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Community acquired Urinary tract infection isolates and their antibiotic susceptibility pattern

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A B S T R A C T

INTRODUCTION: Urinary tract infection (UTI) is a one of the most common outpatient health problem which is second common diagnosed infection in the community. Management of CA-UTI (Community acquired-urinary tract infection) should be accurate to eliminate the pathogens and to avoid complications, so it is important to do microbiological culture to know the antibiotic susceptibility testing. The aim this study is to know the urinary tract infection pathogens and their susceptibility patterns among patient.

MATERALS AND METHODS: This is a retrospective, cohort study conducted for 6 months on urinary samples collected from the patients presenting with urinary tract infections to outpatient department of our hospital. The data was collected from laboratory culture registers and the results were obtained in the Microsoft Excel and statistically analyzed by calculating the numbers and percentages of all descriptive variables.

RESULTS: Out of 288 urine isolates, 70 (24.3%) were Escherichia coli, 48 (16.6%) isolates were Klebsiella pneumoniae, 40 (13.8%) Pseudomonas aeruginosa isolates, 30 (13.8%) Enterococci isolates, 22 (7.6%), Coagulase Negative Staphylococci isolates, 16 (5.5%), Candida, 10 (3.4%), Proteus spp, 6 (2.08%), Acinetobacter spp, 4 (1.38%), Citrobacter spp and 2 (0.69%) were Enterobacter spp isolated. Many organisms yielded good sensitivity to penems, nitrofurantoin, fluoroquinolones, cotrimoxazole. Even beta lactam and beta lactamase inhibitor and cephalosporins gave a better sensitivity on testing of few isolates.

CONCLUSION: Neglected Urinary tract infections can lead to serious complications like pyelonephritis, urosepsis. To avoid these complications and to start ultimate antibiotic therapy it is critical to clinicians and microbiologists to focus on various aspects including ordering urine culture, proper sample collection, providing clinical history in requisition forms, and effective utilization of hospital antibiogram.

Keywords: Urine, infection, antibiogram, community acquired .

INTRODUCTION:

Urinary tract infection (UTI) is a one of the most common outpatient health problem which is second common diagnosed infection in the community. By definition it is an infection of the urinary tract that occurs in the community or within less than 48 hours of hospital admission and was in incubation at the time of hospital admission. UTI affect organs of the urinary system such as urethra, bladder, ureter or renal parenchyma The most common organisms isolated are

Escherichia coli, Klebsiella species, Enterococcus species, Proteus species, Pseudomonas aeruginosa, and *Staphylococcus* [1,2]. Urinary tract infection could be a hospital acquired urinary tract infection or community acquired urinary tract infection, usually the hospital acquired UTIs are catheter associated UTIs.

Most of the Uropathogens are originating from colonic flora, they enter into urinary tract either from faecal flora or from environment. They adhere to urethra and start causing infection which can progress to cystitis; pyelonephritis and even can lead to septicaemia. UTI is a most manifestation in childhood [3]. Various microorganisms are responsible for causing UTI but their prevalence varies in relation to age, gender, seasons, socioeconomic status, comorbidities, and the community. These pathogens express virulence factors like adhesins, hemolysin, capsular polysaccharide, enzymes to adhere at urinary tract and cause the disease [4].

Management of CA-UTI should be accurate to eliminate the pathogens and to avoid complications. Antimicrobial practices varies from region to region as it depends on epidemiology of pathogens, host factors, antibiotic prescription practices so it is important to do microbiological culture to know the antibiotic susceptibility testing.

We are trying to project the data of microbiotia in urine samples among patients hailing in and around Nandyal. We also excluded the patients with chronic UTI because this study is focusing more on community acquired urinary tract infections, those patients with chronic UTI or received multiple courses of antibiotics may alter the microbiotia of UTI cases as these patients are more prone to acquire or develop multidrug resistant pathogens and the formation of biofilms.

AIM:
To study the urinary tract infection pathogens in culture and their susceptibility patterns among patient.

