

## Original Article

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# Antibiotic sensitivity pattern of urinary samples isolated from the ICU patients in tertiary care centre

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### Abstract

**Background:** Urinary tract infection (UTI) is the commonest infections diagnosed in out-patients and hospitalized patients. It is the most important cause of morbidity in the world affecting all age group across the life span and in both genders and usually required medical treatment. The emergence of antibiotic resistance in the UTI is a serious public health issue. Our study was designed to identify the pathogen of UTI in catheterised ICU Patient and their antibiotic sensitivity pattern.

**Methods:** Urine samples from ICU patients is collected for period of 6 months. Sample received were routinely subjected to culture on nutrient agar, macconkey agar, Blood agar incubated at 37 degree Celsius overnight. Culture which showed significant pure growth is concerned further evolution. Gram stain is done from the colony's and further biochemical reaction were carried out. Antibiotic sensitivity done by Kirby Bauer disc diffusion method in Miller Hinton Agar. Zone size will be Interpretated according to CLSI Guidelines.

**Results:** This six-month prospective study was conducted to determine the prevalence of organisms in intensive care unit patients as well as their culture and sensitivity patterns in Sree Balaji Medical College and Hospital, Chennai. The study comprised 100 patients who met the inclusion criteria, with 52 men and 48 women participating. Culture positivity was found in 25% of the study participants. *E. coli* infections were more prevalent in the study. It was resistant to ampicillin and ciprofloxacin and susceptible to nitrofurantoin and third-generation imipenam.

**Conclusion:** The current study examines the prevalence of organisms, as well as their culture and sensitivity patterns, in a tertiary care hospital's Intensive Care Unit. Culture-positive infections were found to be prevalent in 25% of the research participants. Nitrofurantoin and third-generation imipenam were found to be toxic to organisms in the study. Resistance to ampicillin and ciprofloxacin was widespread.

### Introduction:

Urinary tract infections (UTIs) are a major public health problem in terms of

morbidity and financial cost, and they are the most expensive urological diseases in terms of total health care costs. Even when renal failure is present, the risk of death is higher

than that of chronic renal failure<sup>1</sup>. UTIs affect both men and women. Clinical studies suggests that women are more likely to get UTIs than men. In healthy women, uncomplicated UTIs occur at a rate of 50/1000/year<sup>2</sup>. At least one episode of UTI affects about half of all women at some point in their lives; between 20% to 40% of women experience recurring episodes. Men account for around 20% of all UTIs<sup>3</sup>. CAUTI (catheter-associated urinary tract infection) is a leading cause of illness and mortality in Indians, affecting people of all ages. Nearly half of patients who require an indwelling urine catheter for more than 5 days develop bacteriuria or candiduria. In every hospital, asymptomatic bacteriuria is a major source of antibiotic-resistant bacteria, with critical care units (CCUs) accounting for the majority of them<sup>4</sup>. CAUTI is a leading source of hospital-acquired bacteremia, and even asymptomatic bacteriuria has been linked to increased in-hospital mortality. Patients in critical care units frequently become feverish for a variety of reasons, both infectious and non-infectious. The significance of UTIs in the CCU stems from the difficulty in separating urosepsis from insignificant bacteriuria with fever from other causes. As a result, starting antibiotic therapy based on a positive urine culture is always appealing. The current study focuses on critical difficulties in the ICU's management of patients with UTI<sup>4</sup>. In a study of over 4300 patients in neurologic intensive care units (ICUs), Dirinker et al. discovered that elevated body temperatures were associated with increased mortality. Longer ICU and hospital stays are associated with greater mortality rates and poorer outcomes. When harmful organisms are found in the urine, urethra, bladder, kidney, or prostate, it is considered to be a UTI. In most cases, infection is indicated by the presence of more

than  $10^5$  organisms per millilitre in a properly collected midstream clean-catch urine sample<sup>5</sup>. In some cases of genuine UTI, however, substantial bacteriuria is absent. A lower quantity of germs ( $10^2$  to  $10^4$ /ml) may indicate infection, especially in symptomatic patients. Colony counts of  $10^2$  to  $10^4$ /ml in urine specimens acquired by suprapubic aspiration or in-and-out catheterization, as well as samples from a patient with an indwelling catheter, often suggest infection<sup>6</sup>. On the other hand, colony counts of more than  $10^5$ /ml of midstream urine are often caused by specimen contamination. To avoid specimen contamination, patients should collect clean-caught midstream urine which is especially prevalent when numerous species are discovered. *Escherichia coli* causes the majority of simple UTIs, but other organisms such as enterococci, *Staphylococcus saprophyticus*, *Klebsiella* spp., and *Proteus mirabilis* can also cause them<sup>7</sup>. Antibiotic resistance has developed as a result of the widespread and inappropriate use of antimicrobial agents, which has become a major problem worldwide in recent years. Antimicrobial medication therapy can be beneficial for a short time, but it can also promote the growth of multidrug resistant organisms (MDROs), such as *Pseudomonas* species, yeast, and resistant gram-negative bacteria. Antibiotic usage can also lead to *Clostridium difficile* infections<sup>8</sup>. The present study is an attempt to analyse the antimicrobial sensitivity pattern of pathogens isolated from the urine samples of admitted patients in ICU patients with catheters. The goal of my study is to determine the pathogen of urinary tract infection in catheterized ICU patients as well as their antibiotic sensitivity patterns.

