catheterization, the risk of acquiring bacteriuria increases over time with an average daily risk of 3% to 10% per day. This study was conducted to determine the confirmed CAUTI rate, prevalence of organisms and their susceptibility patterns. A total of 1258 Foley's catheter cases were followed up for 24 months. Cases were confirmed according to the NABH Standards and Centers for Disease Control and Prevention guidelines. 46 cases of CAUTI (29 cases in 2018 and 17 cases in 2019) were confirmed in 1258 catheterized individuals. The most common isolate was Escherichia coli (41.86%). Isolates were found to be resistant to cotrimoxazole, 2nd & 3rd gen cephalosporins, fluoroquinolones, and decreased sensitivity to other urinary antibiotics. To reduce morbidity, length of hospital stay and patient costs, unnecessary catheter insertion should be avoided. If Foley catheter insertion is required, aseptic precautions should be taken during catheter insertion and the Foley extraction performed as soon as possible. and health worker training and surveillance by infection control teams play an important role in improving practice and reducing infection.

Keywords: Catheter-associated, Urinary tract infections, E. coli, Pseudomonas

INTRODUCTION

Urinary tract infection (UTI) is an infection that affects every part of the urinary system, including the urethra, bladder, ureter, and kidney. Urinary tract infections are the most common type of health-related infection reported to the National Health Care Safety Network (NHSN). purchased in the hospital, about 75% are connected to a urinary catheter, a tube that is inserted through the urethra into the bladder to drain urine. Between 15 and 25% of hospitalized patients receive a urinary catheter during their hospital stay. The risk factor for developing catheter-associated UTI (CAUTI) is prolonged use of urinary catheters.It is estimated that the recommended infection control measures could prevent between 17% and 69% of CAUTI cases, which means that up to 380,000 CAUTI-related infections and 9,000 CAUTI-related deaths could be prevented each year.

A catheter-associated urinary tract infection (UTI) is a urinary tract infection (UTI) in which an indwelling catheter has been placed for more than two calendar days on the day of the event (day one is the day the device is placed) (Fawkia et al., 2019). Urinary tract infection in patients with long-term urinary catheters can be difficult because an in situ catheter may not have any signs and symptoms. CAUTI is defined as a symptomatic urinary catheter (UC) patient who has one or more of the following symptoms or signs without another recognized infection: fever (temperature ≥38 ° C), urination, frequent

urination, dysuria or suprapubic pain, with positive urine culture (Fawkia et al., 2019).

In the intensive care units of seven member hospitals of the International Infection Control Consortium (INICC) in seven cities in India, the total infection rates were 1.41 / 1000 days with catheter for CAUTI, 7.92 / 1000 days with catheter for Central line Associated Blood Stream Infection and 10.46 / 1000 days of ventilation It has been estimated that up to 4% of patients with bacteriuria will eventually develop clinically significant bacteriuria with a death rate of 13-30%. CAUTIs can lead to more serious complications such as sepsis and endocarditis; It is estimated that more than 13,000 deaths are associated with catheter-related urinary tract infections (UTIs) each year (Podkovik et al., 2019). It is a major contributor to secondary bloodstream infections leading to increased morbidity and mortality, with approximately 13,000 attributable deaths per year, a 24-day increase in length of stay, and increased healthcare costs with an additional cost of $ 12002400 per case (Taha et al., 2017).

Four major sites through which bacteria may reach the bladder of a patient with an indwelling urethral catheter

1. Urethral meatus-catheter junction,
2. Connection between catheter and drainage tube,
3. Connection between drainage tube and collecting bag,
4. Outlet of drainage bag.

As soon as microorganisms adhere to the catheter surface through the production of exopolymer substances, they can grow, multiply and spread. Biofilms have considerable survival advantages over planktonic bacteria because they are resistant to both phagocytosis and active substances. Eradicate microorganisms, and normal immune defenses are ineffective within biofilms.

Culture

A urinary tract infection is usually endogenous and is caused by microorganisms in the patient's own intestines. In community-acquired infections, the most common microorganisms are Escherichia coli, Proteus spp. And Klebsiella spp., Which are usually susceptible to most antibiotics and relatively easy to treat. In a community where the indiscriminate use of antibiotics is widespread, multidrug-resistant Gram-negative bacteria are wide-spread in the human gut outside of the hospital environment.

