Prevalence and Antimicrobial Resistance Pattern of Bacterial Strains Isolated from Patients with Urinary Tract Infection

Abstract

The risk of morbidity and complications with urinary tract infection (UTI) are more common in women. Urinary tract infection (UTI) affects all age groups, but women particularly are more susceptible than men due to anatomical relationship of the urinary tract. The risk of complications due to UTI is more common in women, because UTI may be associated with asymptomatic Bacteriuria in women. Asymptomatic Bacteriuria is defined as the presence of actively multiplying bacteria within the urinary tract and culture reveals a significant growth of pathogens that is equal or greater than 10⁵ bacteria per ml of urine, at the time when the patient has no clinical symptoms of urinary tract infection [1-3]. The potential adverse effects of the undiagnosed UTI leads to pyelonephritis and cystitis. In different studies the prevalence of significant Bacteriuria in women was reported as 3-20 % [1-15]. Significant Bacteriuria is a microbial diagnosis based on the isolation of significant count of bacteria in a properly collected specimen of urine from women with symptoms of UTI. Urine culture is the standard test for diagnosing of UTI. This study was therefore undertaken to determine the prevalence and antimicrobial susceptibility pattern of bacterial strains isolated from patients with urinary tract infection women attending at PESIMSR, Kuppam.

Keywords: Antimicrobial Resistance; Antimicrobial Susceptibility Testing (AST); Significant Bacteriuria; Urinary Tract Infection (UTI); Uropathogens; Urine Culture

Abbreviations: UTI: Urinary Tract Infection; AST: Antimicrobial Susceptibility Testing; CONS: Coagulase Negative Staphylococcus

Introduction

Urinary tract infection (UTI) affects all age groups, but women particularly are more susceptible than men due to anatomical relationship of the urinary tract. To investigate the prevalence of urinary tract infection among patients at PES Institute of Medical Sciences & Research Centre, Kuppam, to identify the causative bacteria and to explore their resistance pattern to antimicrobials. This study was conducted with 500 cases of women attending for checkup. Midstream urine specimen was collected from these women and immediately processed for culture. Growth in those plates with significant bacteriuria were subjected to standard biochemical tests for identification and antimicrobial sensitivity. Out of the 500 specimens 68 (13.6%) samples were positive, from which 11 different isolates in this study. Predominant isolate under the gram negative bacteria was Escherichia coli in 28 cases (41.1%) followed by Klebsiella pneumoniae in 9 cases (13.2%), Pseudomonas aeruginosa 4 cases (5.8%), Proteus mirabilis 4 cases (5.8%), Citrobacter koseri 3 cases (4.4%), Proteus vulgaris 3 cases (4.4%), Klebsiella oxytoca 2 cases (2.9%), Providencia rettgerii 2 cases (2.9%) and under the gram positive bacteria Coagulase negative Staphylococcus (CONS) was predominant isolate in 6 case (9.1%), Staphylococcus aureus in 5 cases (7.3%) followed by Enterococcus faecalis 2 cases (2.9%).

Material and Methods

A total of 500 women who do have clinical signs and symptoms of UTI with ages ranging from 18 to 45 years attending at PESIMSR during six month of period were included in this study. Women who were on antibiotic treatment two weeks prior those who having clinical signs and symptoms of urinary tract infection (UTI) were included for this study. Oral consent was taken from the patient and suitable instructions to collect mid stream urine in to the sterile container provided to them was given to all those patients. Specimen was transported to the Department of Microbiology, PESIMSR without delay and processed in the laboratory.

Sampling and bacteriological analysis

Specimen collection
Processing of specimen: (a) Direct microscopy (i) Wet mount (ii) Gram’s stain
(b) Semi quantitative culture method.
(c) Screening test for urine.
i. Specimen collection

a. Mid-stream Specimen of Urine (MSU): Urine samples were collected by obtaining the mid-stream flow by the clean-catch technique. The midstream portion of urine is then collected in plastic sterile, wide-mouthed with a 12 OZ (350ml) container should be covered with a tightly fitted lid.

