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ANTIBIOTIC SUSCEPTIBILITY PATTERN OF CATHETER-ASSOCIATED BACTERIAL PATHOGENS IN URINARY TRACT INFECTION AMONGST CHILDREN AT TERTIARY CARE HOSPITAL

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ABSTRACT

Background: *Urinary Tract Infections are the most common bacterial infection in children. Appropriate therapy is necessary to lower the mortality rate of UTIs.*

Objective: *The aim of the study was to determine the Antibiotic susceptibility pattern of Catheter-Associated Bacterial Pathogens in Urinary Tract Infection Amongst children at tertiary care hospital.*

Methodology*: This study was carried out at the Saidu Group of Teaching Hospital (SGTH), Saidu Medical College (SMC) Saidu Sharif Swat, Pakistan from July 2023 – December 2023 after taking permission from the ethical committee of the institute. Using sterile scissors a total of 204 catheter tips were taken from pediatric patients in various wards (medicine, surgery, and urology) at tertiary care hospital. The clinical samples of catheter tips were then placed in a clean container after being cut 2 cm from the balloon side. The specimens were first kept for 24 hours in nutrient broth that had already been prepared. Blood agar, and MacConkey agar plates were used to subculture the broth, and it was incubated for the whole night at 37°C. Bacteria were identified through gram staining and biochemical tests. Antibiotic susceptibility pattern was performed using Kirby-Bauer disc diffusion method. Data were recorded when distinct zones appeared onto antibiotic agar plates. Data was analyzed using SPSS version 24.*

Results*: A total of 204 samples examined in this study of which 122 were male (59.8%) and 82(40.1%) were female. Out of these samples 78 (38.2%) showed growth on nutrient agar. The 78 cultured positive samples were further processed to find out the frequency of bacteria. In processed samples, P. aeruginosa 25(32%) was found to be most prevalent than E. coli 23 (29.4%) S. aureus (24%) and K. pneumoniae 11(14%). The most prevalent bacteria in Catheter-Associated Bacterial Pathogens in Urinary Tract Infection amongst children was P. aeruginosa 25(32%) and E. coli and 23 (29.4%). P.*

aeruginosa, E. coli and K. pneumonia were sensitive to colistin. Vancomycin was shown to have the highest susceptibility in S. aureus.

Conclusion: *This study concluded that the most prevalent bacteria in Catheter-Associated Bacterial Pathogens in Urinary Tract Infection amongst children were P. aeruginosa and E. coli. P. aeruginosa, E. coli and K. pneumonia were sensitive to colistin.*

Keywords: *Antibiotic susceptibility pattern; Catheter; Bacterial Pathogens; Urinary Tract Infection*

INTRODUCTION

Urinary Tract Infection (UTIs) are the most common bacterial infection in children during the first seven years of life, affecting 8% of girls and 2% of boys, respectively.[1] Certain children may have a higher risk of UTI due to congenital or other urinary tract abnormalities.[2] Children with congenital kidney and urinary tract abnormalities (CAKUT) are at risk of developing UTIs in 30% of cases. Vesico-ureteral reflux (VUR) causes alterations in the unidirectional flow of urine.[3] While pyelo-ureteral junction blockage (PUJO) causes stasis, both of which raise the possibility of harmful microbes multiplying.[4] Over 8% of children between the ages of one month and eleven will have a UTI at least once, and over 30% of toddlers and infants get repeated infections in the six to twelve months after their first UTI.[5] Over 95 percent of bacteria are the most prevalent cause of UTIs. The most common cause of urinary tract infections, Escherichia coli (E. coli) is accountable for over 80% of cases.[6] Males are more likely than females to have Proteus mirabilis, while neonates are more likely to have Streptococcus agalactiae. Furthermore, children with compromised immune systems or abnormalities of the urinary tract (anatomic, neurologic, or functional) may be caused by S. viridians, H. influenza, S. pneumonia, Staph. epidermidis, S. aureus, and Strep. agalactia.[7] UTIs may only be appropriately treated with a correct diagnosis of the local infection, knowledge of susceptibility patterns, and any associated risk factors.[6]