E. coli is the leading cause of UTIs. However, these infections are increasingly being caused by more resistant Gram-negative species such as Klebsiella spp. caused. and Pseudomonas spp. Ampicillin-sensitive Enterococcus faecalis is also gradually being replaced by resistant Enterococcus faecium. CAUTIs are more resistant to antibiotics because hospital patients are colonized with resistant pathogens, a process favored by longer hospital stays and exposure to antibiotics.

Objectives

1. To evaluate the CA-UTI rate and the predominant organisms in the hospital with their susceptibility patterns
2. To determine their outcome.

MATERIALS AND METHODS

Study design

Retrospective observational study

Setting

The study was conducted in a 330 bedded tertiary care tertiary care teaching hospital in Hyderabad, South India. Our study was conducted in five intensive care units (ICUs) and medical wards catering to all surgical and medical specialties with an overall 330-bed strength. Catheters used were Foley indwelling urethral catheters, a closed sterile system

Study period: Jan 2018– Dec 2019

Study population and sampling

All patients admitted to the ICUs and wards during the study were included in the study.

Study procedure

The Infection Control Nurses' underwent basic training on HAI surveillance according to the Centre for Disease Control (CDC) / National Healthcare Safety Network (NHSN) surveillance protocol. The surveillance data were collected by the Infection Control Nurses using a standardized "CAUTI DATA SHEET," which was prepared under the Centers for Disease Control and Prevention guidelines.

Sample collection

The sampling port was first disinfected by wiping with a 70 % isopropyl alcohol impregnated swab. The sample was then aspirated using a sterile small-bore needle and syringe and transferred into a sterile container.

Data analysis

The data were entered into an Excel sheet daily and analysed at the end of every month to generate the

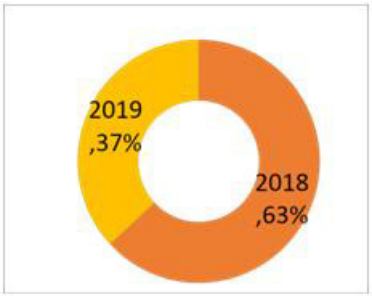

Figure 1. Year wise CAUTI cases

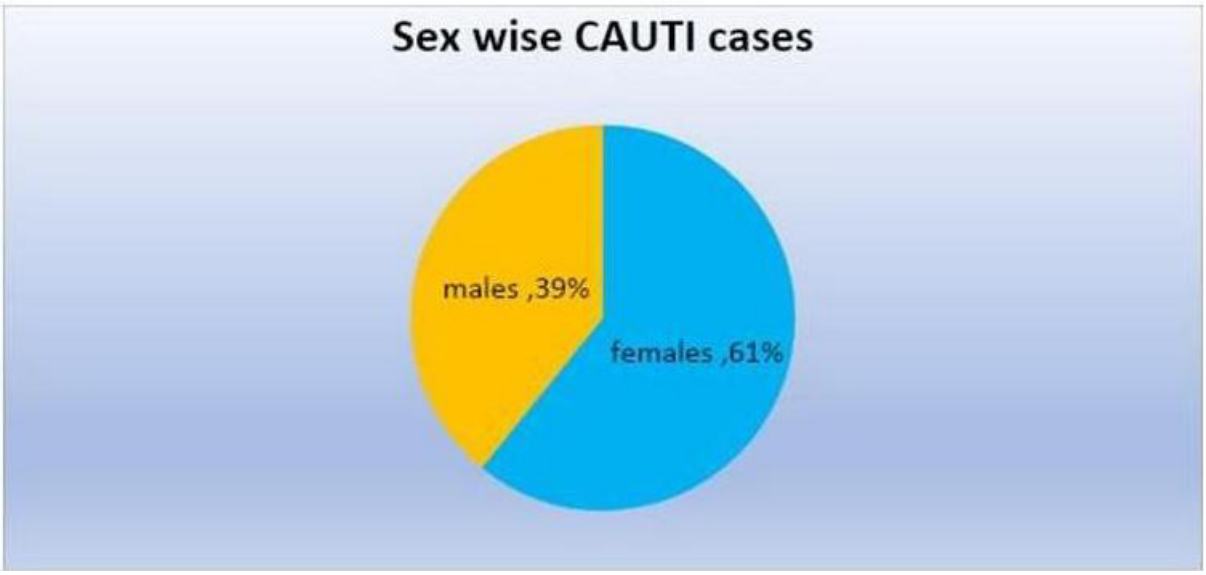

Figure 2. Age wise CAUTI cases

Hospital Acquired Infections (HAI) rates.

