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Urinary Tract Infections In Catheterized Patients And Antibiotic Sensitivity Patterns

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Abstract:

Aims & objectives:
To determine the incidence of urinary tract infections in catheterized patients admitted in the hospital and to identify uropathogens and their antibiotic sensitivity patterns in our hospital.

Methodology:
This is a prospective study on patients with Foley's catheter more than 48 hours in situ. Urine sample is collected from the catheter following CDC urine sampling guidelines, cultured, antibiotic sensitivity is identified. The results are analyzed and susceptibility patterns are observed.

Inclusion Criteria: Patients of ages 14 to 80 years are included. Patients with catheter in situ for more than 48 hours. No prior history of urinary tract infections before insertion of catheter. Patients who are catheterized in the hospital.
Exclusion Criteria: Patients on prolonged antibiotics usage. Patients denied consent for study. Chronic and prolonged catheterized patients.

Results: Total of 745 patients are analyzed, 525 patients showed sterile cultures despite having symptoms suggestive of UTIs. 220 patients developed positive cultures confirming urinary tract infection. The most common isolate is E.coli followed by Klebsiella, Enterobacterecia and Pseudomonas. S.aureus, Acinitobacter, candida are uncommon pathogens isolated. E.coli, Klebsiella showed resistance to Fluroquinolones, Beta lactam group and sensitivity to 3rd and 4th generation Cephalosporin, Imipenem group and Colistin. Pseudomonas showed maximum resistance to all higher antibiotics with susceptibility to Aminoglycosides group of antibiotics.

Conclusion: The study showed the incidence of infections in catheterized patients despite adhering to sterile procedure. It is of utmost importance to maintain strict aseptic conditions, early diagnosis and appropriate diagnosis and proper antibiotic regimen to effectively control UTIs. Empirical antibiotics and non-judicious usage leads to multi drug resistance and can pose a serious threat to the patient's recovery and lead to emergence of resistant strains which may pose a threat in near future.

Introduction

Urinary tract infection attributed to an indwelling urinary catheter is one of the most common nosocomial infections.Approximately 560,000 catheter-associated urinary tract infections (CAUTIs) are reported to the Centers for Disease Control and Prevention (CDC) each year [1]. Incidence of UTIs in catheterized patients is around 75%.Duration of catheterisation plays an important role in the incidence and microbiology of UTIs. Clinical picture has a wide picture from asymptomatic to mild and even severe symptoms. Patients are initiated on antibiotic regimen without prior microbiological evidence. Aggressive antimicrobial exposure leads to incidence of multidrug resistance.CAUTI arises through bacterial entry into the urinary tract via the urinary catheter. Formation of a biofilm on the urinary catheter perpetuates the bacterial presence in the urinary tract [3]. Most of the case remain asymptomatic and rarely lead to complications. Treatment of asymptomatic UTIs is unlikely to offer any clinical benefit to the patient, it might even decrease the rates of emergence of drug resistance microbes. It might be of clinical benefit in pregnant woman and patients undergoing urological procedures [4]. There are higher chances of failure of treatment in patients with long term indwelling catheters, as they usually develop poly microbial cultures [5]. Antimicrobial treatment of such patients fails to eradicate the catheter-associated biofilm and facilitates the emergence of antimicrobial-resistant flora [6, 7].

Aim and objectives

- The aim of the present study is to identify the patterns of antibiotic resistance in uropathogens. To identify the incidence of UTIs in catheterised patients and to identify the microbiology and antibiotic patterns of isolates.

Methodology

This is a prospective analytical study undertaken in NRI Medical College, Mangalgiri over a period of 8 months from January 2021 to August 2021.

- **Sample collection:**

Urine samples were collected from patients falling under the inclusion criteria. Samples are collected after disconnecting the urine bag from Foley catheter and collecting the urine from the catheter after letting out some urine. Clinical, medical, demographic data were collected from each patient and noted. Diagnosis of UTI is done as per the latest CDC guidelines published in January 2021.

- **Culture and sensitivity testing**

The urine samples were collected in wide mouthed containers as per standard collection methods and cultured for aerobic, anaerobic and fungal isolates. With the calibrated loop (0.001 ml), urine was plated onCystine Lactose Electrolyte-Deficient (CLED) medium, MacConkey agar and blood agar and then incubated aerobically at 37 °C for 24 hours for quantitative analysis to assess the microbial counts. Isolates were considered positive or significant if the urine culture showed colony counts of $>10^5$CFU/ml [8].

- **Sensitivity patterns.**

The identification and sensitivity patterns of isolates to various antibiotic regimens was done with Kirby Bauer Disc Diffusion method following CLSI guidelines.