Due to the improper use of antibiotic , the antibiogram of common pathogens is progressively fluctuating in all countries.[8] Appropriate therapy is necessary to lower the mortality rate of UTIs. It might be difficult to identify a UTI after two years.[9] Children with Simple UTIs can be treated with cephalosporins, amoxicillin, sulphonamides, or trimethrim-sulfamethoxazole. Amoxicillin, Sulphonamides, cephalosporins, or trimethoprim-sulfamethoxazole that concentrate in the lower urinary tract.[10] The bacteria that cause urinary tract infections are more probable to develop resistance to common antibiotics like trimethoprim-sulfamethoxazole in high-income nations, according to research.[11] Although medications have helped to reduce the mortality rate of S. aureus, the bacteria rapidly becomes resistant to them. It is a serious infection for both people and animals due to elements such toxins, adhering proteins, enzymes, antimicrobial peptides, and super-antigen.[12] Multiple drug resistance These days, Escherichia coli constitutes a cause for concern due to its broad host range, increased degree of virulence, survival ability, and several documented pandemics.[13] E. Coli multidrug resistance (MDR) is a severe problem that endangers the health of both people and animals.[14] Therefore the current study was carried out to determine the Antibiotic susceptibility pattern of Catheter-Associated Bacterial Pathogens in Urinary Tract Infection Amongst children at tertiary care hospital.

Methodology

This study was carried out at the Saidu Group of Teaching Hospital (SGTH), Saidu Medical College (SMC) Saidu Sharif Swat, Pakistan from July 2023 – December 2023 after taking permission from the ethical committee of the institute. Using sterile scissors a total of 204 catheter tips were taken from pediatric patients in various wards (medicine, surgery, and urology) at the children at tertiary care hospital. The clinical samples of catheter tips were then placed in a clean container after being cut 2 cm from the balloon side. The specimens were first kept for 24 hours in nutrient broth that had already been prepared. Blood agar, and MacConkey agar plates were used to subculture the broth, and it was incubated for the whole night at 37°C. Colony morphology, color pigmentation, and colony size and form were used to make a preliminary identification of the bacterial isolate colonies. For identification of gram positive and gram negative bacteria

gram staining was performed. To validate the biochemical features, isolates underwent further processing for biochemical profiling. Results have been noted for each of the processed isolates after oxidase, TSI, methyl red, citrate, urease, indole, , & Voges Proskauer assessments were performed.

Antibiogram

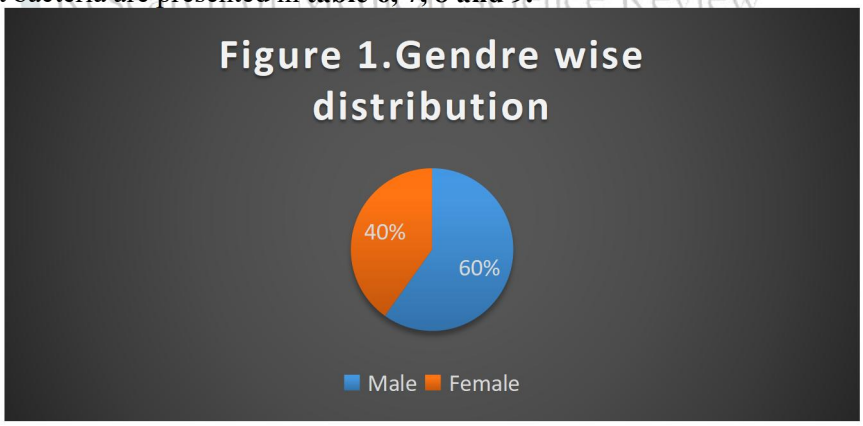
The Kirby-Bauer disc diffusion technique was used to determine the antibiotic susceptibility pattern. Data were recorded when distinct zones appeared onto antibiotic agar plates. Data was analyzed using SPSS version 24.

Results

A total of 204 samples examined in this study of which 122 were male (59.8%) and 82(40.1%) were female. male to female ratio was 3; 2.(Figure 1) Out of these samples 78 (38.2%) showed growth on nutrient agar.). Majority of the samples were collected from medical ward 70(34.3%),followed by surgical ward 68(33.33%) and urology ward 66(32.35%) as shown in figure 2.The 78 cultured positive samples were further processed to find out the frequency of bacteria. In processed samples, *P. aeruginosa* 25(32%) was found to be most prevalent, followed by E. coli 23 (29.4%) and *S. aureus* 19 (24%) and *K. pneumoniae* 11(14%) as presented in **table1.**In an analysis of P. aeruginosa demographic factors, the overall sample distribution revealed a high prevalence for males (15.5%) when gender was examined, a high majority for surgical and urological wards when sample location was studied, and a high majority for age group 1-4 when age group was analyzed. **(Table 2)** Males had a high prevalence in the assessment of demographic characteristics for E. coli, according to the total sample distribution for gender investigation. Urological wards had a large majority for sample location analysis, and age groups 5–9 had a high prevalence (11%) for age group study**.(table 3)** Males had a high prevalence (7.5%) in the total sample distribution for the gender study in the research of demographic parameters for *K. pneumoniae***. (Table 4.).** Males had a high prevalence (12.2%) in the total sample distribution for the gender study in the evaluation of demographic parameters for **S. aureus** as presented in **table 5.**