Transport of specimen: Once collected, urine was transported to the laboratory without delay, for urine is an excellent culture media and contaminating bacteria can readily multiply to reach apparently significant numbers.

Processing of specimen

a) Direct microscopy

(i) Wet mount: A wet mount examined after centrifugation was done for detection of both pyuria and bacteriuria. Approximately 10 ml of urine was centrifuged in a tube at 2500-3000 rpm for 5 minutes. The supernatant was discarded and a drop of the deposit was placed on a slide. The drop was covered by a coverslip and observed under a high power objective for bacteriuria, the number of organism/HPF was examined (at least 10 organism/HPF) while for pyuria, the number of pus cells per 20 HPF were counted (more than 10 pus cells/20 HPF).

(ii) Gram's stain: The sediment obtained by centrifuged urine for wet mount examination was used to prepare a smear on a slide, heat fixed and stained by Gram's staining technique. The slide was then observed under oil immersion objective for presence of bacteria and pus cells. Presence of 1 bacteria/oil immersion field was considered positive. At least 50 fields were examined before declaring the smear negative.

b) Semi quantitative culture: All the samples were inoculated on to Blood agar, MacConkey agar and Cystine Lactose Electrolyte Deficient (CLED) agar using calibrated loop as per the standard procedure for semi quantitative technique developed by Kass for urine culture. Those culture plates with bacterial growth showing $10^5$ bacteria per ml of urine were taken up for further processing. Bacterial growth from those plates was identified using standard biochemical tests. Antimicrobial sensitivity was performed as per the Kirby - Bauer disc diffusion method using commercially available discs (Hi-media) on Muller-Hinton Agar plates. After overnight incubation, the zone of inhibition formed around each antibiotic disc was measured and interpreted as sensitive, intermediate and resistant.

Results

Out of 500 urine specimens processed in this study, 68 (13.6%) showed significant bacteriuria. Thus the prevalence of significant bacteriuria in women in this study was 13.6% (Table 1-3) (Figure 1-3).

Table 1: Details of isolates.

| Name of the isolate | No. of isolates | Percentage n= 68 |
|---------------------|----------------|-----------------|
| Escherichia coli    | 28             | 41.10%          |
| Klebsiella pneumoniae | 9              | 13.20%          |
| Pseudomonas aeruginosa | 4              | 5.80%           |
| Proteus mirabilis  | 4              | 5.80%           |
| Citrobacter koseri | 3              | 4.40%           |
| Proteus vulgaris    | 3              | 4.40%           |
| Klebsiella oxytoaca | 2              | 2.90%           |
| Providencia rettgerii | 2                | 2.90%          |
| CONS                | 6              | 9.10%           |
| Staphylococcus aureus | 5                | 7.30%        |
| Enterococcus faecalis | 2                | 2.90%        |

Table 2: Distribution of isolates with respective group.

| Type of Bacteria Isolated | Total n=68 |
|---------------------------|------------|
| GPC                       | 13 (19.1%) |
| GNB                       | 55 (81.0%) |

Citation: Priscilla R, Latha G, Rajan D, Sultana M (2017) Prevalence and Antimicrobial Resistance Pattern of Bacterial Strains Isolated from Patients with Urinary Tract Infection. MOJ Public Health 5(1): 00117. DOI: 10.15406/mojph.2017.05.00117
Table 3: Age wise distribution and significant bacteriuria.

| Age Group   | No. of Samples | No. of Cases with Significant Bacteriuria | Percentage |
|-------------|----------------|------------------------------------------|-------------|
| 18- 25 Years | 229            | 39                                       | 57.35%      |
| 26- 35 Years | 270            | 29                                       | 42.64%      |
| 36- 45 Years | 1              | 0                                        | 0           |

Discussion

Urinary tract infections are remarkably common in women. Some 20% women in the age group 20-65 years suffer from at least one attack per year, 50% develop urinary tract infections within their life time [18]. Not surprisingly infections of the urinary tract are the most common bacterial infections encountered in women. These can be both asymptomatic and symptomatic. UTI is a common and important medical condition, which will result in overt renal infections such as pyelonephritis, cystitis and other complications if not detected and treated [16,17]. The prevalence of UTI among the women in this study was 13.6%. Varying prevalence rates of significant bacteriuria in women were reported ranging from 3.3% to 23.9% depending on the population studied.