Inclusion criteria

1. Patients willing to participate in study. 2. Patients who are catheterized in the institution itself.3. Patients who are on Foley's Catheter for more than 48hours.4. Patients aged 14 to 80 years are included.5. Patients with no prior history of UTIs or any urethral manipulations before catheterization.

Exclusion criteria

1. Patients denied consent for study.2. Patients with prolonged usage of antibiotics.3. Patients requiring chronic or long term catheterization.

Results

Out of 745 catheterized patients, 220 developed bacteriuria, 525 showed sterile cultures. Out of 220 positive cultures, 31% (n = 68) have diagnosed as Catheter Associated Urinary Tract Infections (CAUTIs) and 69 %(n= 152) have Catheter Associated Asymptomatic Bacteriuria (CA-ASB).

Out of total 745 catheterized patients, 304 patients showed symptoms suggestive of urinary tract infections such as fever, supra-pubic pain and tenderness and cloudy urine, flakes in urine collected

in urine bag. Out of those 304 symptomatic patients 30 %(n = 91) have a positive culture, 70 % (n= 213) have sterile culture despite having features suggestive of UTIs

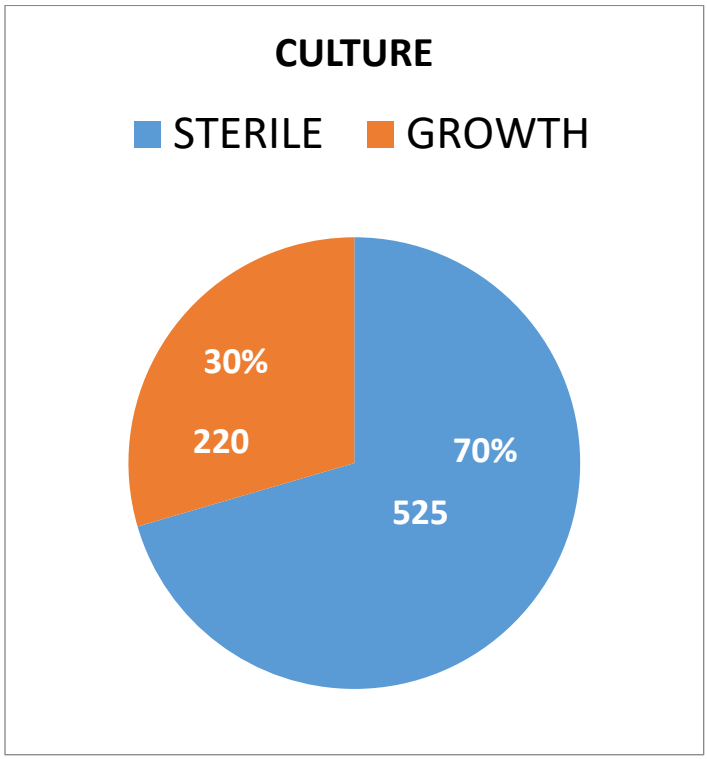

CHART 1 – Urine culture results

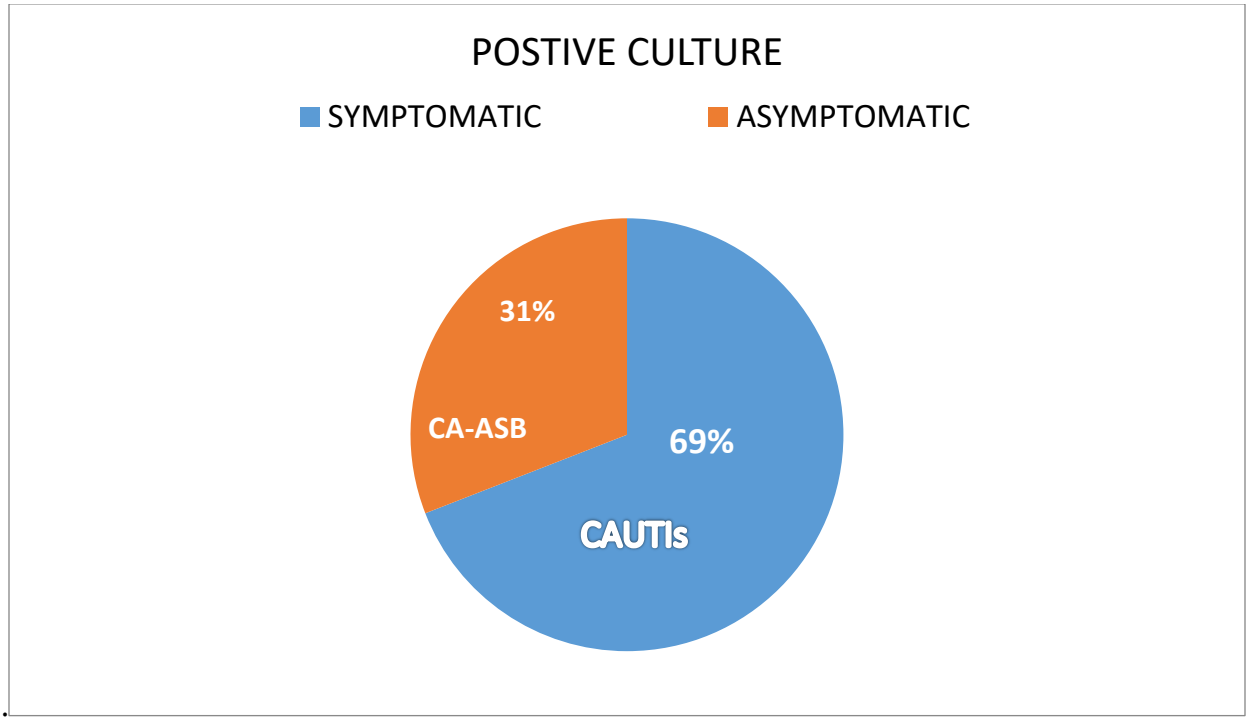

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CHART 2 – Culture positive patients with symptoms

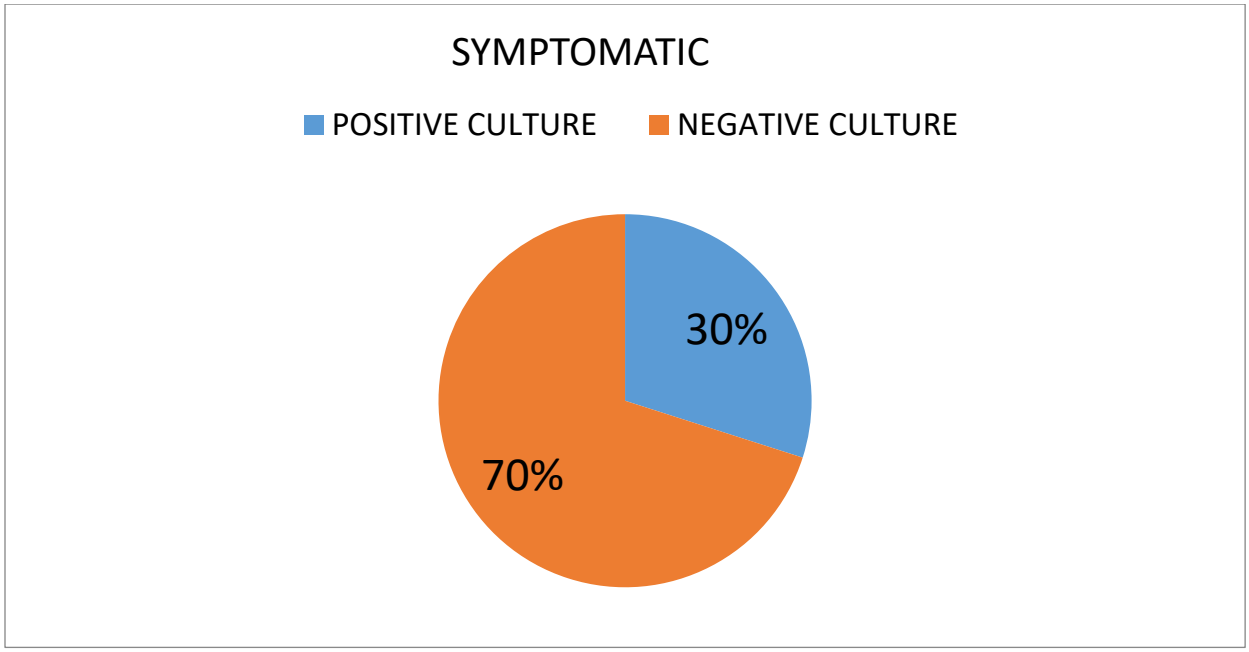

CHART 3 – Culture results in symptomatic patients

CAUTIs – Catheter Associated Urinary Tract Infections
CA-ASB – Catheter Associated Asymptomatic Bacteriuria

Age & Gender prevalence

AGE	MALE		FEMALE		TOTAL	
	NO	%	NO	%	NO	%
<18 YEARS	2	1.09%	1	0.90%	3	1.36%
18-30	9	8.25%	36	32.43%	45	20.45%
31 - 45	32	29.35%	32	28.82%	64	29.09%
>45 YEARS	66	60.55%	42	37.83%	108	49.09%
TOTAL	**109**	**%**	**111**	**%**	**220**	100.00%