OBJECTIVES:
1.To assess the microbiotia in urinary tract infections in our community
2.To know the most common pathogens isolated from urine samples of UTI cases
3.To determine the susceptibility pattern of isolates.

MATERIALS AND METHODS:
Study Settings:
This is a retrospective, cohort study conducted on urinary samples collected from the patients presenting with urinary tract infections to outpatient department of our hospital. The study has been carried out in department of Microbiology of Government General Hospital/Medical College, Nandyal, Andhra Pradesh. Ethical approval was obtained from the hospital review committee before conducting the study.

Study period: From January 2024 to December 2024.

Inclusion criteria:
1.Patients above 2 years of age and both sexes
2.Patients with UTI symptoms.

Exclusion criteria:
1.Patients with chronic UTI, already catheterized, immunocompromised, patients suffering from phimosis or paraphimosis.
2.Patients who received multiple course of antibiotics for UTI in the last 3 months.

Sample collection and transportation:
A total number of 745 samples were collected from patients presenting with urinary tract infection clinical manifestations in a wide mouth, screw capped, leak proof container. Specimens were advised to collect by catching mid-stream urine samples after cleansing their genital area with plain water and the samples were transported immediately by triple packaging to avoid cross contamination of samples. If there is any delay in transportation of samples, those were stored in refrigerator up to 24 hours.

Study Procedure:
Specimens were processed as per the standard guidelines [5]. Urine specimens were inoculated on to CLED agar, Nutrient agar and Macconkey agar using calibrated loops for plating. Quantitative culture streaking method was followed to read the colony count. This method allows for CFU/mL findings as well as the isolation of colonies for identification and susceptibility testing. Incubator was set as 370C before incubating plates; plates were incubated for 24 hours. After 24 hours of incubation of streaked culture media if there is no growth then those plates were further incubated for another

24 hours.. The colony characteristics observations, its gram stain and biochemical reactions were performed as per standard precautions [5].

Antimicrobial Susceptibility Testing:

Antibiotic susceptibility testing was done on Muller Hinton Agar by modified Kirby bauer disk diffusion method using clinical and laboratory standard institute guidelines (CLSI) [6].

Antibiotic disks used for Gram positive organisms testing were penicillin (10U), amoxyclav (30 µg), amikacin (30 µg), ciprofloxacin (5 µg), nitrofurantoin (200µg), clindamycin (2µg), cotrimoxazole (1.25 µg/23.75 µg), cefoxitin (30 µg), ofloxacin (5 µg), vancomycin (30µg) and teicoplanin (30µg).

Gram negative isolates antibiotics were: amoxyclav (30 µg), ceftazidime (30 µg), ceftriaxone (30 µg), cefipime (30 µg), Ceftazidime+clavulanic acid (30/10 µg), piperacillin+tazobactum (30/6 µg), ciprofloxacin (5 µg), cotrimoxazole (1.25 µg/23.75 µg), meropenem (10 µg), amikacin (30 µg), nitrofurantoin (200 µg), ofloxacin (5 µg), cefaperazone+sulbactum (75/30 µg). Standard Quality Control strains were used as a part of testing. Multi Drug testing was done for all strains isolated according to CLSI guidelines.

Statistical Analysis:

The data was collected from laboratory culture registers and the results were obtained in the Microsoft Excel and statistically analyzed by calculating the numbers and percentages of all descriptive variables.