Data record was from Hospital Infection Control Committee (HICC) files, CAUTI checklist, Microbiology records & from Medical Records Department.

From HICC files we have documented the CAUTI cases and the culture reports

RESULTS

Year wise comparison showed gradual decrease in CAUTI cases in 2019.

CAUTI Prevention strategies were –

- Use aseptic technique for daily catheter care - hand hygiene,
- closed drainage system was maintained,
- If a urine specimen is required, specimen collection is performed aseptically via the sampling port, if a port is not present, puncturing the catheter tubing with a needle and syringe in patients with short-term catheterization 3.
- Keeping the drainage bag above the floor but below the bladder level to prevent reflux/contamination
- Reviewing the need for the catheter on a daily basis and removing the catheter promptly when no longer necessary
- Removal of the indwelling urinary catheter on postoperative day 1 or 2 for most surgical patients

The number of cases was decreased in 2019 when compared to 2018 as a result of regular monitoring by trained nurses and checklist documentation by trained nurses. Figure 1

Sexwise CAUTI cases

The total number of cases was 46, with 28 females (60.86%) and 18 males (39.13%). Figure 2

Most of the CAUTI cases fall in the age group of 50–60 years, followed by 60–70 years. Most of the cases from the Critical Care Unit (CCU) and Medical Intensive Care Unit (MICU) 1 and 2 were under neuro care with comorbid status. Table 1,2

Table 1. Age wise CAUTI cases in males and females

Age wise	Males n= 18	Females n = 28
40–50 years	4	8
51–60 years	4	12
61 - 70 years	9	8

Table 2. CAUTI age wise category - clinical cases on Urinary catheter

Age wise category	Cases on urinary catheter	2019	2018
40-50 years	trauma care in CCU	2	2
	Poisoning	2	3
	PPH		1
	Hysterectomy		1
50-60 years	Gastrectomy	1	1
	total knee replacement		1
	Stroke	1	4
	Urosepsis	2	3
	ovarian malignancy		1
	Diabetic keto acidosis	2	1
	Stroke	3	4
61-70 years	Urosepsis	2	1
	Total abdominal Hysterectomy		1
	Hemiparesis	2	1