TABLE 1 Age and Gender prevalence of UTI

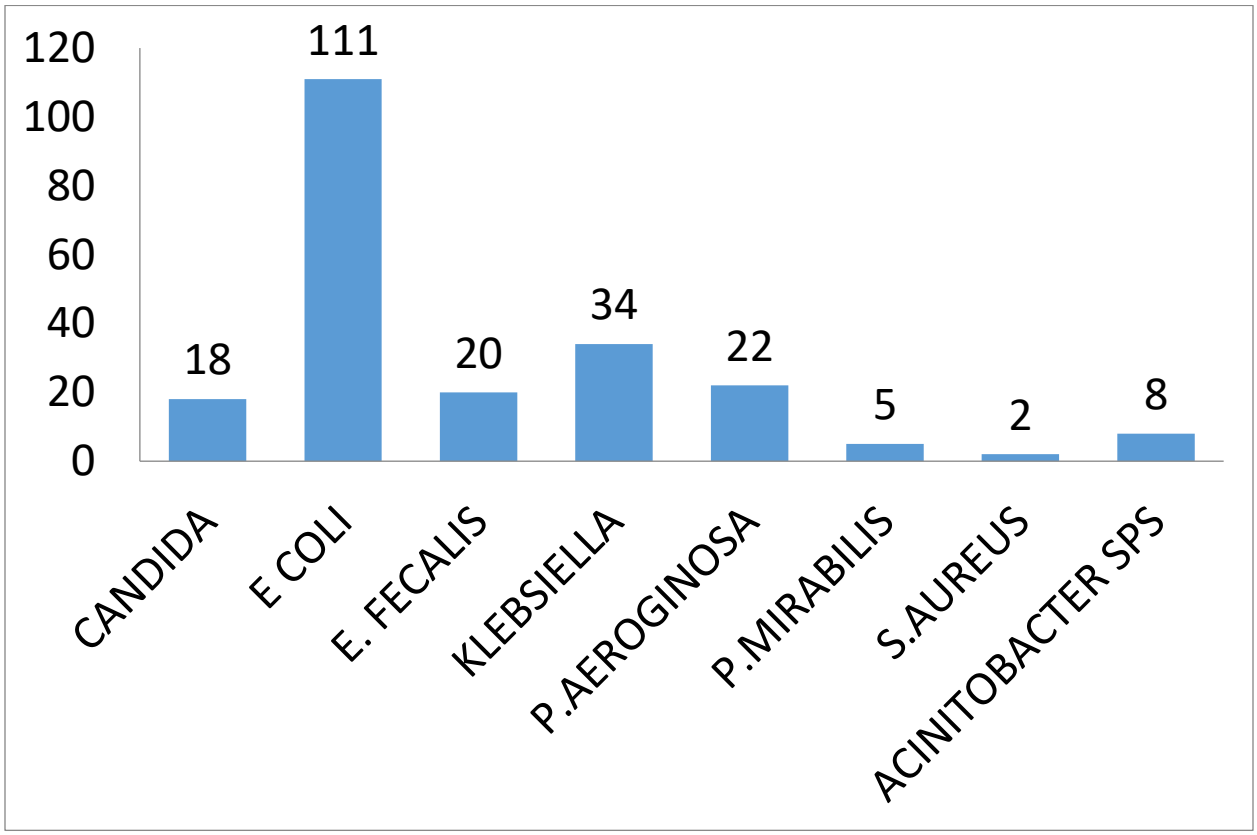

CHART 4 – Bacteria isolated from cultures

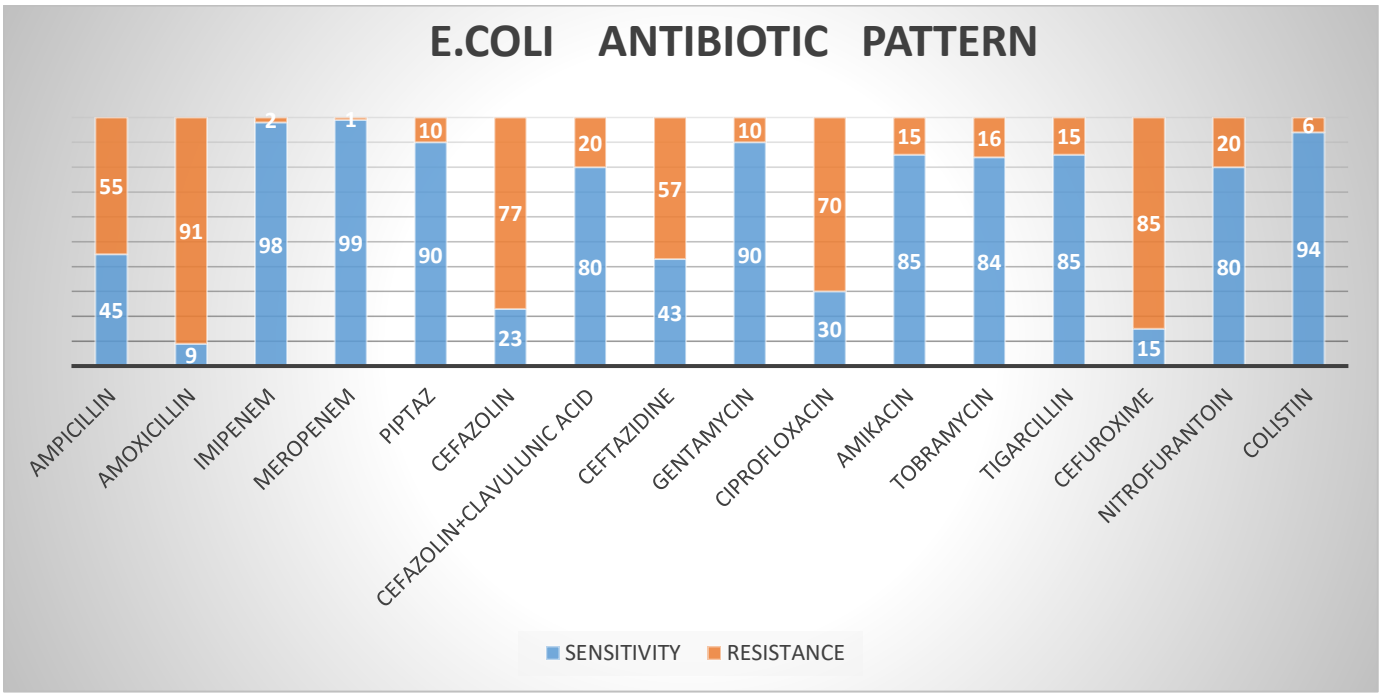

CHART 5 –Antibiotic sensitivity patterns seen with E. Coli infections

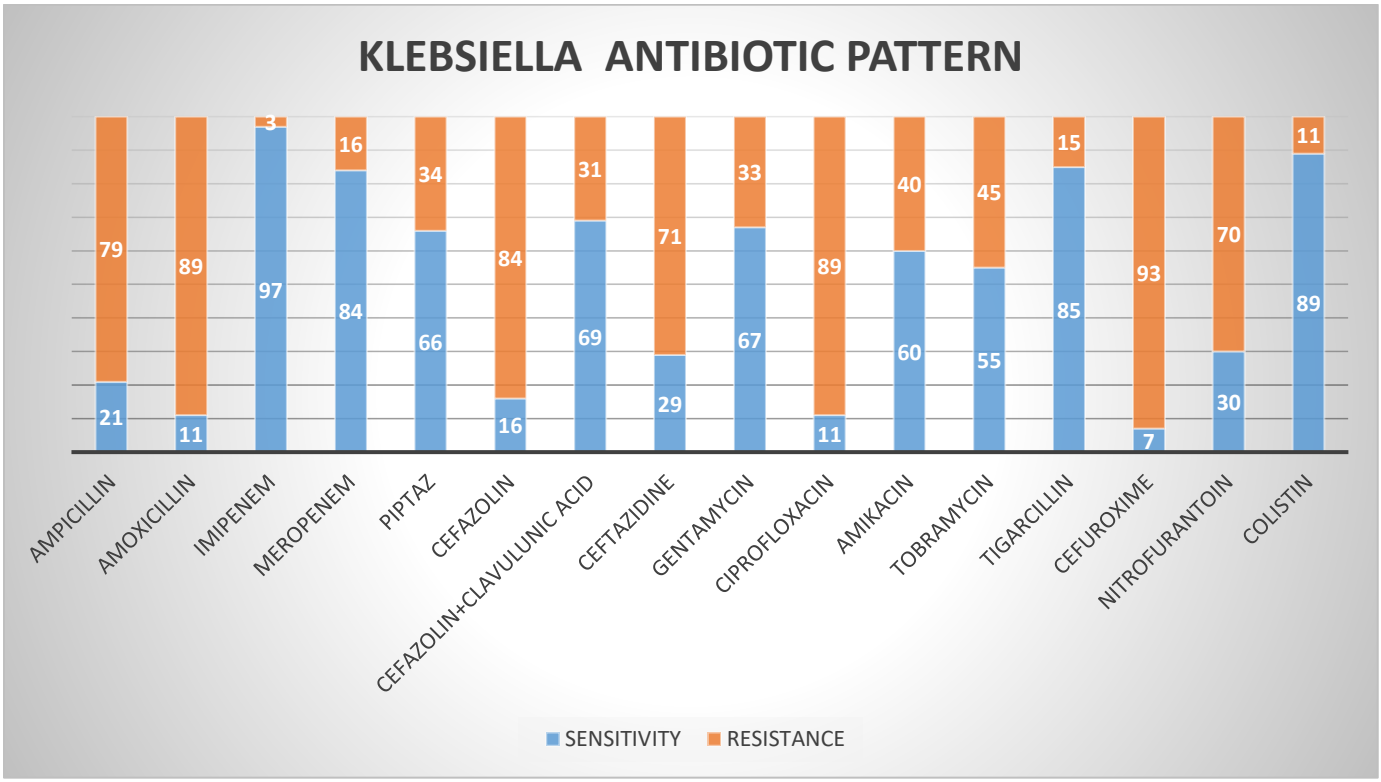

CHART 6 – Antibiotic sensitivity patterns seen with Klebsiella infection

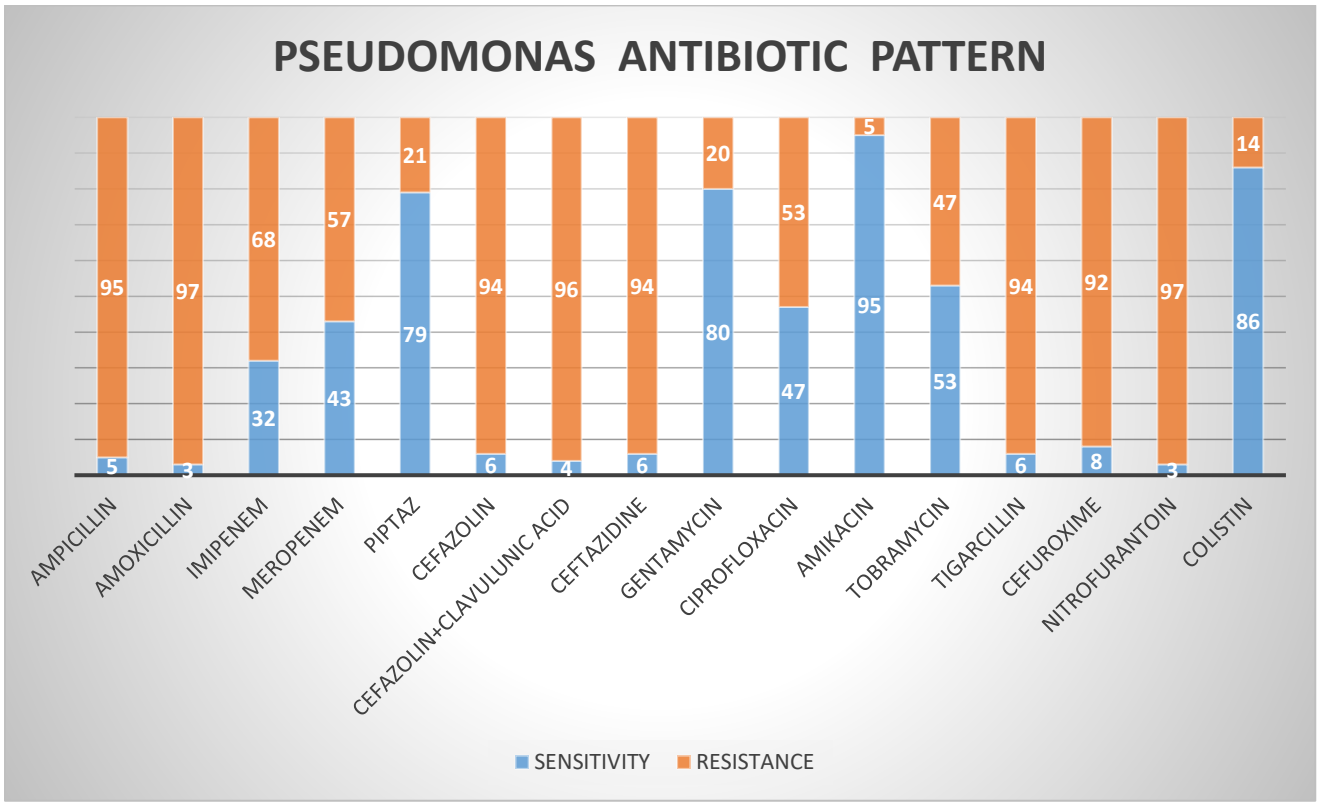

CHART 7 - Antibiotic sensitivity patterns seen with Psueudomonas infection

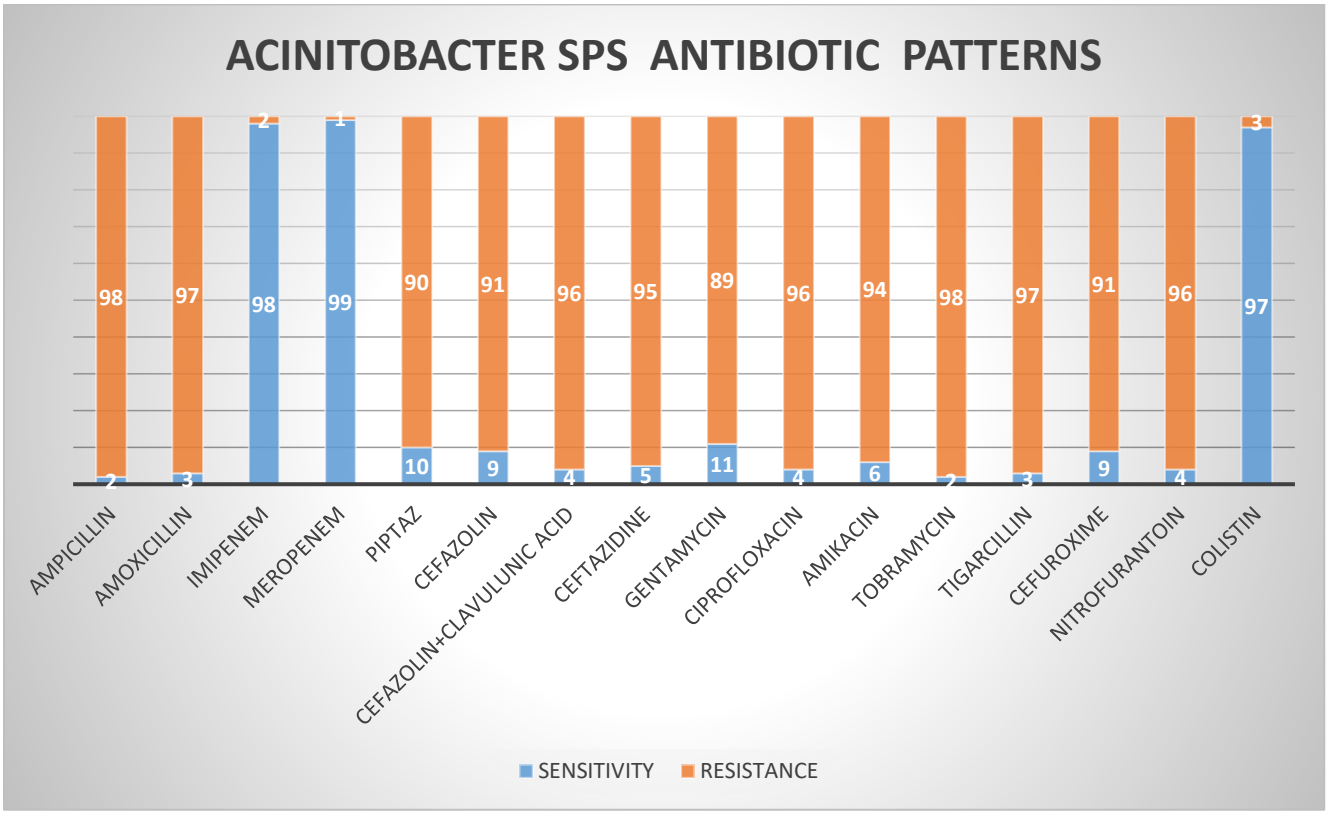