## **Methodology**

This study was carried out in the Central Diagnostic Laboratory, Department of Microbiology, Sree Balaji Medical College and Hospital, Chennai, between April 2021 and September 2021. The Institutional Review Board approved the study.

**Study Design:** Cross sectional study

**Collection of Samples:** Urine samples from ICU patients.

**Sample Processing:** Urine samples from ICU patients is collected and processed in the lab. This study was done for period of 6 months. Sample received were subjected to culture on Nutrient agar, MacConkey agar and incubated at 37 degree Celsius overnight. Culture which showed significant pure growth is concerned further evolution. Gram stain is done from the colony and further biochemical reaction were carried on. Antibiotic sensitivity done by Kirby Bauer disc diffusion method in Mueller Hinton agar. Zone size was Interpretated according to CLSI Guidelines in mm.

**Sample Size:** 100 Urine Samples

**Inclusion Criteria:** All patients admitted in ICU with urinary tract infection from April to September 2021.

**Exclusion Criteria:** Patients with previous history of Urinary Tract Infection were excluded.

**Study Population:** ICU patients in Sree Balaji Medical College and Hospital, Chrompet, Chennai.

Study Period: Six months

Informed Consent: Not applicable

**Laboratory Methods:** A portion of the specimen is used for bacterial culture, while the rest is examined under the microscope right away.

**Microscopy:** The deposit is centrifuged and analysed under a microscope for pus cells, erythrocytes, epithelial cells, and bacteria.

**Culture:** For urine specimen culture, most laboratories use a semi quantitative method (the standard loop technique).

**Standard loop technique:** To culture a fixed volume of uncentrifuged urine, a typical calibrated loop is employed. Blood agar and MacConkey's agar are used and incubated for 24 hours at 37°C. The number of colonies produced the next day is counted, and the total count per millilitre is determined. The blood agar allows for a quantitative measurement of bacteriuria, while MacConkey's medium allows for a bacterium's presumptive diagnosis

**Interpretation of results:** Kass (1956) established the following criteria for active bacterial infection of the urinary tract: Significant bacteriuria occurs when the number of bacteria in a single species is greater than  $10^5$ /mL. Doubtful significance: a sample with between  $10^4$  and  $10^4$  bacteria per mL should be cultured again. There is no significant growth ( $10^3$  bacteria per mL, and they are considered contaminants).

**Identification:** Colony characteristics, Gram's staining, motility, biochemical reactions, and the slide agglutination test are used to identify the organisms.

**Antibiotic sensitivity test:** Multiple drug resistance develops in Escherichia coli and other prevalent urinary infections, and it is transferrable. Antibiotic sensitivity is required for successful antibiotic treatment.

**Inoculation of samples onto various culture media:** The sample was inoculated onto plates of 5% sheep blood agar, MacConkey agar<sup>9</sup>, Nutrient agar by a semi

quantitative technique using a sterile bacteriological loop, according to standard procedure. These plates were incubated at 37°C aerobically for 24–48 hours<sup>10</sup>. Primary plates were observed for any visible growth after 24 hours, and if there was no growth within 24 hours, they were further incubated for another 24 hrs. All types of colonies on the primary plate were examined macroscopically using a magnifying lens, and the colony characteristics were recorded<sup>10</sup>.

#### **Gram stain for culture smears:**

Smears were made from isolated colonies, stained by Gram staining, and were observed under oil immersion objective for the size, shape, and gram arrangement that would help in preliminary identification.

**Motility:** Motility is demonstrated by the hanging drop method.

#### **Identification of Organisms**

**Gram Positive Organisms:** (*Staphylococcus aureus*, *Coagulase negative staphylococcus species*, *Enterococcus species*). They are gram - positive cocci of a size ranging from 0.5-2 um, spherical in shape, and arranged either in singles, clusters, or pairs. Colonies on blood agar are circular, smooth, convex, opaque or translucent, and range in size from 1–4 mm, with a narrow zone of beta hemolysis or no hemolysis.

**Gram Negative Organisms:** (*Escherichia coli*, *Klebsiella pneumonia*, *Klebsiella oxytoca*, *Citrobacter freundii*, *Enterobacter species*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Proteus mirabilis*, *Providencia species*). They are thin, long or short, plump or pleomorphic gram-negative bacilli. In macconkey agar, colonies are circular or spreading, convex or flat, smooth, moist or mucoid, lactose fermenting or non-lactose fermenting, with sizes ranging from 2-4 um.