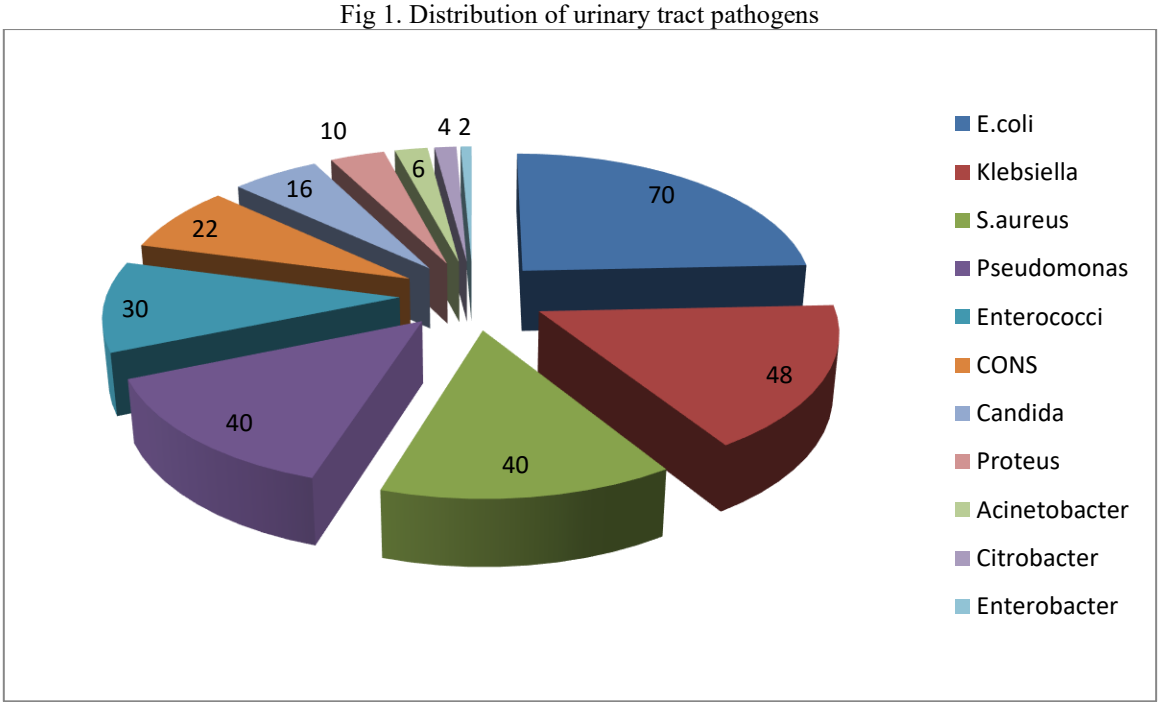
RESULTS:

745 urine specimens were processed in the department of Microbiology and the reporting was done by authorized signatories. Out of 745 urine samples, 288 (38.6%) showed urine culture positive and remaining 457 (61.3%) were culture negative. Polymicrobial isolated urine specimens were repeated again with fresh samples to avoid erroneous reporting.

Among 288 organisms, 92 (31.9%) were Gram positive isolates, 180 (62.5%) were Gram negative isolates and 16 (5.5%) were Candida.

Out of 288 urine isolates, 70 (24.3%) were Escherichia coli, 48 (16.6%) isolates were *Klebsiella pneumoniae*, 40 (13.8%) *Pseudomonas aeruginosa* isolates, 30 (13.8%), *Enterococci* isolates, 22 (7.6%), *Coagulase Negative Staphylococci isolates*, 16 (5.5%) *Candida*, 10 (3.4%) *Proteus spp*, 6 (2.08%) *Acinetobacter spp*, 4 (1.38%) *Citrobacter spp* and 2 (0.69%) were *Enterobacter spp* isolated (Fig 1).

Fig 1. Distribution of urinary tract pathogens



Among 180 Gram negative isolates, 134 (74.4%) were Enterobacteriaceae members and 46 (25.6%) were Non fermenters.

Among Enterobacteriaceae bacteria 80-90% of isolates were susceptibility to amikacin, nitrofurantoin, meropenem, ertapenem, ciprofloxacin and ofloxacin. 60-70% was susceptible to beta lactam and beta lactamase inhibitors, ceftazidime and around 55% sensitivity shown towards cephalosporins and amoxyclav.

