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Bacterial urinary tract infections and their association with age, gender and socioeconomic status

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Short Communication

ABSTRACT

Urinary tract infections are among common health issues worldwide. A large number of pathogens can colonize urinary tract due to enriched chemical composition of urine making it favorable for microbial growth. Current study was designed to investigate bacterial associated UTI and antimicrobial susceptibility pattern was determined by Kirby Bauer's disc diffusion method. Samples (n=85) were analyzed to determine the bacterial strains involved in infectious cases and relationship with age, gender and social status of patients was determined. Results of the study revealed that 61% of samples were positive for *Escherichia coli,* other contributing pathogens were *Staphylococcus spp*. (24%), *Klebsiella spp*. (9%), *Proteus spp*.(4%) and others (2%). Out of 85 samples (march-june 2015), 48(56%) were from females and 37(44%) from males. Samples were categorized into five age categories age and majority of the collected samples (42%) were found in age group of young adults (15-25 years) following elder adults (29%) and elderly (20%) respectively. Socioeconomic analysis of data revealed that maximum number of patients visiting hospital for UTI belongs to villages (53%) followed by small cities (42%) and developed cities (5%). It is concluded that young females having low socioeconomic status and less awareness about hygienic measures are at great risk of UTI.

Keywords: Urinary tract infections; Antimicrobial susceptibility; Kirby Bauer's disc diffusion method.

INTRODUCTION

Urinary tract infections are considered among the most common bacterial infections and are only second in frequency to respiratory tract infections (Kass 2002). UTI can be community acquired or catheter associated nosocomial. Pregnant women, patients with catheters or urologic abnormalities, patients with diabetes or AIDS and the elderly persons are at greater risk of urinary tract infections (Foxman 2002). Adult women above 18 have at least one episode of UTI in their life histories; particularly pregnant women are at greater risk. The incidence is similar in men and women above the age of 50 associated with disease of prostate (Bacheller & Bernstein 1997).

Most common bacteria associated with UTI are *Escherichia coli*, accounting for 80% of uncomplicated infections. Other uropathogens include *Staphylococcus spp, Klebsiella spp, Proteus spp.* and *Pseudomonas spp.* (Stamm 2002, Forsyth *et al.*2018). Treatment with suitable antibiotics is necessary to cure from particular bacterial infection. Standard analysis of bacterial UTI therefore includes determination with suitable drug for bacteria involved in a specific infection. Kirby Bauer's Disc Diffusion method is used for determination of bacterial susceptibility against multiple drugs, and antibiotic found effective for specific bacteria is recommended for treatment (Akram *et al*., 2007). Other methods used for diagnosis include urine culture, cystoscopy and renal tract imaging.

In uncomplicated cases, UTI is generally self-limiting but slow process. Three days antibiotic therapy is sufficient for treatment in a few cases (Sheerin 2011). In complicated cases, broad spectrum antibiotics are used for long term therapy which leads to rapid cure but may develop antibiotic resistance and adversely effects micro flora of urinary tract (Foxman 2010).

Current study was designed to determine the bacterial UTI through Kirby Bauer's Disc Diffusion method and correlate the obtained cases with age groups, gender and socioeconomic status.

Author's Contribution: **S. M**., Guided in research and wrote manuscript; **R. Z**., Did research; **M. G. & H. Q**., Did research and proof reading

MATERIALS AND METHODS

Sample collection

Urine samples (n=85) were collected from outdoor and indoor patients visiting Mayo Hospital, Lahore. Midstream urine was collected in sterile containers and properly labeled. Patient's background was recorded including age, gender and socioeconomic status to perform comparison of these parameters with number of infected cases.

Processing of samples

Samples were initially inoculated on Cysteine Lactose Electrolyte Deficient (CLED) agar for bacterial isolation. Staining techniques, selective and differential agars and biochemical tests were performed for further identification of bacterial species. Antimicrobial sensitivity was determined by Kirby Bauer's Disc Diffusion method using Muller Hinton agar (MHA).

Antibiotic susceptibility test

Kirby Bauer's disc diffusion method was used to determine antibiotic sensitivity pattern for isolated strains. Zone of inhibition was measured in millimeters and compared with CLSI (Clinical Laboratory Standard Institute) standards as sensitive, resistant or intermediate resistant (Akram *et al*. 2007). Different antibiotics were used for sensitivity test of isolated bacteria (Table I).

