Original Research Article

Bacteriological Study of Catheter Associated Urinary Tract Infection in a Tertiary Care Hospital

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**Abstract**

Catheter associated urinary tract infections (CAUTI) are one of the most common cause of hospital acquired infections or nosocomial infections. Indwelling urinary catheterization in hospital setting has become a potential source for drug resistance and has now gained a prime importance in patient outcome. Hence, the aim of this study is to isolate uropathogens from CAUTI and find out antimicrobial sensitivity pattern among the isolates. This study was conducted over a duration of 2 years and urine samples were collected from 126 catheterized patients. The urine samples were processed microbiologically and antimicrobial sensitivity was performed. Out of 126 catheterized patients, 26 developed CAUTI and Escherichia coli 17 (65.3%) was the most common organism followed by Proteus species 4 (15.38%), Klebsiella pneumoniae 2 (7.6%), Enterococcus species 2 (7.6%) and staphylococcus epidermidis 1 (3.8%). Enterobacteriaceae showed significant resistance to drugs like gentamycin, ciprofloxacin, and ceftazidime and were highly sensitive to drugs like imipenem, meropenem, nitrofurantoin, amikacin, ceftazidime - clavulanic acid and piperacillin - tazobactum. Among the gram positives, enterococcus 2 (7.6%) was the most common organism followed by staphylococcus epidermidis 1 (3.8%). Only one (3.8%) ESBL producer was detected among gram negative bacilli. 26 patients (20.63%) developed CAUTI among the analyzed 126 patients. Among these 13 (50%) developed CAUTI on 7th day of catheterization. Hence, dedicated infection control practice along with early diagnosis and timely therapeutic management is very important to control these CAUTI.

**Keywords**

CAUTI, infection control, ESBL, Escherichia coli.

**Article Info**

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**Introduction**

Catheter associated urinary tract infection is one of the most common cause of hospital acquired infections. The indwelling catheterization has become a potential cause for morbidity among patients admitted in the hospital and has gained a prime importance in patient outcome. Bacteriuria develops in around 10 to 15% of hospitalized patients with indwelling urethral catheter. Among the community acquired pathogens E. coli is responsible for approximately 80 to 90% of cases followed by other gram negative bacilli and gram positive cocci. CAUTI in patients with indwelling urinary catheters is
presumed by the presence of signs or symptoms compatible with urinary tract infection with no other identified source of infections along with 10^5 or more CFU/ml of one bacterial species in a single catheter urine specimen (48 hours catheterization) or in a mid stream voided urine specimen from a patient whose catheter has been removed within the previous 48 hours. In appropriate use of antimicrobial agents and inappropriate following of preventive bundles has led to increase in emergence of multidrug resistant uropathogens and increased risk of mortality in hospitalized patients (Hooton et al., 2009).

**Materials and Methods**

This study was conducted over a period of 2 years in a tertiary care hospital PESIMSR, Kuppadam. A total of 126 urine samples were collected from patients who were catheterized.

The following patients were excluded from the study:

- Patients who were earlier treated with UTI were excluded.
- Patients already suffering from cystitis and prostatic enlargement.
- Patients on suprapubic catheter, nephrostomy tube and condom catheter were excluded.

Samples were collected on first day of catheterization, later repeated every alternate day till 11th day. First day sample was collected and processed to rule out prior urinary tract infection. The samples collected were inoculated onto blood agar and Macconkey agar by using standard calibrated loop. Samples which had ≥ 10^5 CFU/ml were processed further for biochemical reactions and antimicrobial sensitivity testing. Screening of ESBL producing strains was done using ceftriaxone, ceftazidime, aztreonam, cefotaxime and cepodoxime. CAUTI in patients with indwelling urinary catheters is presumed by the presence of signs or symptoms compatible with urinary tract infection with no other identified source of infections along with 10^5 or more CFU/ml of one bacterial species in a single catheter urine specimen (48 hours catheterization) or in a mid stream voided urine specimen from a patient whose catheter has been removed within the previous 48 hours.

**Results and Discussion**

Out of the 126 patients analyzed, 26 (20.63%) of them developed CAUTI. Among them 12 (46.1%) were female and 14 (53.9%) were male. 13 (50%) of them developed CAUTI on the 7th day of catheterization. *Escherichia coli* 17 (65.3%) was the most common organism isolated followed by proteus species 4 (15.38%), *Klebsiella pneumoniae* 2 (7.6%), *Enterococcus* species 2 (7.6%) and *Staphylococcus epidermidis* 1 (3.8%). Gram negative bacilli were predominant than gram positive cocci. Among gram positive cocci *Enterococcus* species 2 (7.6%) was the most common followed by *Staphylococcus epidermidis* 1 (3.8%). Only one (3.8%) ESBL producer (*Klebsiella*}
pneumoniae) was detected among gram negative bacilli.