In blood agar, colonies are circular or spreading, smooth, convex or flat, opaque or translucent, and greyish white colonies with occasional beta hemolysis.

#### **Antibiotic Sensitivity Testing:**

Antimicrobial susceptibility testing of the identified organisms<sup>39</sup> was done by using commercially available disc (Himedia, India) in accordance with Kirby Bauer's disc diffusion method (CLSI).

#### **Results:**

This six-month prospective study was conducted to determine the prevalence of organisms in intensive care unit patients as well as their culture and sensitivity patterns. Sree Balaji Medical College and Hospital, Chennai. The study comprised 100 patients who met the inclusion criteria, with 52 men and 48 women participating. Culture positivity was found in 25% of the study participants. Culture's Pervasiveness Positive attitudes are more prevalent in children under the age of three. *E. coli* infections were more prevalent in the study. It was resistant to ampicillin and ciprofloxacin and susceptible to nitrofurantoin and third-generation imipenam. Infections caused by *E.coli*, which were sensitive to Nitrofurantoin and resistant to ampicillin, were more prevalent in urinary tract infections.

#### **Discussion**

The most prevalent nosocomial infection is urinary tract infection (UTI), with catheterization being the most common cause. Foley's catheter used in all patients. The purpose of study was to know the prevalence of bacterial isolates in urinary tract infection. In this study, 100 patients, of whom 52 were males, and 48 were Females were included. Among the 100 patients, 25 patients had bacterial growth in urine in ICU patients. It

constituted 25% of urine culture positives cases. This was consistent with the studies done by Tambyah et al.<sup>11</sup> where it was 30% and Henry Alaveran et al., where it was 26%. The incidence of urinary tract infection among males in my study was 13%, and that in females was 12%. This was consistent with studies done by Somwang et al and Tambyah et al.<sup>16</sup>, which showed that females have a higher risk for catheter-associated urinary tract infection. The most common organism producing catheter associated urinary tract infection in my study was *Escherichia coli* (44%), followed by *Klebsiella pneumonia* (28%) and *Enterococci* (11%). In most of the studies like Herbert et al.<sup>12</sup>. and Tambyah et al.<sup>11</sup>., the commonest organism producing the catheter associated urinary tract infection was *Escherichia coli*, followed by *Klebsiella pneumonia*. A similar result was obtained in studies done by M. Sharifi et al. in Iran and Tangtrakul et al. in Thailand, which showed that *Klebsiella pneumoniae* was more common than *Escherichia coli* in catheter-associated urinary tract infection. The present study showed, common organisms like *Escherichia coli* and *Klebsiella pneumoniae* were resistant to a high percentage of the commonly used antibiotics. Antibiotics like Ampicillin (100%) and cefuroxime (72.7%). In my study, gentamicin was sensitive to a greater percentage of *Klebsiella pneumoniae* (71.4%) and *Escherichia coli* (81.8%). This study showed 25% of the urine culture positive patients were asymptomatic this was consistent with a study by Tambyah et al.<sup>11</sup> where more than 90% of catheter-associated urinary tract infection patients were asymptomatic<sup>11</sup>. In my study, all the patients were put on antibiotics from day one. This necessitates catheterization. But still, the risk of urinary tract infection in catheterized patients was 25% which was consistent with

studies where the risk of Infection was around 10% without any prophylactic antibiotics. This shows it is clear that prophylactic antibiotics have no role in catheter-associated urinary tract infections. Urinary infection this was consistent with studies done by Warren JW et al.<sup>12</sup> and Tambyah et al.,<sup>11</sup> which showed that there was no role for prophylactic antibiotics in catheter-associated urinary tract infection. In our study comprised 100 patients who met the inclusion criteria, with 52 men and 48 women participating. Culture positivity was found in 25% of the study participants. 13% of samples were received from males and 12% of samples were received from females. *Escherichia coli* 11 (44%), was the common organism isolated, followed<sup>13</sup> by *Klebsiella pneumonia* 28%), *Pseudomonas aeruginosa* 3 (12%), *Enterococcus* species 2 (8%), *Acinetobacter* 1 (4%), *Klebsiella oxytoca* 1 (4%). The organisms show resistant to ampicillin, ciprofloxacin and susceptible to nitrofurantoin and imipenam. Infections caused by *Escherichia coli*, which were sensitive to Nitrofurantoin and resistant to ampicillin, were more prevalent in urinary tract infections.

### Conclusion:

The current study examines the prevalence of organisms, as well as their culture and sensitivity patterns, in a tertiary care hospital's Intensive Care Unit. Culture-positive infections were found to be prevalent in 25% of the research participants. In the Intensive Care Unit, gram-negative organisms were more prevalent. In catheterized individuals, urinary tract infection is prevalent. The likelihood of a catheter-associated urinary tract infection increases as the number of days catheterized increases. Females developed catheter-associated urinary tract infection than males. Organisms

were susceptible to Nitrofurantoin and third-generation imipenam. Resistance to ampicillin and ciprofloxacin was widespread.

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