Among non fermenters 80-90% of isolates were susceptibility to amikacin, nitrofurantoin, meropenem, ciprofloxacin and ofloxacin. 60-70% was susceptible to injectable beta lactam and beta lactamase inhibitors, ceftazidime.

Table 1. Antibiotic susceptibility pattern of Gram negative isolates

Antibiotics	Esch.coli (n=70)	Klebsiella spp.(n=48)	Pseudomonas (n=40)	Proteus (n=10)	Acinetobacter (n=6)	Citrobacter (n=4)	Enterobacter (n=2)
Ampicillin	12 (17.1%)	IR	-	IR	-	IR	IR
Amoxyclav	40 (57.1%)	24 (50%)	-	6 (60%)	-	IR	IR
Cefotaxime	35 (50%)	24 (50%)	-	6 (60%)	-	3 (75%)	1 (50%)
Cefepime	40 (57.1%)	26 (54.1%)	-	7 (70%)	-	3 (75%)	1 (50%)
Cefotaxime+clavulanic acid	46 (65.7%)	28 (58.3%)	-	7 (70%)	-	3 (75%)	1 (50%)
Ertapenem	62 (88.5%)	40 (83.3%)	IR	10(100%)	IR	4 (100%)	2 (100%)
Meropenem	65 (92.8%)	42 (87.5%)	36 (90%)	10(100%)	5 (83.3%)	4 (100%)	2 (100%)
Amikacin	70 (100%)	48 (100%)	40 (100%)	10 (100%)	6 (100%)	4 (100%)	2 (100%)
Ciprofloxacin	58 (82.8%)	35 (72.9%)	34 (85%)	8 (80%)	5 (83.3%)	4 (100%)	2 (100%)
Cotrimoxazole	46 (65.7%)	28 (58.3%)	IR	8 (80%)	5 (83.3%)	3 (75%)	1 (50%)
Nitrofurantoin	58 (82.8%)	40 (83.3%)	34 (85%)	IR	5 (83.3%)	4 (100%)	2 (100%)
Ofloxacin	58 (82.8%)	37 (77.08%)	34 (85%)	8 (80%)	5 (83.3%)	4 (100%)	2 (100%)
Ceftazidime	46 (65.7%)	28 (58.3%)	24 (60%)	7 (70%)	4 (66.6%)	3 (75%)	1 (50%)
Piperacillin+tazobactum	50 (71.4%)	32 (66.6%)	28 (70%)	7 (70%)	4 (66.6%)	3 (75%)	1 (50%)
cefaperazone+sulbactum	50 (71.4%)	30 (62.5%)	28 (70%)	7 (70%)	4 (66.6%)	3 (75%)	1 (50%)

Among Gram positive isolates, all the organisms were sensitive to teicoplanin and vancomycin. 80-90% of isolates were susceptibility to amikacin, nitrofurantoin, meropenem, ciprofloxacin. 60-70% was susceptible to beta lactam and beta lactamase inhibitors, cephalosporins, cotrimoxazole, clindamycin. 62.5% of isolates were Methicillin Sensitive Staphylococcus aureus and 73.3% of Enterococcus species were penicillin sensitive.

Table 2. Antibiotic susceptibility pattern of Gram positive isolates

Antibiotics	S.aureus (n=40)	Enterococci spp (n=30)	CONS (n=22)
Penicillin	4 (10%)	22 (73.3%)	4 (18.1%)
Amoxyclav	25 (62.5%)	24 (80%)	13(59.09%)
Cefoxitin	25 (62.5%)	IR	12 (54.5%)
Nitrofurantoin	34 (85%)	26 (86.6%)	20 (90.9%)

Cotrimoxazole	28 (70%)	IR	IR
Ciprofloxacin	32 (80%)	24 (80%)	18 (81.8%)
Amikacin	38 (95%)	IR	20 (90.9%)
Clindamycin	32 (80%)	IR	17 (77.2%)
Meropenem	32 (80%)	24 (80%)	18 (81.8%)
Ofloxacin	30 (75%)	25 (83.3%)	17 (77.2%)
Teicoplanin	40 (100%)	30 (100%)	22 (100%)
Vancomycin	40 (100%)	30 (100%)	22 (100%)