CHART8 – Antibiotic sensitivity patterns seen with Acinitobacter infection

Discussion

Urinary tract infections includes wide spectrum of infections ranging from pyelonephritis to cystitis. It can be complicated and uncomplicated type. Urinary tract infections in catheterized patients accounts for approximately 40% of all nosocomial infections annually. In our study at our institution, out of 745 catheterized patients, 220 developed bacteriuria, 525 showed sterile cultures, with incidence rate of around 30%. It can be symptomatic or asymptomatic.

Asymptomatic bacteriuria:

It defined by a mid-stream sample of urine showing bacterial growth $\geq 10^5$ cfu/mL in two consecutive samples in women or in one single sample in men. The spectrum of bacteria in CA-ASB is similar to species found in CAUTIs, depending on the presence of risk factors.

Asymptomatic bacteriuria occurs in an estimated 1-5% of healthy pre-menopausal females, 4-19% in otherwise healthy elderly females and men, 0.7-27% in patients with diabetes, 2-10% in pregnant women, 15-50% in institutionalised elderly populations, and 23-89% in patients with spinal cord injuries.

Asymptomatic bacteriuria is seen in 31% of the positive cultures in our study, it included healthy individuals with no significant morbidities.

Treatment of asymptomatic bacteriuria is not beneficial in women without risk factors, patients with well-regulated diabetes mellitus, post-menopausal women, and patient with dysfunctional or reconstructed lower urinary tracts, patients with renal transplants [9].

