Original Article

Urinary Tract Infections: A Community Study From Suburban Mumbai

Dr. Sapna Malik *, Dr. Sonali Pahuja , Dr. Vimal Pahuja
Associate Professor, Department of Microbiology, K.J. Somaiya Medical College

ARTICLE INFO

Keywords:
Antimicrobial sensitivity
Bacterial isolates
Out Patient Department
Urinary tract infections.

ABSTRACT

AIM: Study of bacterial isolates from urine samples with their antimicrobial sensitivity pattern from patients attending the outpatient department of suburban clinics. Methods: Urine samples were processed on routine media, the isolates obtained were identified and sensitivity was obtained by an automated analyser. Results: Of 755 urine samples 205 (27.15%) showed no growth in culture, 155 (20.5%) samples grew more than 3 colonies i.e. polymicrobial flora suggestive of contamination, 82 (10.9%) urine grew insignificant growth of gram negative bacilli. Majority of the uropathogens were gram negative bacilli (74.1%) followed by gram positive cocci (23.6 %) and fungal isolates were (2.2%). The gram positive isolates were sensitive to most of the drugs tested like Nitrofurantoin (100 %) Tigecycline (100%) Vancomycin(100%) Linezolid (100%) Gentamicin (82-100%) Levofloxacin showed (83-91%) for Staphylococcus aureus & CONS. Enterococcal strains were highly resistant to Levofloxacin and Cotrimoxazole. CONS were highly resistant to Ampicillin. All the gram positive isolates showed decreased sensitivity to Ciprofloxacin (23-41%). The E coli strains were highly sensitive to Amikacin (100%) Imipenem (97%) Colistin (97%) Nitrofurantoin (89.6%) Piperacillin-tazobactam (83%) Tobramycin (83%) and showed moderate sensitivity to Gentamicin (69%) Cefpirome (66%) Ampicillin sulbactam (58%) Ceftriaxone (55%) Ciprofloxacin (51%) Cotrimoxazole (51%) and resistant to Ampicillin. The Klebsiella isolates were highly sensitive to Amikacin (100%) Imipenem (100%) Piperacillin tazobactam (100%) Colistin (92%) Gentamicin (84%) Tobramycin (84%) Ampicillin-Sulbactam(80%) Cotrimoxazole (78%) Ciprofloxacin (73%) and moderately sensitive to Cefpirome (52%) Ceftriaxone (50%). Conclusion:Urinary tract infections are amongst the commonest infections encountered in clinical practice. This article highlights the importance of urine culture and sensitivity as one of the gold standards for the effective treatment and for avoiding irrational use of antimicrobials to reduce the growing resistance in the community and thereby prevent the emergence of highly resistant bacterial strains within the community and ensure judicious use of these agents.

1. Introduction

Urinary Tract Infections (UTI) are amongst the most common of all the bacterial infections affecting humans during their life span. They are also the most common type of bacterial infections seen in outpatient medical practice. Rising incidence of antibiotic resistance and a better understanding of the ecological adverse effects of antibiotics warrant a re-evaluation of the treatment recommendations for uncomplicated UTIs. Uncomplicated UTI is classified as either uncomplicated cystitis or uncomplicated pyelonephritis. UTIs occurring in men, pregnant women and patients with immune suppression or urinary tract anomalies, urinary calculi, recent urologic instrumentation, indwelling catheters and renal transplant are considered complicated infections and require more careful and complex decision making for treatment. UTIs are the second most common infection seen in the general population.