DISCUSSION:

Urinary tract infection is the second most common infections after the respiratory tract infection [7]. Main cause of urinary tract infection is obstruction of urinary tract including stone disease, pelvi-ureteric junction obstruction, benign prostate hyperplasia, vesico-ureteric reflux, urethral strictures and neuropathic bladder [8]. Neglecting urinary tract infections can lead to serious consequences such as chronic urinary tract infection, pyelonephritis, scar tissue to kidneys, renal failure and financial loss to patients. The microbiotia of urinary tract infections varies from region to region and also depends on the population clinical condition. Among Chronic UTI patients and patients with urinary tract abnormalities microbiotia are different as they often receive multiple courses of antibiotics. Hospitalized patients are more susceptible to infections.

Out of 745 urine samples, 288 (38.6%) showed urine culture positive and remaining 457 (61.3%) were culture negative in this study. Paryani JP et al showed [9] Significant bacteriuria was found in 335 (73.14%) samples, insignificant bacteriuria in 23 (5.02%) samples. Akram M et al [10] studied 920 community acquired urinary tract sample 100 (10.86%) samples showed growth of pathogens among which the most prevalent were *E. coli* (61%) followed by *Klebsiella spp* (22%). Yolbas I et al [11] did a study on community acquired Urinary tract infections, noted seasonal variation in the incidence of UTI; UTI were seen in autumn 10.7% (n = 16), summer 35.3% (n = 53), winter 30.7% (n = 46) and spring 23.3% (n = 35).

Among 288 organisms, 92 (31.9%) were Gram positive isolates, 180 (62.5%) were Gram negative isolates and 16 (5.5%) were Candida. Gram negative isolates were most commonly isolated in urinary tract infections [12-15].

UTI is the gold standard for confirmation of urinary tract infection [16]. In UTI specimens the urine culture is pointed out as positive when there is a significant microbial growth as determined by standard microbiological criteria [17]. The usual protocol followed in most of the laboratories while reporting to significance of urine culture is greater than or equal to 100,000 CFUs/ml, this is considered as a significant bacteriuria. Less than this count is also accountable in chronic UTI or pregnancy cases to detect asymptomatic bacteriuria or to avoid the antibiotic killing mask on growing organism.
Out of 288 urine isolates, 70 (24.3%) were *Escherichia coli*, 48 (16.6%) isolates were *Klebsiella pneumoniae*, 40 (13.8%) *Pseudomonas aeruginosa* isolates, 30 (13.8%) *Enterococci isolates*, 22 (7.6%) *Coagulase Negative Staphylococci* isolates, 16 (5.5%) *Candida*, 10 (3.4%) *Proteus spp*, 6 (2.08%) *Acinetobacter spp*, 4 (1.38%) *Citrobacter spp* and 2 (0.69%) were *Enterobacter spp* isolated. Muzammil M et al [12] observed out of 53 positive urine cultures, *Escherichia coli* was detected in 21 (39.6%), *Enterococcus species* were detected in 18 (33.9%), and *Pseudomonas aeruginosa* was detected in 7 (13.2%). Methicillin-resistant *Staphylococcus aureus* (MRSA), *Coliform species, Streptococci, and Klebsiella* were detected in three (5.7%), two (3.8%), one (1.9%), and one (1.9%) of the positive cultures, respectively. Sohail et al [13] observed *E. coli* in 62%, followed by *E. faecalis* (15%), *Pseudomonas* (6%), *Klebsiella spp*., and *Proteus* and *S. aureus* in 1% each. Muntaha et al [14] conducted a study on 155 children of UTI and observed E. coli in 72.26% of the patients, *Klebsiella* in 10.32%, and *S. aureus* in 2.58% of the cases. Amatya P et al [15] noted *E. coli* was in 67% cases and *Klebsiella* was in 21%; almost 90% of cases were sensitive to amikacin while resistance to ofloxacin was present in 85% cases. Akram M et al [10] observed *E. coli* in 62% while *Pseudomonas* in 6% of the UTI cases.

