Pattern of antimicrobial sensitivity in Enterococcus in case of urinary tract infection, 5 years experiences in a tertiary care hospital

Ashis Kumar Saha¹

¹Professor & Head of Medicine, MGM Medical College & LSK Hospital, Kishanganj, Bihar, India

*Corresponding Author: Ashis Kumar Saha
Email: asissaha2008@gmail.com

Abstract

Introduction: Urinary tract infection is very common in our community mostly in females and enterococcal infection is very frequent. There is gradual development of resistance against this organism thus narrowing the spectrum of susceptibility.

Aims: So, the aim of this study to detect the spectrum of sensitivity pattern in case of enterococcus in case of urinary tract infection.

Materials and Methods: In this retrospective cross sectional study, morning midstream clean-catch urine form total 1550 symptomatic patients was studied for the spectrum of antibiotic susceptibility according to Clinical & laboratory Standard Institute (CLSI) guideline.

Results: Total 189 patients were infected with enterococci. They showed sensitivity to Vancomycin (87.83%), Teicoplanin (85.18%), Lenozolid (84.12%) and nitrofurantoin (74.07%), and moderate degree of sensitivity in piperacillin-tazobactam (67.19%), imipenem (64.60%) and gentamicin (46.56%) and Amoxyclillin-clavulanic acid (54.49%).

Conclusion: Proper antibiotic-stewardship is ultimate requirement to prevent the development of bacterial resistance. So, regular surveillance as well as monitoring is very much necessary to update the knowledge about the susceptibility pattern of urinary pathogens which will guide the therapy.

Keyword: Enterococcus, Symptomatic urinary tract infections, Culture and sensitivity, Tertiary medical centre.

Introduction

Urinary tract infection (UTI) is one of the most common infection in case community as well as hospital settings worldwide.1,3 It is most common in females but in case of elderly its incidence is equal in both men and women.2,4 The factors responsible frequency of UTI in females are due to shorter urethra, close proximity to anus and lack of bacteriostatic properties of prostatic secretion. Again, female genital tract is very close to urethra which may lead to spread of infection from one tract to the other.7 UTI may be complicated or uncomplicated. Uncomplicated UTI may be asymptomatic bacteriuria, or it may be cystitis, pyelonephritis in case of men and nonpregnant women. Complicated UTI may be due to above causes when there is associated comorbidity, like, diabetes, immunocompromized or any anatomical barrier, pregnancy. Some organisms will be more virulent in glucose environment so history diabetes is very important in case UTI. Symptoms are usually burning sensation during in micturition, frequency or urgency in micturition, hematuria, suprapubic pain or loin pain. Anatomical barrier may be prostate related, foreign body, tumor or stone in urinary tract, obstructed catheter usually hinder the free flow of urine leading to accumulation of urine and it will imbibe the infection. Again after therapy there may be reinfection or relapse of infection. Relapse is due to infection with the same organism by which the patient was infected as it persisted even after treatment. On the other hand reinfection is due the new organism. The organisms responsible for UTI are Escherichia coli, Enterococcus, Klebsiella, Pseudomonas, Streptococci, Staphilococcus Epidemidis, Proteus, Gram Negative Staphilococci, Serratia, Gram Negative Enteric Bacteria and Yeast.6,8,9 Now annual incidence of urinary tract infection is nearly 25 million worldwide and 30% of total UTI is hospital acquired.10 Traditionally 7—10 courses of antibiotics are recommended for UTI in males short courses for 3 days even single dose therapy are for females as they mainly suffer from cystitis. Short course of B-lactam is not properly investigated as compared to trimethoprim or nitrofurantoin so it requires extensive studies.11 Again in case of hospital acquired acute pyelonephritis, the organisms are resistant to common antibiotics. So, in those cases, broad spectrum antibiotics should be given to start with after sending the urine for culture. Catheter induced UTI is fairly common which may lead to asymptomatic bacteriuria but it can be resolved by removal of catheter.12 But now-a-days novel catheters have been introduced because in these catheters bacteria will not be able to adhere which will decrease the incidence of asymptomatic or symptomatic bacteriuria. The catheter may be of silver alloys based or incorporated with rifampicin and minocycline.13,14 But from the costing point of view silver-alloyed catheter is usually used when it is absolutely necessary to keep the catheter for more than months.15 In case of pregnancy, nearly 5% suffer from asymptomatic bacteriuria and again few of these patients enter into pyelonephritis and these are usually responsible for low-birth weight babies, pre mature delivery, preeclampsia or hypertension. So, repeated urinry culture to detect asymptomatic bacteriuria should be done and follow-up antibiotic treatment should be done to reduce the incidence of UTI and complications during pregnancy.16,17 Following measures can be taken to reduce the incidence of UTI, like, antiseptic use after intercourse, cranberry or blueberries juice containing tannis as it decrease the incidence of pathogens to the uroepithellium, regular cleaning of the urethral opening, intravaginal application of topical estrogen and long courses of low-dose antibiotics. But now-a-days
indiscriminate and improper use of antibiotics, inadequate dose, inadequate duration, frequent change of antibiotic usually lead to resistance of many organisms to many broad spectrum antibiotics and there is change in the pattern of sensitivity of many organisms to different antibiotics. This sensitivity pattern again varies in different geographical areas depending upon the use of antibiotics. Therefore, the aim of this study was to know the pattern of sensitivity of enterococcus against different antibiotics in this geographical area so that it can be used as guideline for proper treatment of all types of patients.