Due to the female anatomy, they are more common and problematic, up to one third of women will experience UTI at some point during their lifetime. Appropriate treatment of a UTI requires accurate classification that includes infection site, complexity of infection and likelihood of recurrence.
Mostly bacteria cause UTIs by ascending means through the urethra into the bladder. Bacteria must possess the virulence factors that cause UTIs. Host defense factors that predispose patients to UTI include urinary stasis, anomalous urinary tract anatomy, Diabetes Mellitus, debility and advanced age. Women have estrogen related issues and shorter urethral length which are the main predisposing factors for an UTI. The common symptoms of UTI are urgency and frequency of micturition with associated discomfort or pain. The commonest condition is cystitis due to infection of the bladder with a uropathogenic bacterium like E.coli, Staphylococcus saprophyticus, Klebsiella spp, Proteus spp, Pseudomonas spp or Enterococcus spp. Candida infections may occur in diabetic or immune compromised hosts. Rarely infections can be caused by Streptococcus spp., anaerobic Streptococci or Gardenella vaginalis. The most serious infections are acute pyelitis and pyelonephritis where loin pain and fever are accompanied by bacteremia detected by blood culture. Certain patients with signs and symptoms of UTI sometimes produce samples of urine that show pus cells but do not yield a significant growth and this can be due to anti-microbial therapy, organisms that do not grow on ordinary media such as Tuberculosis, Gonococcal infection or Anaerobic bacteria, abacterial pyuria which may be due to urethral or bladder infection with Chlamydia, Ureaplasma spp, Trichomonas or viral infections. In pregnancy due to enlarged uterus there is stagnation of urine which causes bacteriuria thus asymptomatic bacteriuria is very common. In children, many a times, a low count is also significant specimen from bladder taken by supra pubic aspiration or catheterisation may yield low counts and must be regarded as significant. Significant bacteriuria: an observation of Kass in 1957 suggested that the number of bacteria to indicate significant bacterial infection in urine is 1,00,000 (10^5) CFU/ml, in true infections and absence of prior antibiotic therapy the number of infecting organisms are likely to be ≥ 10^7 CFU/ml.

**MATERIALS and METHODS**

The study included patients attending the Out Patient Department of a diagnostic center and neighboring general physician Out Patient Department in a suburb of Mumbai. All patients were given wide mouth containers and were explained method of collection of a midstream urine catch. Patients were advised to collect first morning urine samples and the samples to be given to the laboratory within two hours of collection. In case of any delay patients were instructed to refrigerate the samples and given to the laboratory as soon as possible. They were also advised to give a sample before starting any medication or antibiotics. If any of the patients were experiencing severe discomfort and burning micturition, the sample was collected immediately so that the patient could start medication earlier. Once the urine sample reaches the laboratory it is processed in 30-45 minutes without any delay. An un-centrifuged wet mount is seen to determine e number of pus cells and any bacteria or parasite. The urine is then inoculated on Blood agar and MacConkey's agar using sterile standard loops which hold 0.01 ml of urine, these are then incubated for 18-20 hours and both plates are examined the next day for growth. Hundred colonies of one or two organisms in a sample are significant and processed further for identification and antibiotic sensitivity testing. Three or more colonies growth is disregarded and a repeat sample is requested if clinically indicated. Sometimes less than 100 colonies are grown which is reported as insignificant growth and identification and antibiotic sensitivity testing is done only if a special request from clinician is received. Growth is further identified and antibiotic sensitivity pattern is reported by automated analyser -Vitek2 machine.

**RESULTS**

Total number of samples received by laboratory for culture from February 2013 to January 2015 were 2095. Of these samples 755 (36%) were urine samples, from these samples 205 (27.1%) showed no growth in culture, 155 (20.5%) samples grew more than 3 colonies i.e. polymicrobial flora suggestive of contamination, 82 (10.9%) urine grew insignificant growth of gram negative bacilli, 313 (41.46%) urine samples had significant growth of bacteria of these 298 (39.5%) yielded single organisms and 15 (2%) samples grew 2 organisms having significant bacteriuria. The male to female ratio was 1:6, 86% of samples were from women and 14% were from men and adult to child ratio was 9:1. All our patients attended outpatient department and were treated by the family physicians on Out Patient Department basis. There were a few samples which were received from indoor patients but they are not included in the study.