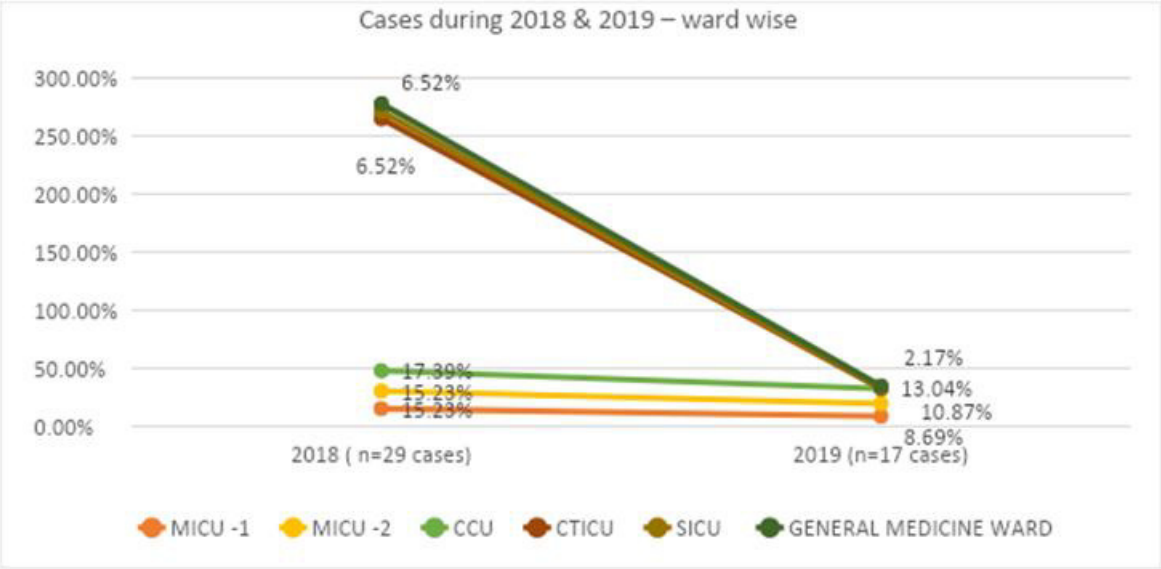

Figure 3. Cases during 2018 and 2019 - ward wise

Cases during 2018 and 2019–ward wise

The maximum number of CAUTI cases was from medical intensive care unit (MICU) -1, medical intensive care unit (MICU) -2, and critical care unit (CCU). Multi-drug resistant Klebsiella pneumoniae, multi-drug resistant Escherichia coli, Pseudomonas aeruginosa, and Burkholderia cepecia were noted. CAUTI cases in 2019 from the Surgical Intensive Care Unit SICU were totally nil, since the policy for removal of the indwelling urinary catheter on postoperative day 1 for most surgical patients was strictly followed. Figure 3,4