Among Enterobacteriaceae bacteria 80-90% of isolates were susceptibility to amikacin, nitrofurantoin, meropenem, ertapenem, ciprofloxacin and ofloxacin. 60-70% was susceptible to beta lactam and beta lactamase inhibitors, ceftazidime and around 55% sensitivity shown towards cephalosporins and amoxyclav. Muzammil M et al [12] noted *E.coli* and *Klebsiella* were 100% sensitive to colistin and polymyxin. *E.coli* is highly sensitive to ertapenem (100%), followed by 18 (85.7%) sensitive to amikacin, 15 (71.4%) sensitive to imipenem, 14 (66.7%) sensitive to gentamicin, 13 (61.9%) sensitive to meropenem, nine (42.9%) sensitive to ampicillin, eight (38.1%) sensitive to piperacillin/tazobactam,

seven (33.3%) sensitive to cefoperazone/sulbactam, six (28.6%) sensitive to co-amoxiclav, cefotaxime, and ceftriaxone, and five (23.8%) sensitive to cefuroxime and ciprofloxacin. All 21 (100.0%) cultures were resistant to amoxicillin. Kumar A et al [18] isolated *E.coli* as a predominant pathogen in urine culture which showed high sensitivity to amikacin (79.24%), followed by levofloxacin (77.21%) and gentamycin (62.26%). It was found to be resistant to norfloxacin (86%), nalidixic acid (86.76%) and cefotaxime (69.88%). Lungaria B et al [19] concluded Enterobacteriaceae tribe appears more resistant to antimicrobials as compared to Pseudomonas spp. Highest susceptibility to antimicrobial agents among Enterobacteriaceae group was found for amikacin (85%) followed by imipenem (82%), aztreonam (81%) and piperacillin-tazobactam (79%).

Among non fermenters 80-90% of isolates were susceptibility to amikacin, nitrofurantoin, meropenem, ciprofloxacin and ofloxacin. 60-70% was susceptible to injectable beta lactam and beta lactamase inhibitors, ceftazidime. Muzammil et al [12] noted seven isolates in urinary tract infections; they were 100% sensitive to amikacin, colistin, piperacillin/tazobactam, meropenem, and polymyxin B. The resistance pattern observed was four (57%) were resistant to ciprofloxacin, followed by two (28%) resistant to gentamicin, imipenem, and cefoperazone/tazobactam. Lunagaria RB et al [19] observed Pseudomonas spp. was polymyxin-B (100%) followed by aztreonam (93%), imipenem (86%) and piperacillintazobactam (86%). Fluoroquinolone group (ciprofloxacin, levofloxacin & lomefloxacin) was more resistant in pseudomonas spp.