Evaluation of antibiotic susceptibility

The mentioned antibiotics were tested for the purpose of antibiotic susceptibility testing, and the CLSI 2021 recommendations were followed in the preparation of the results. The results of antibiotic susceptibility profile of different bacteria are presented in **table 6, 7, 8 and 9.**



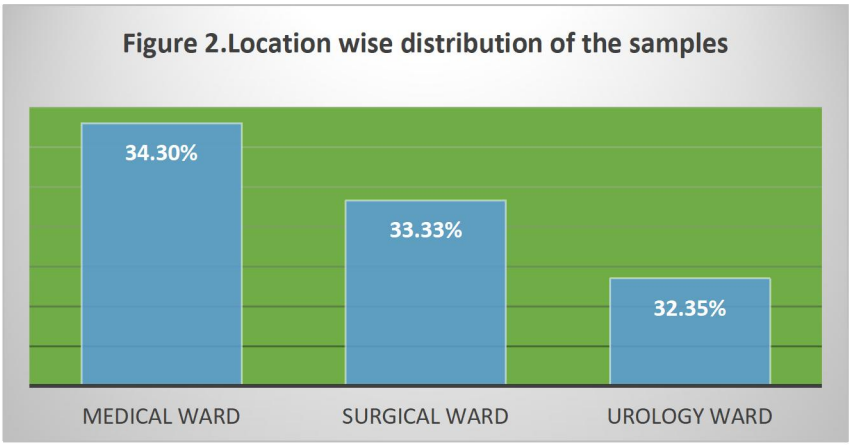


Table 1.Prevalence of bacteria in the specimens

Bacteria	Frequency (%)
P. aeruginosa	25(32%)
E. coli	23 (29.4%)
S. aureus	19 (24%)
K. pneumonia	11(14%)

Table2.Patients clinical demographic distribution for P. aeruginosa

Demographic feature	Category	No of samples	Frequency (%)
Gender	**Male**	122	19(15.5)
	Female	82	7(8.5)
Sample distribution	**Medical ward**	70	9(12.85)
	Surgical ward	68	9(97.14)
	Urology	66	9(94.2)
Age in years	**1-4**	98	14(14.2)
	5-8	66	7(10.60)
	9-12	40	6(15)

Table3. Clinical demographic distribution of individuals with E. coli

Demographic feature	Group	Specimens	No (%)
Gender	**Male**	122	7(5.7)
	Female	82	6(7.3)
Sample distribution	**Medical ward**	70	3(4.2)
	Surgical ward	68	7(10.29)
	Urology	66	12(18.18)
Age in years	**1-4**	98	11(11.22)
	5-8	66	7(10.6)
	9-12	40	4(10)

Table4. Clinical demographic distribution of individuals with K. pneumoniae			
Demographic feature	**Classification**	**No of samples**	**N (%)**
Gender	**Male**	122	9(3.7)
	Female	82	2(2.4)
Sample distribution	**Medical ward**	70	4(5.7)
	Surgical ward	68	4(5.8)
	Urology	66	3(4.54)
Age in years	**1-4**	98	7(7.1)
	5-8	66	2(3.0)
	9-12	40	2(5)

Table5.Patients clinical demographic distribution for S.aureus			
Parameters	**Group**	**samples No**	**Occurrence (%)**
Gender	**Male**	122	15(12.2)
	Female	82	6(7.3)
Sample distribution	**Medical ward**	70	8(11.4)
	Surgical ward	68	6(8.8)
	Urology	66	14(21.21)
Age in years	**1-4**	98	3(3.0)
	5-8	66	2(3.0)
	9-12	40	2(5)