The various organisms isolated in our study were E.coli (46.3%) followed by Enterococcus faecalis (12.8%) then Klebsiella spp (12.1%) Proteus spp (7%) Coagulase negative Staphylococcus spp (7%) Staphylococcus aureus (3.8%) Pseudomonas (3.8%) Enterobacter (3.8%) Candida spp (2.2%) and Acinetobacter (1%).

Majority of the uropathogens were gram negative bacilli 74.1% followed by gram positive cocci 23.6 % and fungal isolates were 2.2%. In our study E.coli (46.3%) were isolated from maximum number of samples and they were highly sensitive to Amikacin (100%) Tigecycline (100%) Imipenem (97%) Meropenem (96.4%) Colistin (97%) Etrapenem (93%) Nitrofurantoin (89.6%) Piperacillin-tazobactam (83%) Tobramycin (83%) Aztreonam (69%) Cefepime (66%) Gentamicin (69%) and the isolates showed moderate sensitivity to Ampicillin sulbactam (58%) Ceftriaxone (55%) Moxifloxacin (55%) Cefazolin (51%) Giprofloxacine (51%) Cotrimoxazole (51%) and the isolates showed resistance to Ampicillin with only (24%) strains being sensitive. Klebsiella (12.1%) was the second most common isolate in the gram negative bacilli causing urinary infection in our study group. The Klebsiella isolates were highly sensitive to Amikacin (100%) Imipenem (100%) Etrapenem (100%) Tigecycline (100%) Piperacillin tazobactam (100%) Colistin (92%) Gentamicin (84%) Tobramycin (84%) Ampicillin-Sulbactam (80%) Moxifloxacin (78%) Cotrimoxazole (78%) Giprofloxacine (73%) moderately sensitive to Cefepime (52%) Ceftriaxone (50%) and resistance to Cefazolin (23%) and Ampicillin-Sulbactam (26%) all the Klebsiella strains were inherently resistant to Ampicillin. The other isolates found in our study were Proteus spp (7.03%) Pseudomonas spp (3.83%) Enterobacter spp (3.83%) and Acinetobacter spp (1%). The Proteus...
spp and Enterobacter spp showed good sensitivity to Aminoglycosides, Carbapenems, Quinolones, Piperacillin-Tazobactam and Colistin ranging from 90-100%, second and third generation Cephalosporins and Aztreonam showed moderate sensitivity of 60%.

The non-fermenters were highly sensitive to Amikacin, Gentamicin, Piperacillin-tazobactam, Cefpime, Aztreonam, Etrapenem, Imipenem and Meropenem and showed least sensitivity to Cefazolin, Ampicillin, Nitrofurantoin and Cotrimoxazole. Pseudomonas was highly resistant to Ampicillin-Sulbactam but Acinetobacter spp showed 100% sensitivity to the drug.

Amongst the gram positive isolates Enterocoooci spp (12.78%) topped the list followed by Coagulase Negative Staphylococci (CONS) (7.03%) and Staphylococcus aureus (3.83%). The Enterocoooci isolated and highly sensitive to most of the drugs like Teicoplanin (100%) Tigecycline (100%) Vancomycin (100%) Linezolid (100%) Nitrofurantoin (100%) Rifampicin (82%) Clindamycin (82%) HS Gentamicin (82%) Penicillin (82%) Ampicillin (77%) and Erythromycin (77%). They showed high level of resistance to the following drugs Ciprofloxacin, Cotrimoxazole, Levofloxacin, Quinpristin-Dalfopristin and Tetracycline with sensitivity ranging from 2-10%. The CONS (7%) showed good sensitivity to Teicoplanin (100%) Tigecycline (100%) Vancomycin (100%) Linezolid (100%) Nitrofurantoin (100%) Gentamicin (100%) Tetracycline (100%) Cotrimoxazole (100%) Levofloxacin (83%) Moxifloxacin (83%) and Rifampicin (83%). The isolates were moderately sensitive to Clindamycin (50%) but there was resistance to Penicillin, Ampicillin and Erythromycin with 33% sensitivity to each drug. The Staphylococcus aureus (3.83%) strains were highly sensitive strains with good sensitivity to the most of the drugs tested, Ampicillin (100%) Teicoplanin (100%) Tigecycline (100%) Ceftriaxone (100%) Cefotaxime (100%) Quinpristin-Dalfopristin (100%) Gentamicin (100%) Moxifloxacin (91%) Levofloxacin (91%) Rifampicin (91%) Cotrimoxazole (91%) and Penicillin (75%) only Erythromycin had decreased sensitivity of 50%. All the Staphylococcus spp. were sensitive to Oxacillin.