Among Gram positive isolates, all the organisms were sensitive to teicoplanin and vancomycin. 80-90% of isolates were susceptibility to amikacin, nitrofurantoin, meropenem, ciprofloxacin. 60-70% was susceptible to beta lactam and beta lactamase inhibitors, cephalosporins, cotrimoxazole, clindamycin. 62.5% of isolates were Methicillin Sensitive *Staphylococcus aureus* and 73.3% of *Enterococcus* species were penicillin sensitive. Muzammil et al [12] studied *Staphylococcus aureus* isolates were 100% resistance to amoxicillin, ampicillin, cloxacillin, co-amoxiclav, imipenem, piperacillin/tazobactam, cefotaxime, ceftriaxone, cefuroxime, ciprofloxacin, cephradine, and penicillin. MRSA was detected in three (5.7%) of all the positive cultures. All MRSA isolates were sensitive to vancomycin and teicoplanin, followed by two (67%) sensitive to linezolid and then one (33%) sensitive to gentamicin. Streptococci were sensitive to amoxicillin, ampicillin, co-amoxiclav, cefotaxime, ceftriaxone, cefuroxime, ciprofloxacin, cefixime, penicillin G, teicoplanin, linezolid, and vancomycin. *Enterococcus species* were 100.0% were sensitive to vancomycin; 15 (83.3%) were sensitive to linezolid; 13 (72.2%) were sensitive to ampicillin, amoxicillin, co-amoxiclav, teicoplanin, and penicillin G; and five (27.8%) were sensitive to ciprofloxacin. All 18 (15.0%) cultures were resistant to cefotaxime, ceftriaxone, and cefuroxime. Lungaria B et al [19] documented gram positive bacteria, vancomycin and teicoplanin had 100% sensitivity in *Enterococcus* isolates. Other antibiotics in descending order of sensitivity were linezolid (92%) & nitrofurantoin (92%). Penicillins, fluoroquinolones and tetracyclines were relatively resistant in *Enterococcus* spp. All *Staphylococcus aureus* isolates were Methicillin sensitive *Staphylococcus aureus* (MSSA).

Positive urine cultures are observed when there is significant microbial growth determined by standard microbiological criteria [20]. Although not completely standardized, many laboratories set the cut-off at greater than or equal to 100,000 CFUs/ml for a UTI. However, this particular threshold may miss relevant infections. Consequently, other recommendations have noted a cut off of greater than or equal to 1,000 CFUs/ml in order to capture other bacterial infection

There is a chance that culture results may come out as faulty when it is affected by irreversible factors like firstly improper sample collection leads to grow of contaminants or false colony forming units on media plates, secondly if the transportation is not done on time or storage of samples is not as per recommendations, thirdly operator error may cause no growth or over growth or delay in reporting [21,22]. Last and finally the most obscure note while dealing in laboratories is usage of antibiotics by patients which may mask the presence of micro organisms. Hence it is most important that to accomplish testing and reporting as per guidelines and also knowing the history and clinical picture of the patient is necessary to know by Microbiologists.

CONCLUSION:

Enterobacteriaceae are the leading cause of urinary tract infection worldwide. *Escherichia coli* and *Klebsiella* are predominant pathogens responsible for UTI's. Many organisms yielded good sensitivity to penems, nitrofurantoin, fluoroquinolones, cotrimoxazole, which doesn't mean that these are the only antibiotic choice for infections. Even beta lactam and beta lactamase inhibitor and cephalosporins gave a better sensitivity on testing of few isolates. So clinicians should choose the appropriate antibiotic based on culture, hospital antibiogram and outpatient or inpatient treatment.

Accurate diagnosis of microbiotia and its antibiotic sensitivity pattern will help clinicians to approach the final diagnosis and to manage the patient. Neglected Urinary tract infections can lead to serious complications like pyelonephritis, urosepsis. To avoid these complications and to start ultimate antibiotic therapy it is critical to clinicians and

microbiologists to focus on various aspects including ordering urine culture, proper sample collection, providing clinical history in requisition forms, and effective utilization of hospital antibiogram.

REFERENCES:

1.Chakupurakal R, Ahmed M, Sobithadevi Dn, Chinnappan S, Reynolds T. urinary tract pathogens and resistance pattern. j clin pathol 2010; 63: 652-654.

2.Lutter Sa, Currie Ml, Mitz Lb, Greenbaum La. antibiotic resistance patterns in children hospitalized for urinary tract infections. arch pediatr adolesc med 2005; 159: 924-928.

3.pignanelli s, zaccherini p, schiavone p, nardi pantoli a, pirazzoli s, nannini r. in vitro antimicrobial activity of several antimicrobial agents against escherichia coli isolated from community-acquired uncomplicated urinary tract infections. eur rev med pharmacol sci 2013; 17: 206-209.

4.Seigfried L, Kmetova M, Puzova H, Molokacova M, Filkas J. Virulence associated factors in E. Coli strains isolated from children with UTI. J Med Microbiol 1994;41:127.