Out of 126 catheterized patients analyzed for CAUTI, 26 (20.63%) developed catheter associated urinary tract infection, which is similar to studies done by Kulkarni et al., (Kulkarni et al., 2014), Bhatia et al., (Bhatia et al., 2010), Bagchi et al., (Bagchi et al., 2015). Male predominance was seen compared to females, which was similar to that reported by Jaggi et al., (Namitha Jaggi et al., 2012). 23 (88.46%) patients were found to develop CAUTI after 7 days of catheter insertion, which correlated with studies done by Kulkarni et al., Prolonged catheterization was found to be associated with increased cases of CAUTI, therefore proper maintenance and care of catheter is required to reduce the incidence of CAUTI (Sabir et al., 2014). Among the uropathogens isolated E. coli was the most common followed by Proteus vulgaris, Klebsiella, Enterococcus species and Staphylococcus epidermidis. These findings matched with that of Bagchi et al., Kazi et al., (Mohammad Mukhit Kazi et al., 2015), and Jayashri et al., (Jayashri et al., 2015).

Table.1 organisms isolated from urine of catheterized patients

| Organisms                        | Total isolates-n | Percentage % |
|----------------------------------|------------------|--------------|
| Escherichia coli                 | 17               | 65.3%        |
| Klebsiella pneumoniae            | 2                | 7.6%         |
| Proteus species                  | 4                | 15.38%       |
| Enterococcus species             | 2                | 7.6%         |
| Staphylococcus epidermidis       | 1                | 3.8%         |

Table.2 Antibiotic sensitivity pattern of gram positive organisms

| Antimicrobials                  | Staphylococcus epidermidis (%) | Enterococcus species (%) |
|--------------------------------|--------------------------------|--------------------------|
| Ampicillin                      | 100                            | 50                       |
| Amikacin                        | 100                            | -                        |
| Amoxycillin - clavulinic acid   | 100                            | -                        |
| Clindamycin                     | 100                            | 50                       |
| Co-trimoxazole                  | 100                            | -                        |
| Ciprofloxacin                   | 100                            | 50                       |
| Erythromycin                    | 100                            | 50                       |
| Gentamycin                      | 100                            | -                        |
| Levofloxacin                    | 100                            | -                        |
| Nitrofurantoin                  | 100                            | 100                      |
| Norfloxacin                     | 100                            | 0                        |
| Ofloxacin                       | 100                            | 0                        |
| Penicillin                      | 0                              | 0                        |
| Teicoplanin                     | 100                            | 100                      |
| Vancomycin                      | 100                            | 100                      |
Table.3 Antimicrobial sensitivity pattern of gram negative bacilli

| Antimicrobials                  | Escherichia coli (%) | Klebsiella pneumoniae (%) | Proteus species (%) |
|---------------------------------|----------------------|---------------------------|---------------------|
| Amikacin                        | 87                   | 100                       | 75                  |
| Ampicillin - sulbactum           | 87                   | 50                        | 75                  |
| Ceftriaxone                     | 72                   | 50                        | 50                  |
| Ceftazidime                     | 74                   | 50                        | 75                  |
| Ceftazidime - clavulenic acid   | 88                   | 50                        | 100                 |
| Ciprofloxacin                   | 24                   | 50                        | 25                  |
| Gentamycin                      | 87                   | 50                        | 25                  |
| Imipenem                        | 100                  | 100                       | 100                 |
| Meropenem                       | 100                  | 100                       | 100                 |
| Nitrofurantoin                  | 94                   | 100                       | 100                 |
| Piperacillin - tazobactum       | 87                   | 50                        | 75                  |

Enterobacteraeae showed significant resistant to common antibiotics like Ciprofloxacin, gentamycin, and ceftriaxone. Most of the gram negative bacilli showed complete sensitivity to drugs like nitrofurantoin, imipenem, meropenem, piperacillin-tazobactum, and ampicillin-sulbactum. Most of the gram positives showed complete sensitivity to drugs like vancomycin, teicoplanin, and nitrofurantoin (Anupurba et al., 2003).

In conclusion, prolonged catheterization is an important risk factor for the development of hospital acquired infections like CAUTI. Among the uropathogens isolated E. coli is the most common agent. Uropathogens isolated from CAUTI showed one ESBL producer and some of them resistant to commonly used antibiotics. This shows that appropriate timely diagnosis and management is very important to control these pathogens. Strict aseptic precaution has to be taken while insertion and daily catheter care to reduce CAUTI. Strict antibiotic stewardship and antibiotic policy following can reduce inappropriate use of antimicrobials.

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