**TABLE 1** : Number Of Samples With Growth And No Growth In Culture

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>NUMBER</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL NUMBER OF SAMPLES RECEIVED FOR CULTURE</td>
<td>2095</td>
<td>36.04</td>
</tr>
<tr>
<td>Urine Culture</td>
<td>755</td>
<td>36.04</td>
</tr>
<tr>
<td>Growth In Urine Culture</td>
<td>313</td>
<td>41.46</td>
</tr>
<tr>
<td>Insignificant Growth In Urine Culture</td>
<td>62</td>
<td>10.86</td>
</tr>
<tr>
<td>Polymeric Flora In Urine Culture</td>
<td>155</td>
<td>26.02</td>
</tr>
<tr>
<td>No Growth In Urine Culture</td>
<td>205</td>
<td>27.15</td>
</tr>
</tbody>
</table>

**TABLE 2** : Organisms Isolated in Culture

<table>
<thead>
<tr>
<th>Total Number Of Organisms</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escherichia coli</td>
<td>145</td>
</tr>
<tr>
<td>Enterococcus faecalis</td>
<td>40</td>
</tr>
<tr>
<td>Klebsiella spp</td>
<td>38</td>
</tr>
<tr>
<td>Proteus spp</td>
<td>22</td>
</tr>
<tr>
<td>Coagulase Negative Staphylococcus spp</td>
<td>22</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>12</td>
</tr>
<tr>
<td>Pseudomonas spp</td>
<td>12</td>
</tr>
<tr>
<td>Enterobacter spp</td>
<td>12</td>
</tr>
<tr>
<td>Candida spp</td>
<td>67</td>
</tr>
<tr>
<td>Actinobacter spp</td>
<td>63</td>
</tr>
</tbody>
</table>

**TABLE 3** : Gram Positive Isolates with Sensitivity Pattern

**TABLE 4** : Gram Negative Isolates With Sensitivity Pattern:

---

DISCUSSION

UTIs are commonly encountered in clinical practice, thus clinicians need to be abreast with the advantages and limitations of diagnostic tests and empirical antibiotic therapy for improved outcome for patients. UTIs are the second most common infection in general population, frequently seen in most patients attending the Out Patient Department. Urine analysis is a simple test that can be performed in a clinic setting. It can be utilized to evaluate patients with urinary complaints with ease and rapidity. In urinary analysis, dip stick results are more likely utilized for deciding therapeutic intervention as compared to microscopic urine analysis. Dip stick testing varies in its accuracy for prediction of infection such as nitrate test having high specificity but poor sensitivity. The combination of dipstick positive leukocyte esterase and routine blood tests have the highest sensitivity of 77% and specificity of 70%. Urinary analysis may also suggest diagnosis other than UTI for e.g. Clue cells, trichomonas spp and others.3

Urine culture till date remains as gold standard for diagnosing UTIs, a culture showing No Growth essentially rules out UTI caused by the common organisms.3,4 Urine culture ideally obtained before and without antibiotics is recommended in patients with acute pyelonephritis and in management of pediatric UTIs. Culture is also recommended in patients with complicated UTIs (congenital abnormalities, pregnancy, immune suppression etc.) recurrent UTIs or failure of empiric treatment.