5.JG Collee JP Digcid AG Fraser Mackie & McCartney practical medical microbiology. 14th edn. Churchill, Livingstone. New York. 1996.

6.Clinical and Laboratory Standards Institute (CLSI). Performance Standards for Antimicrobial Susceptibility testing. CLSI supplement M100, Wayne, PA: Clinical and Laboratory Standards Institute 2024.

7.Liperky BA. Urinary tract infection in men: Epidemiology, pathophysiology, diagnosis and treatment. Ann Intern Med 1989;111:138.

8.Measly RE, Levison ME. Host defense mechanisms in the pathogenesis of UTI. Med Clin of North America 1991;75:275.

9.Pattern and sensitivity of microorganisms causing urinary tract infection at teaching hospital. Paryani JP, Memon SR, Rajpar ZH, Shah SA. J Liaquat Uni Med Health Sci. 2012;11:97–100.

10. Akram M, Shahid M, Khan AU. Etiology and antibiotic resistance patterns of community-acquired urinary tract infections in JNMC Hospital Aligarh, India. Ann Clin Microbiol Antimicrob. 2007;6:4.

11.Community-acquired urinary tract infections in children: pathogens, antibiotic susceptibility and seasonal changes. Yolbas I, Tekin R, Kelekci S, et al. Eur Rev Med Pharmacol Sci. 2013;17:971–976.

12.Muzammil M, Adnan M, Sikandar SM, Waheed MU, Javed N, Ur Rehman MF. Study of Culture and Sensitivity Patterns of Urinary Tract Infections in Patients Presenting with Urinary Symptoms in a Tertiary Care Hospital. Cureus. 2020 Feb 16;12(2):e7013.

13. Sohail M, Khurshid M, Saleem HG, Javed H, Khan AA. Characteristics and antibiotic resistance of urinary tract pathogens isolated from Punjab, Pakistan. Jundishapur J Microbiol. 2015;8:0.

14. Muntaha ST, Ismail M, Hassan F. Causative organisms and their sensitivity pattern of urinary tract infection in children. J Islamic Int Med Coll. 2016;11:145–148.

15. Amatya P, Joshi S, Shrestha S. Culture and sensitivity pattern of urinary tract infection in hospitalized children in Patan Hospital. J Nepal Paediatr Soc. 2016;36:28–33.

16.Schmiemann G, Kniehl E, Gebhardt K, Matejczyk MM, Hummers-Pradier E. The diagnosis of urinary tract infection: a systematic review. Dtsch Arztebl Int. 2010 May;107(21):361-7.

17.Wilson ML, Gaido L. Laboratory diagnosis of urinary tract infections in adult patients. Clin Infect Dis. 2004 Apr 15;38(8):1150-8.

18.Kumar, A., Kumar, R., Gari, M., Keshri, U. S. P., Mahato, S. K., & Ranjeeta, K. (2017). Antimicrobial susceptibility pattern of urine culture isolates in a tertiary care hospital of Jharkhand, India. International Journal of Basic & Clinical Pharmacology, 6(7), 1733–1739.

19.Lunagaria R B, Trivedi N A, Analysis of urine culture isolates from microbiology laboratory of a tertiary care Hospital. Indian J Microbiol Res 2019;6(2):106-108.

20.Wilson ML, Gaido L. Laboratory diagnosis of urinary tract infections in adult patients. Clin Infect Dis. 2004 Apr 15;38(8):1150-8.

21.Selek MB, Bektöre B, Sezer O, Kula Atik T, Baylan O, Özyurt M. Genital region cleansing wipes: Effects on urine culture contamination. J Infect Dev Ctries. 2017 Jan 30;11(1):102-105.

22.Silver SA, Baillie L, Simor AE. Positive urine cultures: A major cause of inappropriate antimicrobial use in hospitals? Can J Infect Dis Med Microbiol. 2009 Winter;20(4):107-11.