Month and year-wise Catheter-Associated Urinary Tract Infection

In 2018, 29 cases were noted with Escherichia coli as the

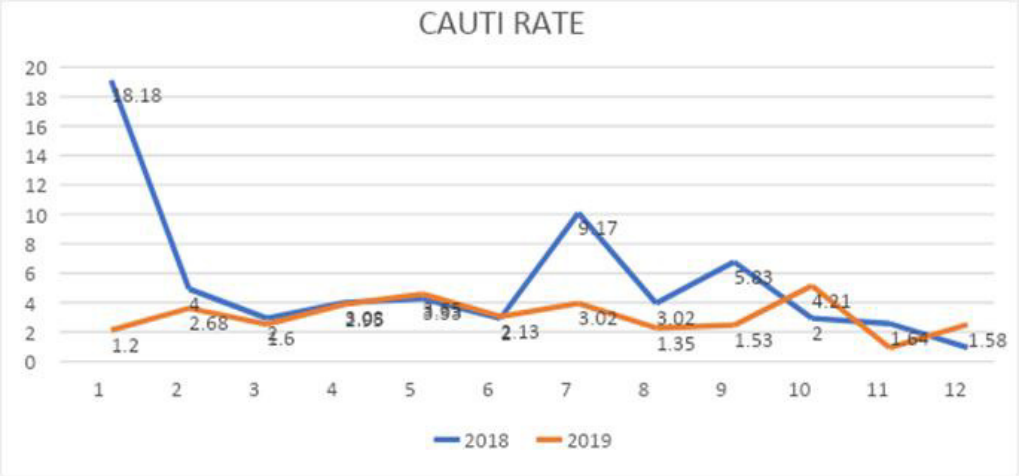

Figure 4. CAUTI rate per 1000 catheter days

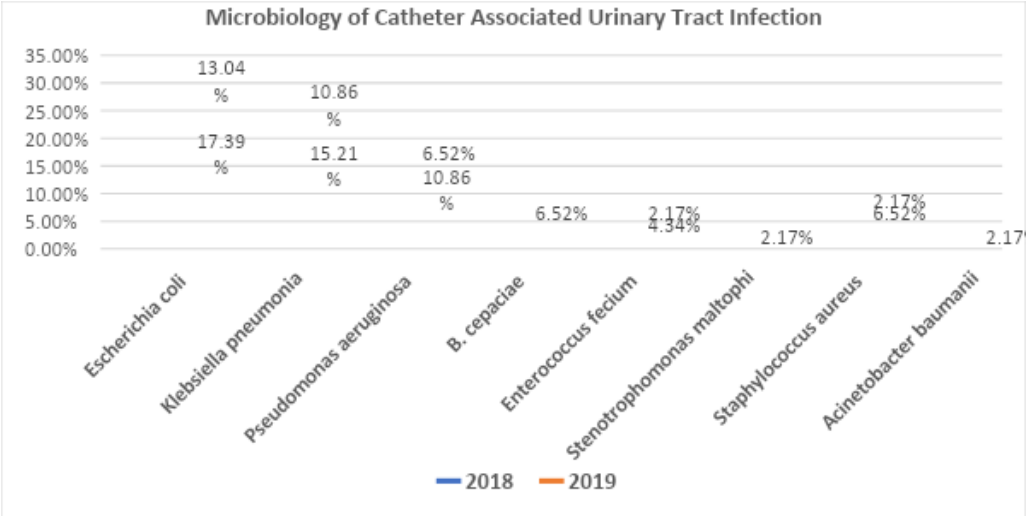

Figure 5. Microbiology of catheter associated urinary tract infection

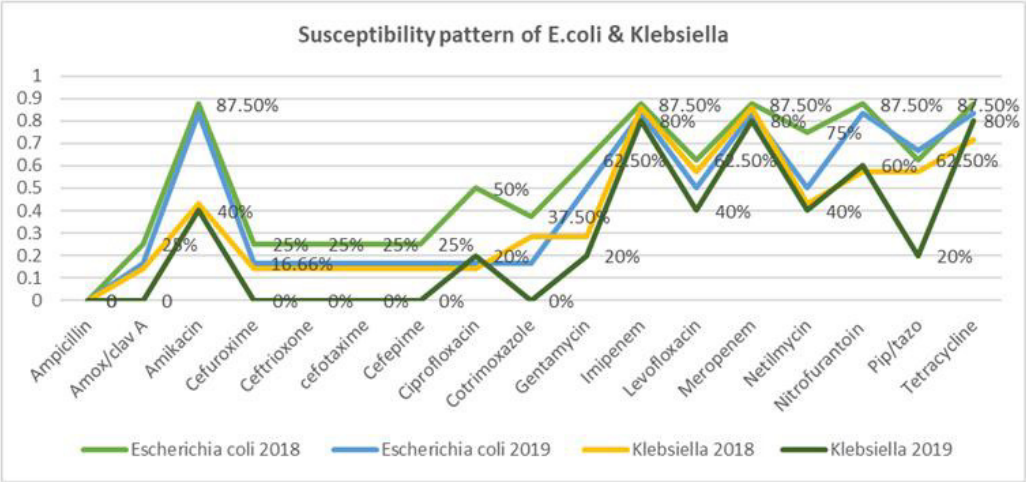

Figure 6. Susceptibility pattern of E.coli and Klebsiella

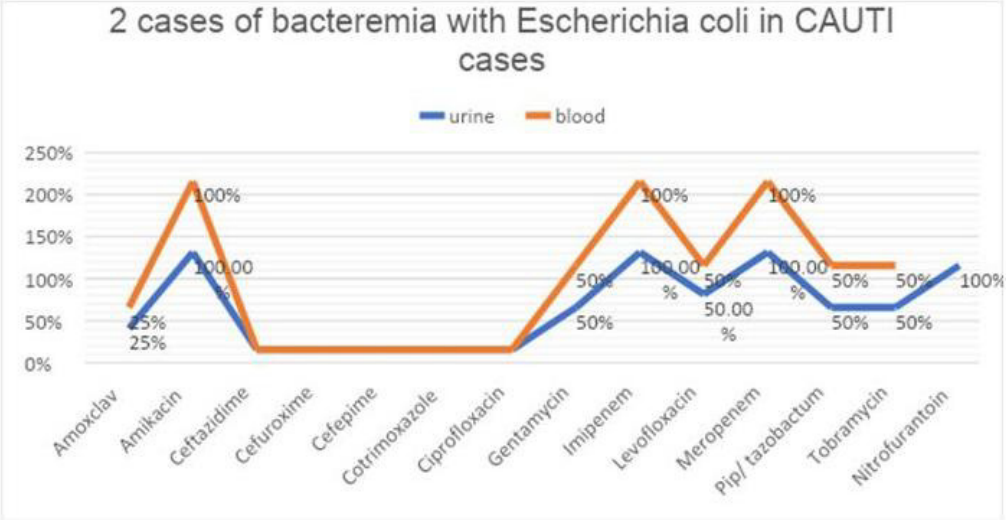

Figure 7. 2 cases of bacteremia with escherichia coli in CAUTI

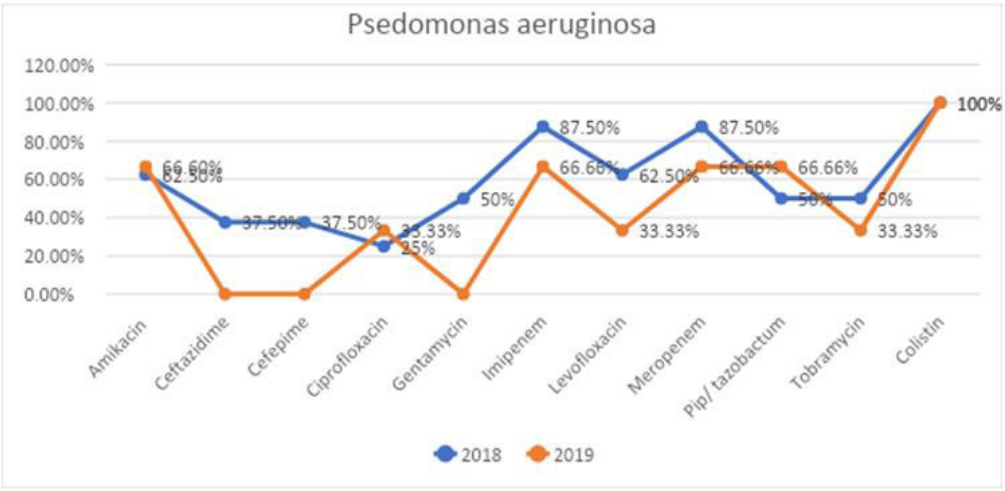

Figure 8. Pseudomonas aeruginosa

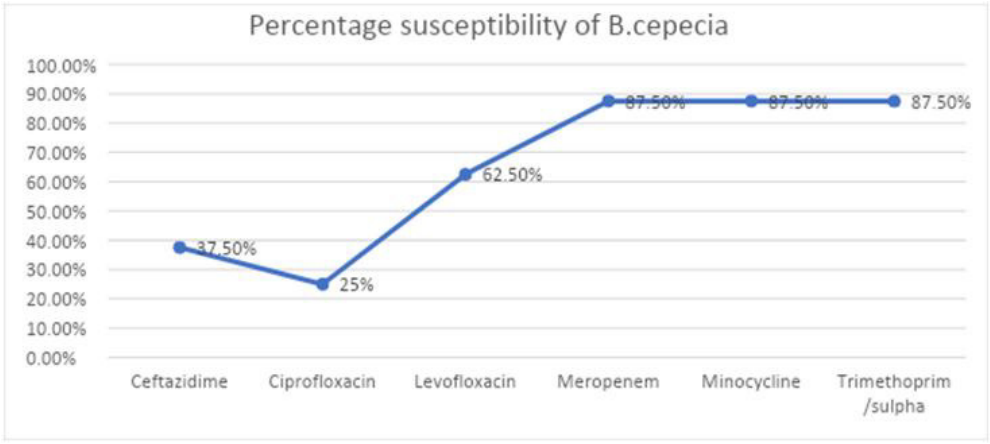

Figure 9. Percentage susceptibility of B.cepecia

predominant species, followed by multi-drug resistant Klebsiella pneumoniae spp. and Pseudomonas aeruginosa spp. In 2019, there has been a gradual decrease. Among the fermenter gram-negative bacteria, Escherichia coli and Klebsiella pneumoniae, in the nonfermenting group Pseudomonas aeruginosa, Burkholderia cepecia, Stenotrophomonas maltophila, and Acinetobacter baumannii. Among the Gram-positive bacteria, MRSA and VRE were observed. Multi-drug resistant strains were predominant in 2018. Figure 5,6

It was observed in the susceptibility pattern of Escherichia coli for both 2018 and 2019 with urinary specific antibiotics such as cotrimoxazole and fluoroquinolones, most of the isolates were resistant, and decreased susceptibility to aminoglycosides, pip/ tazobactam, and amox/clav A. Nitrofurantoin was the most active agent against Escherichia coli, followed by amikacin. It can be used in treatment management, except for renal insufficiency, where both nitrofurantoin and amikacin are contraindicated (Gransden et al., 1990). In CAUTI cases with vancomycin-resistant Enterococcus faecium, the management of these two cases was by bladder irrigation, followed by a change of catheter and treatment using fosfomycin, linezolid, and nitrofurantoin. Two cases were associated with Escherichia coli blood stream infection in 2018.

Although the number was small in 2019, Pseudomonas aeruginosa isolates were more resistant to cephalosporins, aminoglycosides, and carbapenems. All the strains were sensitive to colistin.