Our study includes patients suggestive of UTIs where urine culture is advised before starting antibiotics by the family physician. Most cases are comprised of uncomplicated cystitis, our patients are mostly Out Patient Department cases attending the various clinical centers in the area for urinary complaints.

The male to female ratio in our study is 1:6 which explains that women are at higher risk of UTIs than men due to female’s anatomy of a shorter urethra than men and estrogen dependant issue.4 The study also included 5.9% children below 5 years of age.

In our study of 2095 samples were received for culture of which 755 (36.04%) samples were urine. Thus of all the samples received for culture the largest single fraction was urine. Of these samples 41.46% showed significant growth and in 10.90 % two infecting organisms having significant growth were reported. Samples which grew three or more organisms constituted 20.53 % of the received samples. These were hence labeled as Polymicrobial flora which is suggestive of contamination.

A hospital study done by Desai et al yielded 23.56% of significant growth in urine which is less as compared to our study.6 This indicates that most of the patients are treated by family physician on Out Patient Department basis rather than a hospital unless associated with a complication or severity of symptoms. Another study by Sood et al showed only 17.19% of urine samples yielded significant growth7 which again suggests that UTIs is one of the most frequent infections encountered by a family physician and very few patients attend a hospital Out Patient Department for UTI.

Majority of the uropathogens isolated were enteric gram negative bacilli (69.32%) followed by gram positive cocci (23.64%), followed by non fermenting gram negative bacilli (4.79%) and Candidial infections comprised of (2.23%) of the isolates which can be compared with studies done by Desai et al which reported 63.22% of enteric gram negative bacilli and 25.8% of gram positive cocci isolates and Amin et al reported 94% enteric gram negative bacilli and 5.6% gram positive cocci. Enteric gram negative bacilli colonise the urogenital mucosa with adhesion by pili/fimbriae and P-1 blood group phenotype receptor hence E.coli and Klebsiella are most common uropathogens.4,6,8,9,10 Our study has 22.3% of Candida species isolated which is comparable with studies by Dimitrov etal where Candida albicans comprised of 3% of isolate.11 In a study done by Khan et al Candida spp species 10.5% were the second most common uropathogen.12 Various similarities and differences in the uropathogens isolated by different authors may result from various factors such as different host factors, socioeconomic status, hygiene practices, environmental conditions, health care practices, and cultural differences in each country.

The present study is a community based study, but our results of gram positive isolates is comparable with Desai et al and few more authors.6,7,13 Amongst the gram positive isolates Enterococcus faecalis was most common isolate followed by CONS and Staphylococcus aureus, Enterococcus faecalis tops the list of gram positive isolates as they are a gut flora and known to cause UTIs very frequently but they are a challenge to the clinician for treatment being highly resistant organisms.14 These organisms were highly resistant to Ciprofloxacin, Cotrimoxazole, Levofloxacin, Quinpristine-Dalfopristine which showed only 23% sensitivity each and for 10 tetracycline only 10% of the strains were sensitive. Enterococci spp. showed 100% sensitivity to drugs like Penicillin, Ampicillin, HS Gentamicin, Nitrofurantoin, Rifampicin, Erythromycin, Clindamycin, Linezolid, Vancomycin, Tigecycline and Teicoplanin leaving the clinician with multiple choices for treatment of these UTIs. Sensitivity pattern obtained by us is comparable to a study done by A. Somwane et al.15 Staphylococcus aureus strains were sensitive to Penicillin and Ampicillin showing 75-100% sensitivity and CONS were showing resistance to both drugs with only 33% of strains being sensitive. Staphylococcus aureus and CONS showed good sensitivity to majority of drugs i.e. Gentamicin, Cotrimoxazole, Nitrofurantoin, Levofloxacin, Moxifloxacin, Rifampicin, Quinpristine-Dalfopristine, Linezolid, Vancomycin, Tetracycline, Teicoplanin and Tigecycline sensitivity ranging from 83 - 100%. The drugs like Ciprofloxacin, Erythromycin and Clindamycin showed low to moderate sensitivity with CONS and...
Staphylococcus aureus sensitivity ranged for the above drugs from 33-50%, except 100% sensitivity to Clindamycin. Amongst the gram positive cocci isolates, Enterococci strains in our study were resistant to the commonly used drugs for UTIs like Ciprofloxacin, Cotrimoxazole, Levofloxacin but sensitive to Nitrofurantoin. Staphylococcus aureus and CONS showed sensitivity to most of the drugs except Ciprofloxacin therefore this emphasizes the importance of urine culture and sensitivity as an important investigation in treatment of UTIs and is a useful guideline to the treating physician in case of difficult and resistant organisms. CONS are now an accepted uropathogen and are found to be multidrug resistant. Our study highlights the same wherein most of the CONS isolates were resistant to Penicillin, Ampicillin, Ciprofloxacin, Erythromycin and Clindamycin. Nitrofurantoin, Linezolid and Vancomycin were most effective drugs and is comparable with studies done by Kumar et al.16