Age

The present study, it was observed that UTI in women at the age group 18-25 years had highest percentage of infection (57.35%) followed by 26-35 years (42.64%) and 36-45 years (0.50%). This is in contrast with in the study which was conducted by Girish...
babu et al. [2], age group of 18-25 years had highest percentage of infection (60%). Turpin et al. (2007) 6 also reported a high percentage of infection aged 35-45 years. The observed trend of UTI in this study and reports from other studies shows the age range of 18-25 years serving as a risk group for developing UTI women 8.

**Isolates**

The most common bacterial isolate from women enrolled in this study was *Escherichia coli* in 28 cases (41.1%) and followed by Klebsiella pneumoniae in 9 cases (13.2%), Pseudomonas aeruginosa 4 cases (5.8%), Proteus mirabilis 4 cases (5.8%), Citrobacter koseri 3 cases (4.4%), Proteus vulgaris 3 cases (4.4%), Klebsiella oxytoca 2 cases (2.9%), Providencia retgeri 2 cases (2.9%) and under the gram positive bacteria Coagulase negative Staphylococcus (CONS) was predominant isolate in 6 case (9.1%). Staphylococcus aureus in 5 cases (7.3%) followed by Enterococcus faecalis 2 cases (2.9%). This is similar to many studies conducted in the past. Gram positive organisms have also received more attention as causative agents of urinary tract infection. Coagulase negative Staphylococcus (CONS) was second most common isolate in 6 cases (9.1%). Staphylococcus aureus was in 5 cases (7.3%) and Enterococcus faecalis in 2 cases (2.9%) were under Gram positive organisms. This is correlated with the reports of previous studies.

**Antibiotics**

In the present study analysis of antimicrobial sensitivity pattern shows that among the 13 isolates of gram positive cocci, they were sensitive to Vancomycin (100%), followed by Nitrofurantoin (92%), Amikacin (64%), Gentamicin (55%), Norfloxacin (50%), Co-trimoxazole (42%), Clindamycin (28%), Amoxycillin/clavulanic acid (25%) and Ciprofloxacin (15%). Analysis of antimicrobial sensitivity pattern among 55 isolates of gram negative bacilli, they were sensitive to Imipenem (100%), Amikacin (93%), Nitrofurantoin (92%), Norfloxacin (30%), Ciprofloxacin (23%), Cefotaxime (23%), Amoxycillin/clavulanic acid (23%) and Co-trimoxazole (13%).

**Conclusion**

UTI in women if not detected and treated may be treated as a cause for significant morbidity in women. Various studies including this study was identified that prevalence of UTI is a real problem among women. It may be a good practice to undertake mandatory screening of all cases attending to hospital for UTI and accordingly the management of positive cases to avoid complication later in the life. UTI can be ascertained on the basis of microscopy and microbial culture. Thus urine culture is the gold standard screening technique for UTI. Our study showed 13.6% significant bacteriuria in women on screening by culture. Gram negative organisms were the commonest organisms isolated; among which *Escherichia coli* was the principle urinary pathogen. The isolates were most sensitive to *Staphylococcus aureus*, Nitrofurantoin, Amikacin, Piperacillin/tazobactam, Cefotaxime and Ciprofloxacin. All the isolates were least sensitive to *Nalidixic acid*, Co-Trimoxazole, Cefepime.