DISCUSSION

Escherichia coli was the predominant species, followed by multi-resistant Klebsiella pneumoniae spp. and Pseudomonas aeruginosa spp, in the non-fermenting group Pseudomonas aeruginosa, Burkholderia cepecia, Stenotrophomonas maltophila and Acinetobacter baumanii. MRSA and VRE have been observed in gram-positive bacteria. Zahran et al. reported the most common isolates in CAUTI patients: (18%), Ecoli (3%) and Pseudomonas (1%). Oumer et al. Showed that 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%) (Oumer et al., 2021).

Multi-drug resistant (MDR) isolates consisted of approximately 10% of the total isolate and the most common isolate of MDR is vancomycin-resistant enterococci (VRE) 50% of the total isolate. Multi-resistant strains dominated in 2018. The overall prevalence of MDR among the isolates was 37/42 (88.1%). Most of the 30/42 bacterial isolates (71.4%) were biofilm producers (Oumer et al., 2021). The total number of cases was 46, with 28 females (60.86%) and 18 males (39.13%). This is similar to the study done by Zahran et al., and Majumder et al., female had more CAUTI compared to males (Fawkia et al., 2019; Majumder et al., 2018).

Most CAUTI cases are in the 50 to 60 age group, followed by 60 to 70 years. Most of the cases in the Critical Care Unit (CCU) and Medical Intensive Care Unit (MICU) 1 and 2 were in neurological treatment Podkovik et al. A total of 146 adult indwelling urinary catheter patients were selected for statistical analysis, contributing to 1,301 hospital intensive care units and 1,189 catheter days (Figure 1). (59.6%) men and 59 (40.4%) women, with a general mean age of 55.48 ± 21.65 years (Podkovik et al., 2019).

Little is known about the epidemiology of nosocomial urinary tract-related bloodstream infection. A case-fatality rate of 32.8% highlights the severity of this condition (Chang et al., 2011). There has been a dramatic improvement after the implementation of standard catheter delivery protocols. The incidence decreased from 63% in 2018 to 37%. The incidence of MDR pathogens was reduced from 17% to 13% with Escherichia coli and from 15% to 10% with Klebsiella pneumoniae. The incidence of Pseudomonas spp. It was comparatively lower, but multi-drug resistance was observed more frequently in 2019. Two cases (6.89%) were linked to Escherichia coli bloodstream infection in 2018, but were not observed in 2019.Gransden et al. showed that Escherichia coli accounted for 861 (23.9%) of 3,605 bacteraemia episodes in an 18-year prospective survey at St. Thomas Hospital, a proportion that changed little during the survey (Gransden et al., 1990). Majumder et al., reported that 2-4% cases with CAUTI developed bacteraemia (Majumder et al., 2018). It was observed in the Escherichia coli susceptibility pattern for 2018 and 2019 with specific urine antibiotics such as cotrimoxazole and fluoroquinolones, most isolates were resistant, and susceptibility to aminoglycosides, Pip / Tazobactam and Amox / Clav A decreased active ingredient against Escherichia coli, followed by Amikacin. Lakshmi et al., reported the susceptibility pattern for Escherichia coli has shown gradual decline to all the Quinolones, Cotrimoxazole and good response to Nitrofurantoin and Aminoglycosides.

Yüksel et al., In their study, they showed that nitrofurantoin was the most effective active ingredient against E. coli (2.2% resistant strains), followed by amikacin (4.9%), ceftriaxone (7.5%) and ciprofloxacin (12%) (Yüksel et al., 2006; Lakshmi et al., 2021). Oumer et al., In their study, they showed that high drug resistance (> 80%) to cotrimoxazole, cefoxitin and tetracycline was observed. Ciprofloxacin and nitrofurantoin were the most effective drugs (Lakshmi et al., 2021; Lakshmi, 2018).

Pseudomonas aeruginosa has shown a good response to Aminoglycosides, Carbapenems and Betalactam Inhibitor combinations and mostly resistant to Cephalosporins and quinolones. Lakshmi et al., in her study has shown in her study there was still a good

response to Aminoglycosides, Beta lactam inhibitor combinations and Carbapenems for Pseudomonas aeruginosa (Lakshmi, 2018; Lakshmi and Naaz, 2021).