Materials and Methods
The study was started after getting permission from the local ethical committee of our hospital. This is a cross sectional retrospective study of five years from our medical college. Total 1550 patients with suggestive symptoms of UTI were taken in this study. Morning midstream clean catch urine specimen were collected for microbial analysis. No mixed infections were encountered. Urine specimen was inoculated by pre calibrated platinum loop in MacConkey agar and 5% sheep blood agar media to deliver a measured quantity (1.0 μl) to detect the growth of the susceptible bacteria. Enterococcus was detected on brain-heart infusion agar (Becton Dickinson Microbiology systems, Cockeysville, MD, USA) supplemented with 2000 mg/L streptomycin as well as 500 mg/L gentamicin. At 37°C for 48 hours colony forming unit (CFU) count of 10⁵/ml was considered as positive. Then, antibiotic susceptibility was tested by using Kirby-Bauer disk diffusion method following CLSI guideline. For this commercial antibiotics were used for sensitivity test. Following antibiotic disc were taken from the manufacturers, Becton Dickinson and Company, USA, Oxoid Ltd. UK: Imipenem (10 μg), amikacin (30 μg), nitrofurantoin (300 μg), gentamicin (30 μg), tobramycin (30 μg), cefazidime (30 μg), ceftriaxone (30 μg), ciprofloxacin (5 μg), amoxicillin-clavulanic acid (20/10 μg), ampicillin (25 μg), Vancomycin (30 μg), linezolid (30 μg), piperacillin-tazobactam (100/10 μg), Teicoplanin (30 μg), azithromycin (15 μg), cephalixin (30 μg) were used. Staphylococcus aureus (ATCC 25923), Pseudomonas aeruginosa (ATCC 27853) and E. coli (ATCC 25922) were used as control strains.

Statistical method
Obtained data were entered in the STATISTICAL PACKAGE SOCIAL SCIENCES version 17 for proper evaluation for calculation of percentage for different susceptibility pattern.

Result
Total number of patients included was 1550 and total number of affected patients with enterococcus was 189 (12.19%).

| Table 1: Pattern of antimicrobial Sensitivity pattern of Enterococcus fecalis infection of urinary tract (n=189) |
|-----------------|---------------|----------------|
| **Antibiotic**   | **Sensitivity** | **Percentage** |
| Amoxycillin      | 53            | 28.04          |
| Amoxycillin-Clavulanic acid | 103          | 54.49          |
| Piperacillin-Tazobactam | 127          | 67.19          |
| Cefoparazone-Tazobactam | 2            | 1.05           |
| Cefuroxime       | 1             | 0.53           |
| Cefotaxime       | 1             | 0.53           |
| Cefoxitin        | 1             | 0.53           |
| Cefazidime       | 1             | 0.53           |
| Ceftriazone      | 1             | 0.53           |
| Cefepime         | 0             | 0              |
| Azithromycin     | 0             | 0              |
| Aztreonam        | 2             | 1.05           |
| Ertapenem        | 3             | 1.58           |
| Imipenem         | 124           | 65.60          |
| Meropenem        | 13            | 6.87           |
| Gentamicin       | 88            | 46.56          |
| Tobramycin       | 10            | 5.29           |
| Netilmicin       | 26            | 13.75          |
| Amikacin         | 16            | 8.46           |
| Norfloxacin      | 42            | 22.22          |
| Ciprofloxacin    | 60            | 31.74          |
| Ofloxacin        | 53            | 28.04          |
| Levofloxacin     | 66            | 34.92          |
| Cotrimoxazole    | 6             | 3.17           |
| Chloramphenicol  | 5             | 2.64           |
| Tetracycline     | 6             | 3.17           |
| Tigicycline      | 4             | 2.11           |
| Vancomycin       | 166           | 87.83          |
| Teicoplanin      | 161           | 85.18          |
| Lenazolid        | 159           | 84.12          |
| Polymyxin B      | 11            | 5.82           |
| Colistin         | 11            | 5.82           |
| Ticarcillin      | 4             | 2.11           |
| Nitrofurantoin   | 140           | 74.07          |