**References**

1. Lavanya SV, Jugalakshmi D (2002) Prevalence of bacteriuria in women. Indian J med Microbiol 20: 105-108.
2. Girishbabu R, Srikrishna R, Ramesh ST (2011) Asymptomatic bacteriuria in pregnancy. Int J Biol Med Res 2(3): 740-742.
3. Imade PE, Izekor PE, Eghafona NO, Enabulele OL, Ophori E (2010) Asymptomatic bacteriuria among pregnant women. North Am J Med Sci 2(6): 263-266.
4. Yashodhara P, Mathur R, Raman L (1987) Urinary tract infection in women. Indian J Med Res 86: 309-314.
5. Roy SK, Sinha GR, Quadros M (1974) A study of bacteriuria in pregnancy. J Obstet Gynecol India 24: 244-250.
6. Turpin CA, Bridget Minkah, Danso KA, Frimpong EH (2007) Asymptomatic bacteriuria in pregnant women attending antenatal clinic at komfo anokye teaching hospital, Kumasi. Ghana Med J 41(1): 26-29.
7. Jayalakshmi J, Jayaram VS (2008) Evaluation of various screening tests to detect asymptomatic bacteriuria in pregnant women. Indian J Pathol Microbiol 51(3): 379-381.
8. Abdullah AA, Al-Moslih MI (2005) Prevalence of asymptomatic bacteriuria in pregnant women in Sharjah, United Arab Emirates. East Mediterr Health J 11(5-6): 1045-1052.
9. Felièce D, Garingola-Molina (2000) Asymptomatic Bacteriuria Among Pregnant Women, Phil J Microbiol Infect Dis 29(4): 177-186.
10. Obirikorang C, Quaye L, Bio FY, Amidu N, Acheampong L, et al. (2012) Asymptomatic Bacteriuria Among Pregnant Women Attending Antenatal clinic at the University Hospital, Kumasi, Ghana. Journal of Medical and Biomedical Sciences 1(1): 38-44.
11. Platt R (1983) Quantitative definition of bacteriuria, Am J Med 75(1B): 44-52.
12. Akram M, Shahid M, Khan A (2007) Etiology and antibiotic resistance patterns of community acquired urinary tract infection in JNMC hospital Aligarh, India. Ann Clin Microbiol Antimicro 4: 23-26.
13. Leigh DA, Williams JD (1964) Method for detection of significant bacteriuria in large group of patients. J Clin Pathol 17: 498-503.
14. Sharifa A, Al Sibiani (2009) Asymptomatic bacteriuria in pregnant women in Jeddah, Western Region of Saudi Arabia: Call for Assessment. JKAU Med Sci 2(6): 263-266.
15. Dalzell JE, Lefevre ML (2000) Urinary tract infection during pregnancy. Am Fam Physician 61(3): 713-721.
16. Gilstrap LC, Leveno KJ, Cunningham FG, Whalley PJ, Roak ML (1981) Renal infection and pregnancy outcome. Am J Obstet Gynecol 141(6): 709-716.
17. Gratacos E, Torres PJ, Vila J, Alonso PL, Cararach V (1994) Screening and treatment of asymptomatic bacteriuria in pregnancy prevent pyelonephritis. J Infect Dis 69(6): 1390-1392.
18. Saed S, Tariq P (2011) Symptomatic and Asymptomatic Urinary Tract Infections during pregnancy. Int J Med Microbiol Res 2(2): 101-104.
19. Akinloye O, Ogbulu DO, Akinloye OM, Terryalli QA (2006) Asymptomatic bacteriuria in pregnancy in Ibadan, Nigeria: a reassessment. Br J Biomed Sci 63(3): 109-112.
20. Roberts AP, Phillips R (1979) Bacteria causing symptomatic urinary tract infection or asymptomatic bacteriuria, J Clin Pathol 32(5): 492-496.

21. Schnarr J, Smaill F (2008) Asymptomatic bacteriuria and symptomatic urinary tract infections in pregnancy. Eur J Clin Invest 38(52): 50-57.

22. Perera J, Randeniya C, Perera P, G Nimesha, J Renuka (2012) Asymptomatic Bacteriuria in Pregnancy : Prevalence, Risk factors and Causative Organisms. Sri Lankan Journal of Infectious Diseases 1(2): 42-46.

23. Sussman M (1998) Urinary tract infections. In Topley & Wilson's Microbiology and Microbial Infections. 9th (edn), Arnold, London, pp. 601-621.