CONCLUSION

To reduce morbidity, length of hospital stays and patient costs, unnecessary catheter insertion should be avoided. If Foley catheter insertion is required, aseptic precautions should be taken during catheter insertion and the Foley extraction performed as soon as possible. For all medical professionals who care for catheterized patients, we have guaranteed regular training on techniques and procedures for the introduction, maintenance, and removal of urinary catheters. Timely education about CAUTI, other complications of urinary catheterization and alternatives to indwelling catheters. Continuous education and training of health workers, as well as monitoring by infection control teams, play an important role in improving practice and reducing infections.

REFERENCES

Fawkia EZ, Ahmed I, Sawsan AO, Sameh AE, Gamil KM (2019). Causative Organisms of Catheter Associated Urinary Tract Infection in Medical Wards and Intensive Care Units Int. J. Int. Med. p-ISSN: 2326-1064 e-ISSN: 2326-1072; 8(3): 37-41doi: 10.5923/j.ijim.20190803.01

Taha H, Raji SJ, Khallaf A, Abu Hija S, Mathew R, Rashed H, Du Plessis C, Allie Z, Ellahham S (2017). Improving Catheter Associated Urinary Tract Infection Rates in the Medical Units. BMJ Qual Improv Rep. Apr 6;6(1): u209593.w7966. doi: 10.1136/bmjquality. u209593.w7966. PMID: 28469893; PMCID: PMC5387977.

Chang R, Greene M, Chenoweth C, Kuhn L, Shuman E, Rogers M, Saint S (2011). Epidemiology of Hospital-Acquired Urinary Tract–Related Bloodstream Infection at a University Hospital. Infection Control & Hospital Epidemiology, 32(11), 1127-1129. doi:10.1086/662378

Gransden WR, Eykyn SJ, Phillips I, Rowe B (1990). Bacteraemia due to Escherichia coli: a study of 861 episodes. Rev Infect Dis. Nov-Dec;12(6):1008-18. doi: 10.1093/clinids/12.6.1008. PMID: 2267481

Majumder M, Ahmed T, Ahmed S, Khan A (2018). Microbiology of Catheter Associated Urinary Tract Infection. 10.5772/ intechopen.80080.

Yüksel S, Ozturk B, Kavaz A, Ozçakar ZB, Acar B, Güriz H, Aysev D, Ekim M, Yalçinkaya F (2006). Antibiotic resistance of urinary tract pathogens and evaluation of empirical treatment in Turkish children with urinary tract infections. Int J Antimicrob Agents. Nov;28(5):413-6. doi: 10.1016/j.ijantimicag.2006.08.009. Epub 2006 Sep 26. PMID: 17000085.

Oumer Y, Regasa Dadi B, Seid M, Biresaw G, Manilal A (2021). Catheter-Associated Urinary Tract Infection: Incidence, Associated Factors and Drug Resistance Patterns of Bacterial Isolates in Southern Ethiopia. Infect Drug Resist. Jul 24; 14:2883-2894. doi: 10.2147/IDR.S311229. PMID: 34335034; PMCID: PMC8318706.

Lakshmi JT, Naveen Chandra Reddy P, Charan S (2021). Susceptibility of E. coli to Commonly Used Antimicrobials isolated From Urine Samples [Internet]. Saspublisher.com. [cited 2021 Aug 31]. Available from: http://saspublisher.com/wp-content/uploads/2017/08/SJAMS-57D2817-2822.pdf

Lakshmi JT (2018). Prevalence and antimicrobial susceptibility pattern of Pseudomonas aeruginosa isolated from clinical samples in a tertiary care hospital. Saudi J Pathol Microbiol [Internet]. Available from: https://saudijournals.com/media/articles/SJPM-38-239-245-c.pdf

Lakshmi Jyothi MW, Naaz S (2021). Prevalence and antibiogram of bacterial uropathogens in a tertiary care teaching hospital [Internet]. Ijcmas.com. [cited 2021 Aug 31]. Available from: https://www.ijcmas.com/abstractview.php?ID=19524&vol=9-10-2020&SNo=41

Podkovik S, Toor H, Gattupalli M, et al. (August 26, 2019). Prevalence of Catheter-Associated Urinary Tract Infections in Neurosurgical Intensive Care Patients – The Overdiagnosis of Urinary Tract Infections. Cureus 11(8): e5494. doi:10.7759 /cureus.5494