Table 1 showed highest degree of sensitivity in case of Vancomycin (87.83%), Teicoplanin (85.18%), Lenazolid (84.12%) and nitrofurantoin (74.07%), and moderate degree in piperacillin-tazobactam (67.19%), imipenem (64.60%) and gentamicin (46.56%) and Amoxycillin-clavulanic acid (54.49%). Table 1 also demonstrated 100% resistance to cefepime and azithromycin, less than 5% sensitivity to other fourth generation of cephalosporin, aztreonam, ertapenem, ticarcillin, Cotrimoxazole, chloramphenicol, tetracycline, Tigicycline. Fluoroquinolones demonstrated mild degree of sensitivity (lowest was the Norfloxacin 22.22% and highest was levofloxacin 34.92%).

Discussion
Since bacterial infection of the urinary tract is most common in our community hence it needs urgent attention. So identification of the organism is of prime importance as it detects the susceptibility of the organism to the specific
antibiotic which can cure the patient. Empirical use and
improper duration of the antibiotic administration will lead
to resistance to that antibiotics which may be responsible for
the emergence of multidrug resistant organism in the
community as well as in the hospital settings. This
resistance may be due to development of spontaneous
mutation, development in the enteric bacteria by R plasmids
which is responsible multidrug resistance. Similarly, another
study demonstrated 100% sensitivity to vancomycin,
lenozolid.19 Sharifi et al. demonstrated 18.6% resistance
against enterococcus as compared to this present study.20
One study from South India demonstrated 81% sensitivity
for vancomycin to enterococcus.21 Antibiotic resistance
cannot explain the virulence of enterococci. Because any
infection in the body follows a common sequence of events,
like, colonization followed by adhesion to host tissues,
invasion of the host tissues and resistance to the host
defense mechanism. Now the pathogen directly infects the
urinary tract by toxin production or indirectly by producing
inflammation produces for pathological changes.22

In the antibiogram of Khan IU et al, in the year 2014
enterococcus was susceptible to Lenozolid, vancomycin and
Teicoplanin are 100% sensitive and nitrofurantoin was
92.3% sensitive which was very similar to this present study.
On the other hand, the present study demonstrated 65.60% sensitivity to
imipenem whereas the study of Khan IU et al. it was nearly
92%.

This study showed that only 12.19% patient was
affected by enterococcus related urinary tract infection. It is
nearly same in the study done by Setu SK et al. in 2016 (268
out of total number affected 2287, 11.67%).24

Significant resistance was observed in case of most
commonly used antibiotics, like, fluoroquinolones for their
broad-spectrum action, bacterial potency, well tolerance to the
patients, good oral bioavailability and excellent post
antibiotic effect. But due to progressively development of
resistance enterococcus in this present study demonstrated
low sensitivity (31.74% -- 34.92%) as shown in the study
done by Setu et al.24

Conclusion
Due to empiric use of antibiotics in inadequate dose for
improper duration without proper culture and sensitivity
lead to development of multidrug resistant bacteria. Thus,
there is gradual narrowing of the spectrum of antibiotic
sensitivity for any bacteria which ultimately increases the
mortality of the patient. So, proper antibiotic-stewardship is
the ultimate requirement to prevent the development of
bacterial resistance. So, regular surveillance as well as
monitoring is very much necessary to update the knowledge
about the susceptibility pattern of urinary pathogens which
will guide the therapy.

Acknowledgement
We are very thankful for the laboratory technician for
providing us the information of this records.

Source of funding
Nil.

References
1. Akortha EE, Ibadin OK. Incidence and antibiotic susceptibility pattern of staphylococcus aureus, amongst the patients with
2. Dalela G, Gupta S, Iain DK, Mehta P. Antibiotic resistance pattern in uropathogens at a tertiary care hospital at Jhalawar with special reference to ESBL, Amp-C β-Lactamase and
Inc. 634.
7. Epstein JI. The lower urinary tract and male genital tract system, chapter 21 in “Robbins and Cotran Pathologic basis of
10. Abu Shaqra. Occurrence and antibiotic sensitivity of Enterobacteriaceae isolated from a group of Jordanian patients
12. Godfrey KM, Lindsay EN, Ronald AR. How long catheter
insertion of standard latex and sinver-impregnated latex Foley
impregnated bladder catheters in reducing catheter associated
bacteriuria: a prospective randomized, multicenter clinical
15. Plowman R, Graves N, Esquivel J. An economic model to
assess the cost and benefits of the routine use of silver alloy
coated urinary catheters to reduce the risk of urinary tract
infections in catheterized patients. J Hosp Infect 2001;48:33-
42.
16. Mayon-White RT, Ducel G. An international survey of the
17. Fisher JF, Newman CL, Shobel JD. Yeast in the urine:
9.