Table 6. Antibiogram of P. aeruginosa isolates.			
Antibiotics	Sensitive	Intermediate	Resistant
Gentamicin	14 (56.0%)	04 (10.0%)	11 (34.0%)
Ciprofloxacin	13 (52.0%)	2 (5.0%)	13 (43.0%)
Meropenem	10 (38.0%)	04(13.0%)	14 (49%)
Imipenem	19 (70.1%)	03(8.9%)	6(21.0%)
Tobramycin	11 (41.67%)	02(5.1%)	14 (50.0%)
Ceftazidime	12 (44.83%)	02(5.1%)	14(50.0%)
Cefotaxime	11 (40.0%)	03(10.0%)	14 (50.0%)
Amikacin	14 (50.0%)	5(5.0%)	13(45.0%)
Colistin	26 (100%)	0	
Ampicillin	0	0	0

Table 7 Antibiotic susceptibility pattern of K. pneumonia			
Antibiotic	**Sensitive**	**Resistant**	**Intermediate**
Gentamicin	**06 (46%)**	**2 (10.0%)**	**6 (44%)**
Ciprofloxacin	**06 (46%)**	**3 (18%)**	**5 (36%)**
Meropenem	**05 (36 %)**	**2 (10.0%)**	**7 (54%)**
Imipenem	**09 (72.5%)**	**0**	**4 (27.5%)**
Tobramycin	**5 (36.0%)**	**2 (10.0%)**	**7 (54.0%)**
Ceftazidime	**5 (36.0%)**	**2 (10.0%)**	**7 (54.0%)**
Cefotaxime	**4 (27.0%)**	**2 (10.0%)**	**8 (63.0%)**
Amikacin	**5 (37%)**	**2 (10.0%)**	**7 (53.0%)**
Colistin	**12(100%)**	**0**	**0**
Ampicillin	**0**	**0**	**100**

Table 8.Antibiogram of *E.coli*			
Antibiotics	**Sensitive**	**Resistant**	**Intermediate**
Gentamicin	**10 (40.0%)**	**02 (5.0%)**	**13 (55.0 %)**
Ciprofloxacin	**13 (54.0%)**	**3 (10.0%)**	**9(36.0%)**
Meropenem	**10 (40.0%)**	**3 (10.0%)**	**12 (50.0%)**
Imipenem	**15 (64.0%)**	**2 (5.0%)**	**8 (31.0%)**
Tobramycin	**10 (40.0%)**	**3 (10.0%)**	**12 (50.0%)**
Ceftazidime	**9 (37%)**	**4 (13.%)**	**12 (50%)**
Cefotaxime	**11 (45%)**	**3 (10.0%)**	**11 (45.0%)**
Amikacin	**11 (45.0%)**	**2 (5.0%)**	**12 (50.0%)**
Colistin	**23 (100%)**	**0**	**0**
Ampicillin	**0%**	**0%**	**100%**

Table 9.Antibiogram of *S.aureus*			
Antibiotics	**Sensitive**	**Resistant**	**Intermediate**
Penicillin	**09 (42.0%)**	**04 (16.0%)**	**9 (42.0%)**
Cefoxitin	**10 (58.0%)**	**02 (5.0%)**	**8(37.0%)**
Erythromycin	**9 (43.1%)**	**03 (11.0%)**	**10 (47.37%)**
Ampicillin	**10 (47.37%)**	**2 (5.26%)**	**10 (46.0%)**
Trimethoprim- sulfamethoxazole	**12 (58.0%)**	**3 (11.0%)**	**7 (31.0%)**
Tetracycline	**10 (48.0%)**	**3 (10.0%)**	**9(42.0%)**
Azithromycin	**9 (42.0%)**	**4 (15.0%)**	**10 (43.0%)**
Clindamycin	**12 (58.0%)**	**2 (6.0%)**	**8 (36.0%)**
Ciprofloxacin	**11 (53.0%)**	**4 (16.0%)**	**7 (31.1%)**
Vancomycin	**20 (100%)**	**0**	**0**

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Discussion

Urinary tract infections (UTIs) are the most common bacterial disease in children, affecting 8% of girls & two percent of boys below the age of seven.30 percent of persons who have had a UTI as a child are at risk of getting another one. Certain diseases, such congenital urinary tract abnormalities, increase a child's likelihood of developing UTIs.[2] UTIs can affect either the lower urinary tract (cystitis or bladder infection) or the upper urinary tract (pyelonephritis or kidney infection Particularly in children and newborns, it can be difficult to differentiate between clinical symptoms of pyelonephritis and cystitis..[16] Males are more likely than females to have P.mirabilis, and newborn infants are more likely to have *S. agalactiae than H. influenza, Staph.aureus, Staph. epidermidis, S. viridians, S. pneumoniae, and S. agalactiae. S. agalactiae* may be the cause of anatomic, neurological, or functional abnormalities of the urinary tract or weakened immune systems.[16] The only way to treat UTIs effectively is to properly identify the local bacteria and obtain information on the susceptibility pattern and any associated risk factors. The bacterial sensitivity pattern of prevalent diseases is steadily shifting in all nations due to improper antibiotic usage.[17] This study was carried out to isolate and identify catheter-associated bacterial pathogens within UTIs among pediatric individuals to find out the prevalence and antibiogram of catheter-associated bacterial pathogenic organisms in urinary tract infections among pediatric individuals and to take into account the aforementioned facts and figures as well as the significance of UTIs in pediatrics.

