

# UROPATHOGEN ISOLATES AND THEIR ANTIBIOTIC SENSITIVITY IN PATIENTS WITH INDWELLING CATHETER ASSOCIATED URINARY TRACT INFECTIONS

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## ABSTRACT

**Objective:** To determine the frequency of uropathogen isolates and their antibiotic sensitivity against commonly prescribed antibiotics in patients with indwelling catheter associated UTIs (CAUTIs) in our institution.

**Methodology:** Our study was carried out at the Departments of Internal Medicine and Nephrology, Lady Reading Hospital (LRH), Peshawar, from July 2018 to December 2018. It was a descriptive cross sectional study. Patients of both genders with UTI and who were catheterized with age ranging from 16 to 65 years were included through consecutive (non-probability) sampling technique. Specimens, catheter tip, were obtained under strict aseptic techniques to detect common bacterial isolates and their sensitivities against commonly prescribed antibiotics. Data were analyzed via SPSS version 20.

**Results:** There were total 179 catheterized patients. Among them, 67% patients were female. Mean age was 47 ±2.15 years. Sixty six (37%) patients had catheter associated UTI and among them 42 (63.64%) patients were female. *Escherichia coli* was found in 37% patients followed by *Klebsiella pneumoniae* in 20% patients. Meropenem and piperacillin-tazobactam had highest sensitivity (89%) in patients with CAUTIs.

**Conclusion:** One-third of our patients had catheter associated urinary tract infection and the most frequent bacteria found was *Escherichia coli* followed by *Klebsiella pneumoniae*. A higher resistance was found to the commonly prescribed antibiotics.

**Key Words:** Urinary tract infection, Catheterization, Catheter associated UTI, Uropathogens, *E. Coli*, Antibiotics

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## INTRODUCTION

Urinary catheters are standard medical gadgets used for relieving urinary retention and incontinence. Because of its recurrent use and lack of quality catheter care, 21-50% patients are at risk of different complications. Worldwide, the most remarkable indwelling catheter related complication is nosocomial urinary tract infections (UTIs) i.e. UTI acquired in a hospital setting<sup>1</sup>. Catheter-associated UTIs (CAUTIs) represent 40% of the whole nosocomial infections in hospital and hospice setups and establish almost 80% of nosocomial UTIs<sup>1,2</sup>. It can lead to increase in hospital stay, prolonged antibiotic therapy, financial loss and higher mortality<sup>3,4</sup>. Moreover, CAUTI may be associated with multi drug resistant

strains which may require aggressive antibiotic therapy and risk of spread to other patients<sup>5,6</sup>.

Indwelling urinary catheters act as portal of entry for uropathogens and a site for their multiplication. The development of bacteriuria in such patients occurs at a rate of 3-10% per day of catheterization. Among these, 10-25% may have symptomatic UTIs with ascending infection of bladder, ureters and kidneys<sup>7-9</sup>. According to the published research, the most frequent species are *Escherichia coli*, *Staphylococcus epidermidis*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Enterococcus spp.* and *Candida spp.*<sup>10,11</sup>.

Urinary tract catheterization is an important aspect of medical care. However, inherently as well as its in-

judicious use may lead to a huge burden of CAUTI in hospitalized patients with significant morbidity, mortality and utilization of a large number of available antibiotics<sup>12</sup>. The alarming increase in antibiotic resistance is a serious clinical concern. Rational use of antibiotics with proper dose, spectrum and duration are neglected by treating health care professionals<sup>13</sup>. As a result, treatment options are becoming more limited. Therefore, updated knowledge of the prevailing uropathogens and their antibiotic sensitivity/resistance pattern is important for optimal treatment of CAUTIs<sup>14</sup>.

The present study was conducted to determine the frequency of uropathogen isolates and their antibiotic sensitivity against commonly prescribed antibiotics in patients having indwelling catheter associated UTIs (CAUTIs) at our institution. This will aid in guiding appropriate antibiotic selection and development of guidelines for the treatment of CAUTIs. Consequently, length of stay in the hospital, extra costs and mortality may be reduced.

## METHODOLOGY

This study was carried out at the Departments of Internal Medicine and Nephrology, Lady Reading Hospital, Peshawar, from July 2018 to December 2018. It was a descriptive cross sectional study. Sample was collected through consecutive (non-probability) sampling technique. We included patients of both genders with UTI and who were catheterized with age ranging from 16 to 65 years. Patients who had taken antibiotics in last five days at the time of presentation and patients with urinary tract anatomical abnormalities as well as those who were unwilling to participate were excluded from the study. UTI was operationally defined as 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 (quantitative urine WBC >10 cells/microL) or positive urine culture. Patients with indwelling urethral catheterization and signs and symptoms consistent with UTI were defined as CAUTI. Culture positivity (Culture growth of  $\geq 10^5$  colony forming units (CFU)/ml of uropathogenic bacteria) obtained after 48 hours of urinary catheteriza-

tion was considered as catheter associated bacteriuria.