Catheter-associated UTI (CAUTIs):

Urinary Tract Infections occurring in a person whose urinary tract is currently catheterised or has been catheterised within the past 48 hours.

CAUTIs are one of the leading cause of health care-associated bacteraemia. Approximately 20% of hospital-acquired bacteraemia arise from the urinary tract, with 10% mortality rates.

Pathogenesis of CAUTIs:

Catheters facilitate colonisation with uropathogens by providing a surface for the attachment of host cell binding receptors recognised by bacterial adhesins, thus enhancing microbial adhesion[10].

Uroepithelial mucosa is disrupted, exposing new binding sites for bacterial adhesins, and residual urine in the bladder is increased through pooling below the catheter bulb.

Some bacteria produce a layer of mucopolysaccharides, proteins known as biofilm, it acts as a barrier to host defences and antibiotics. This leads to increased risk of antimicrobial resistance. Some bacterial biofilms can alter the urine pH leading to formation of a favourable environment for the microbes to grow. Biofilm also facilitate the development of catheter encrustations causing obstruction to urine outflow [10].

Antimicrobial agent selections for a CA-UTI should be specific and targeted, depending on the Gram stain and culture results.60% to 80% of CAUTIs are due to gram-negative organisms such as Escherichia. coli, Klebsiella, Pseudomonas, Proteus and Enterobacterecia species. 20% to 40% of cultures are gram-positive with Enterococcus and Staphylococcus species being the most common[11].

Out of the total 220 positive cultures, 180 isolates were of gram negative organisms with E.coli is the most common isolate followed by Klebsiella. 18 isolates are of candida species, 22 are gram positive cultures. 31% of the cultures showed symptoms and 69% showed no symptoms despite having positive cultures.

Patients on catheters and symptomatic patients are to be initiated on empirical broad spectrum antibiotics until culture reports show a specific targeted antibiotic. Factors to be considered when initiating empirical therapy are risk of drug resistance, the duration of hospital stay, prior antimicrobial agents used and duration of hospital stay[11].

In our study, the antibiotic sensitivity patterns for most common isolates were analysed and reported.

E.coli isolates showed varied response to various antibiotics, overall the antibiotic patterns showed by most of the E.coli isolates are similar. Least sensitivity (5% to 29%) is shown towards amoxicillin and cefazolin, while moderate sensitivity (30 to 70%) is shown to ampicillin, ciprofloxacin. Highest sensitivity (>70%) is seen with Imipenem group of antibiotics, piperacillin, amikacin, nitrofurantoin.

Klebsiella pnemoniae is the 2nd most common gram negative isolate in the cultures, least sensitivity is shown to cefuroxime, ciprofloxacin, cefazolin, ampicillin, amoxicillin. Moderate sensitivity is shown to piperacillin, cefazolin along with beta-lactamase inhibitors, gentamycin, amikacin, and nitrofurantoin. Highest sensitivity is shown to Imipenem, meropenem, tigarcillin, Colistin.

For mild to moderate CA-UTIs initial first line of treatment was intravenous or oral Fluroquinolones or 3rd generation cephalosporin. In our study there is increase in Fluroquinolones resistance which is 70% in E.coli, 89% in Klebsiella, 53% in Pseudomonas, 96% in Acinitobacter, when compared with other previous studies. The treatment for mild to moderate CA-UTIs, oral or intravenous 3rd generation cephalosporin are the initial treatment of choice. In severe and complicated CA-UTIs Imipenem group of antibiotics can be the drug of choice for empirical therapy. In cases of Candida, catheter removal is treatment. In symptomatic candiduria, blood culture need to be done as Candida, often descends from a systemic blood infection. Systemic treatment with oral fluconazole 200 mg/day for 2 weeks is recommended for cystitis. For pyelonephritis, oral fluconazole 200 mg/day to 400 mg/day for 2 weeks may be administered for susceptible strains.For resistant strains, Flucytosine 25 mg/kg four times daily or amphotericin B 0.3 mg/kg/day to 0.7 mg/kg/day systemically.

CONCLUSION

Prolonged use of indwelling catheter acts as source and nidus for occurrence of UTIs, which may significantly alter the course and outcome of treatment.Uropathogens isolated from such cases showed resistance to a wide spectrum of antibiotics, demanding the need for initiating high antibiotics. There is increased resistance to Fluroquinolones in our study.Improper diagnosis, initiation of therapy with higher antibiotics and poor catheter care leads to emergence of multidrug resistance variants. The preventive practices includes, indication for catheterization, early removal, maintenance of close drainage system, aseptic technique while insertion of catheter, care of the catheter. Periodic assessment of causative organisms and antibiotics patterns in the community provides a huge advantage in initiating the antibiotic therapy and preventing multi drug resistance.

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