A total of 204 samples examined in this study. Out of these samples (38.2%) showed growth on nutrient agar**.** The 78 cultured positive samples were further processed to find out the frequency of bacteria**.** In processed samples, *P. aeruginosa* 25(32%) was found to be most prevalent, followed by E. coli 23 (29.4%) and *S.*

aureus 19 (24%) and *K. pneumoniae* 11(14%)**.** The findings of Mishra & Wadhai's (2016) study on P. aeruginosa in OT samples were relevant to this study.[18] Dhom et al. [19] in the technique of analysis on E. coli in surgical sites, and Mohammad et al. [20] in the study planned on K. pneumoniae in operation theater specimens were similar to our study. in our study Majority of the samples were collected from medical ward 70(34.3%),followed by surgical ward 68(33.33%) and urology ward 66(32.35%). These findings were corroborated by study on P. aeruginosa in ward samples by Sapkota et al.[21] and research on E. coli in surgical ward samples by Nasir, Muhammad Aetesam, et al. [22] According to P. aeruginosa antibiotic susceptibility profiling, tobramycin had the highest resistance, followed by meropenem, ceftazidime, and cefotaxime , while colistin (100%) and imipenem had the highest susceptibility.. In a comparative study conducted on catheter samples in the Czech Republic, Olejnickova et al[23] also found that P. aeruginosa isolates had a little susceptibility to amikacin and resistance to ciprofloxacin (43.0%) and gentamicin, but over 90 per cent susceptibility to colistin. A comparative study on catheter samples was also designed by Bizuayehu et al in Ethiopia. They reported that P. aeruginosa isolates showed high resistance to ceftazidime (83.3%), gentamicin (41.7%), and tobramycin (41.7%), as well as imipenem, a susceptible antibiotic (85.3%).[24] the little variation in the results might be the consequence of the study's different demographic location. The most susceptible antibiotics in the K. pneumoniae antibiotic susceptibility profile were imipenem 09 (72.5%) and colistin hundred percent next to gentamicin as well as ciprofloxacin (46%), while cefotaxime (27%) had the highest resistance, followed by meropenem, tobramycin, along with amikacin . High resistance to amikacin (94.4%), gentamicin (80.3%), ciprofloxacin (70.4%), & cefotaxime (53.5%) was reported by Hyun et al.[25] In their investigation on clinical samples in Korea. Variations in the kind of specimen and sampling site may be the cause of the discrepancy in results. According to E. Coli antibiotic susceptibility profiling, ciprofloxacin and colistin had the highest susceptibility, while gentamicin had the highest resistance, followed by tobramycin, meropenem, ceftazidime, or amikacin. Hyun et al. (2019) found that 99.2% of clinical samples in Korea were susceptible to amikacin, 56% to ciprofloxacin, and 66.1% to gentamicin in a comparison analysis.[25] Vancomycin (100%), clindamycin, cefoxitin, and trimethoprim-sulfamethoxazole (58.0%) were shown to have the highest susceptibility in S. aureus antibiotic susceptibility profile, whereas erythromycin and ampicillin showed the most resistance. In a research on S. aureus in catheter samples, Vidyasagar & Nagarathnamma (2018) similarly observed 100% vancomycin resistance; however, these isolates had a slight erythromycin (20%) and clindamycin (20%) susceptibility.[26] Concerningly a high frequency of infections in catheter specimens has been exacerbated by resistant isolates that are not just resistant to identified medicines. Resistance to antibiotics and other treatment alternatives is necessary for the real studies of bacterial contamination, which involve advanced studies.

Conclusion

This study concluded that the most prevalent bacteria in Catheter-Associated Bacterial Pathogens in Urinary Tract Infection amongst children were *P. aeruginosa* and *E. coli*. *P. aeruginosa*, E. *coli* and *K. pneumonia* were sensitive to colistin

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