This study was conducted after being approved by institutional Ethical Review Board (IRB). Those patients who met our inclusion criteria were recruited for the study through OPD and Emergency departments. A written informed consent was acquired after the purpose of the study and its benefits were disclosed to the patients. All these patients were subjected to detailed history and clinical examination. From all included patients with UTI, specimens (catheter tip) were obtained under strict aseptic techniques and sent immediately to hospital laboratory for culture (isolation and identification) to detect common uropathogen isolates; and sensitivities (antimicrobial susceptibility testing) against commonly prescribed antibiotics (such as amoxicillin-clavulanate, quinolones, aminoglycosides, fosfomycin, nitrofurantoin, cefoperazone-sulbactam, piperacillin-tazobactam and meropenem) using standard microbiological methods. Relevant investigations were carried out including complete blood count (CBC), RBS, blood urea, creatinine and urine detailed report (D/R). Exclusion criteria were strictly followed for controlling confounders and bias in our results. All of the given information i.e. name, age, sex, presence of CAUTI, common bacteria and their antibiotic sensitivities, was registered in a predesigned proforma.

Data were then analyzed via SSPS version 20. Mean  $\pm$ SD was computed for quantitative variables i.e. age. Percentages and frequencies were calculated for categorical variables like gender, catheter associated UTIs, uropathogen isolates and their antibiotic sensitivities. All these results were then formulated into tables. Post stratification chi-square test was used and  $p \leq 0.05$  considered as significant.

## RESULTS

There were total of 179 catheterized patients. Among them, 67% patients were female. Mean age was  $47 \pm 2.15$  years. The frequency of CAUTIs was 30% in the age group of 56-65 years followed by 25% in 46-55 years age group. Stratification of catheter associated UTI with age is shown in Table 1.

**Table 1: Stratification of catheter associated UTI with age (n=179)**

Catheter Associated UTI	Age Groups					Total
	16 to 25 Years	26 to 35 Years	36 to 45 Years	46 to 55 Years	56 to 65 Years	
Yes	6	10	13	17	20	66
No	12	17	23	28	33	113
Total	18	27	36	45	53	179

**Table 2: Gender distribution of catheter associated UTI (n=179)**

Catheter associated UTI	Gender		Total
	Female	Male	
Yes	42 (23.46%)	24 (13.41%)	66 (36.87%)
No	78 (43.58%)	35 (19.55%)	113 (63.13%)
Total	120 (67.04%)	59 (32.96%)	179 (100%)

**Table 3: Uropathogen isolates (n=66)**

Uropathogens	Frequency	Percentage
<i>Escherichia coli</i>	24	37%
<i>Klebsiella pneumoniae</i>	13	20%
<i>Staphylococcus epidermidis</i>	12	18%
<i>Pseudomonas aeruginosa</i>	11	16%
<i>Enterococcus</i>	4	6%
<i>Proteus mirabilis</i>	2	3%
Total	66	100%

**Table 4: Antibiotics sensitivity pattern in patients with CAUTIs (n=66)**

Age Groups	Frequency	Percentage
Meropenem	59	89
Piperacillin-Tazobactam	59	89
Cefoperazone-Sulbactam	58	88
Fosfomycin	48	73
Nitrofurantoin	44	67
Ceftriaxone	9	14
Quinolones	5	7
Amoxicillin-Clavulanate	2	3

Sixty six (37%) patients had catheter associated UTI and among them 42 (63.64%) patients were female, as shown in Table 2.

*E. coli* was found in 37% patients followed by *Klebsiella pneumoniae* in 20% patients, as shown in Table 3.

Meropenem and piperacillin-tazobactam had highest sensitivity in patients with CAUTIs. Sensitivities of other antibiotics are shown in Table 4.

## DISCUSSION

Worldwide, 150 million people suffer UTI annually with more than 6 billion US dollars expenditure related to healthcare and absenteeism from work<sup>15</sup>. The mortality associated with CAUTI is about 10%<sup>16</sup>. In our study, 66 (36.87%) patients had catheter associated UTI. Our findings were similar to Bagchi et al<sup>2</sup> and Bi et al<sup>17</sup> who reported 29.09% and 37.4% patients with CAUTIs, respectively. In another study, 21.1% showed significant bacteriuria<sup>14</sup>. Karkee et al<sup>18</sup> reported significant bacteriuria and CAUTIs in 17 (12.5%) patients. Zarb et al<sup>19</sup> showed 17.2% of CAUTIs prevalence, which was lower as compared to our study. On the other hand, Anthony et al<sup>20</sup> observed significant bacteriuria in 60.9% of their study patients. The difference in frequency of CAUTIs can be explained by differences in host susceptibility, hygiene practices, technique of catheterization, duration of indwelling catheter and quality of catheter care among the different populations studied.