Hence to conclude, in our study, though gram positive cocci were found to be resistant to two or more drugs, but majority of the strains were highly sensitive to Nitrofurantoin, Cotrimoxazole, Linezolid and Vancomycin, thereby making Nitrofurantoin or Cotrimoxazole the drug of choice for treatment of community acquired UTIs and keeping Linezolid and Vancomycin as reserve drugs.

The antibiogram of our gram negative isolates showed that most of the isolates were highly sensitive to Amikacin, Imipenem, Meropenem, Tigecycline, Colistin, Nitrofurantoin, Etrapenem and Piperacillin-Tazobactam ranging from 82.7 - 100%. The Cephalosporins, Fluoroquinolones and Cotrimoxazole were moderately effective against the isolates with sensitivity ranging from 51-70%. The Ecoli strains were more resistant to the Cephalosporins and Fluoroquinolones as compared to others, Klebsiella spp, Proteus spp and Enterobacter spp showed very good sensitivity to most of the tested drugs. Amongst the non fermenting gram negative bacilli most of the strains were highly sensitive to Piperacillin-Tazobactam, Cefipime, Aztreonam, the Carbapenems, Aminoglycosides and Colistin. A difference in sensitivity was observed with Fluoroquinolones where in Acinetobacter strains were more sensitive than the Pseudomonas strains. Therefore to conclude the gram negative bacilli showed good sensitivity to higher drugs like Amikacin, Carbapenems, Tigecycline, Colistin, Piperacillin-Tazobactam and moderate sensitivity to routinely used drugs such as Cephalosporins and Fluoroquinolones which is comparable to a study done by Horcajada et al.17 Fluoroquinolones are showing a highly variable efficacy against the gram negative isolates thus again emphasizing that all UTIs should be treated post a urine culture and sensitivity investigation to avoid misuse or irrational use of antibiotics in the community.

CONCLUSION

Thus to conclude from our study, Fluoroquinolones which are routinely used in treatment of UTIs are now being found to be less effective in both gram negative and gram positive bacterial infections hence they should be used judiciously. Nitrofurantoin shows good efficacy in both gram negative and gram positive bacteria hence it can be used to treat uncomplicated UTIs and it also gets concentrated in the urine thereby proving advantageous in treatment of UTIs. Selection of appropriate antibiotic also reduces the collateral damage of antibiotics, the antimicrobial resistance and hospital interventions thereby increasing rational & more efficacious prescribing and improving clinical outcome. Thus clinicians need to be aware of the antimicrobial pattern and should rely on urine culture investigation so as to know the infecting organism and the sensitivity pattern of the same to avoid irrational use of antibiotics in the Out Patient Department thereby ensuring better life for every individual in the community.

REFERENCES

5. A G Fraser; J G Collee, A Simmons, Collee, B P Marmion: Mackie and Mcnartney Practical Medical Microbiology 11th Edition

© Copyright 2019 BioMedSciDirect Publications IJBMR - ISSN: 0976:6685. All rights reserved.