In our study, 63.64% patients with CAUTIs were female and 36.36% patients were male. Our findings were in accordance with other studies which showed increased frequency of CAUTIs in females as compared to males (70–80% vs.20–30%) respectively<sup>2</sup>. In another study, 89.2% of the isolates were from females<sup>21</sup>. Females are considered at high risk for UTI and about one-third experience it at some point in their lifetime. The gender difference in frequency and susceptibility of CAUTIs can be explained by differences in the anatomical structure of the genitourinary tract (females have relatively shorter and wider urethra)<sup>22</sup>, closer proximity of female urethra to the anus, lack of prostatic fluid with antimicrobial properties in females, sexual behavior, use of sanitary materials and hygiene practices<sup>23,24</sup>.

Mean age in our study was 47 ±2.15 years. The frequency of CAUTIs was highest (30%) in the age group of 56–65 years followed by 25% in 46–55 years age group. Our findings were similar to the other published studies. Karkee et al<sup>18</sup> showed increased frequency of CAUTIs among age group of 61–70 years. Another study reported 27% and 25% frequency of CAUTIs in those 61 years and above followed by 50–60 years of age respectively<sup>25</sup>. Increasing age is considered an important risk factor for acquiring CAUTIs due to relatively weak immune status as well as increased need for catheterization<sup>26</sup>.

*Escherichia coli* was the most frequent uropathogen found in 37% of patients with CAUTIs followed by *Klebsiella pneumoniae* (20%), *Staphylococcus epidermidis* (18%) and *Pseudomonas aeruginosa* in 16% patients. Our results were in conformity with the previously published studies showing *E. coli* as the most frequent uropathogen isolated from patients with CAUTIs. The frequency distribution of *E. coli* as reported by different studies from various regions of the world include: Canada 80%<sup>27</sup>, India 70%<sup>28</sup>, Korea 38.7%<sup>29</sup> and Nigeria 21.5%<sup>30</sup>. Similarly, Hossain et al<sup>31</sup> reported *E. coli* in 81% of isolates, Sabir et al<sup>11</sup> in 80% and Sandhu et al<sup>32</sup> 41.17% of isolates. In another study, *E. coli* was the most common uropathogen (34.85%) followed by *Klebsiella pneumoniae* (19.7%)<sup>2</sup>. Karkee et al<sup>18</sup> showed *E. coli* and *Klebsiella pneumoniae* as the commonest uropathogens (35.3% and 17.65% respectively).

In our study, resistance shown by uropathogens to the commonly used antibiotics included amoxicillin-clavulanate (97%), quinolones (93%), ceftriaxone (86%), aminoglycosides (54%), fosfomycin (31%), nitrofurantoin (26%), cefoperazone-sulbactam (12%), piperacillin-tazobactam (11%) and meropenem (11%). In the study by Sabir et al<sup>11</sup>, *E. coli* showed highest resistance among isolates to different antibiotics as: amoxicillin (100%), amoxicillin-clavulanate (62.6%), doxycycline (66.6%), quinolones (54.2%), ceftriaxone/imipenem (43.3%), tazocin (14%) and amikacin (12.7%). Another study showed that *E. coli* had resistance to quinolones in 85% of isolates<sup>33</sup>.

Gebremariam et al<sup>14</sup> also reported increased resistance of isolates to commonly used antibiotics including ampicillin (81–100%), amoxicillin-clavulanate (77–93.6%), co-trimoxazole (55–72.3%) and tetracyclines (46–55.5%). Moreover, resistance was significantly higher in CAUTI patients as compared to the non-catheterized patients<sup>31</sup>. Catheter-associated isolates were found to have resistance to fluoroquinolones in 35% and cefepime / ceftazidime in 16%<sup>34</sup>. Ahmed et al<sup>35</sup> observed increased resistance in isolated micro-organisms and most of the commonly used antibiotics were found ineffective. However, carbapenems showed comparatively lower resistance.

## CONCLUSION

In our setup, the frequency of catheter associated urinary tract infection was 37% and the most frequent bacteria found was *Escherichia coli* followed by *Klebsiella pneumoniae*. A higher resistance was found to the commonly prescribed antibiotics.

## RECOMMENDATIONS

Decrease in the prevalence of CAUTIs can be achieved through establishment of standard guidelines regarding

judicious catheterization, sterile placement, high quality catheter care and timely removal of catheter. Based on the locally prevalent uropathogens and their antibiotic sensitivity, treatment regimens and guidelines need to be tailored and antibiogram need to be made and followed accordingly. Antibiotics with least resistance like cefoperazone-sulbactam, piperacillin-tazobactam and meropenem should be used preferably for treatment of CAUTIs.

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#### CONTRIBUTORS

AMK conceived the idea, planned the study and drafted the manuscript. ZA, GSS, N, MK and MA helped acquisition of data, searched the literature, did statistical analysis and drafted the manuscript. MARA supervised the study and critically revised the manuscript. All authors contributed significantly to the submitted manuscript.