Table I: Antibiotics for susceptibility testing

Antibiotics	Concentration	Isolated Bacterial strains
Cefepime	30µg	*E. coli*
Vancomycin	30µg	*E. coli, Staphylococcal spp.*
Tazobactam	110µg	*E. coli*
Amikacin	30µg	*E. coli, Klebsiella spp., Proteus spp.*
Meropenem	10µg	*E. coli*
Ceftazidime	30µg	*E. coli, Klebsiella spp., Proteus spp.*
Gentamicin	10µg	*S. aureus*
Tetracycline	30µg	*S. aureus*
Chloramphenicol	30µg	*S. aureus*
Streptomycin	10µg	*S. aureus*
Amoxycillin	30µg	*Proteus spp., Klebsiella spp.*

RESULTS AND DISCUSSION

Samples (n=85) were analyzed for antibiotic sensitivity test. Results revealed different patterns of antibiotic sensitivity in different samples (Fig. 1). *Escherichia coli* were found in majority of the positive samples (61%). Other organisms found contributing in UTI infections were *S. aureus* (24%), *Klebsiella spp.* (9%), *Proteus spp.* (4%) and some other species (2%) (Table II).

Table II: Percentage of isolated bacteria from positive samples

Bacteria	Number of positive samples (n=85)	Percentage positivity
E. coli	52	61
Staph. Aureus	20	24
Klebsiella spp.	8	9
Proteus spp.	3	4
Other bacteria	2	2

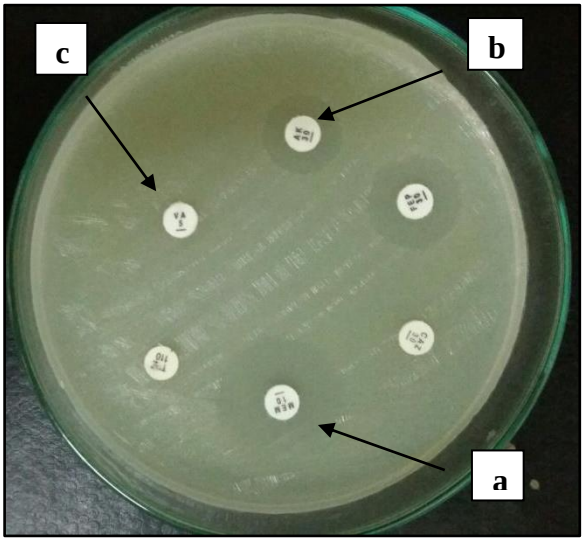

Fig. 1: *E. coli* showing sensitive (a), intermediate resistant (b) and resistant (c) pattern towards different antibiotics

Similar results were found by Akram *et al*. (2007) where *E.coli, K. pneumonia, S. aureus, P. aeruginosa* and *A. baumannii* were found in 61%, 22%, 7%, 4% and 3% samples respectively. In a survey conducted to investigate the prevalence and susceptibility of uropathogens in 17 different countries, samples were found positive for *E. coli, Klebsiella spp., Enterobacter spp., Citrobacter spp., Proteus spp., Enterobactor spp., Staphylococcus spp.,* and *Pseudomonas spp*. (Kahlmeter 2003). Another study revealed the presence of *E.coli* (74.6%), *Klebsiella spp.* (11.7%), *S. saprophyticus* (6.4%) *and P. aeroginosa* (2.2%) which is in accordance with current study (Farajnia *et al*., 2009). Reason for *E.coli* at greater percentage is the presence of virulence factors which help to fight host defense mechanisms and injure the tissues. Aerobactin system, Adhesion molecules such as Pilli, K capsule, cytotoxic necrotizing factor 1 and hemolysin are contributing virulence factors of *E.coli* in pathogenesis of UTI (Wiles *et al*.2008).

Analysis of data for age groups should that majority of the samples (42%) belonged to young adults between 15-25 years of age. Less number of cases was found in infants and children at percentage of 5% and 11%, respectively, but adults above 25 and 45 were also positive at higher percentage of 29% and 20%, respectively (Table III). It has been reported earlier that middle aged group was involved at 35% of total analyzed cases followed by young adults (33.1%), elderly persons (24.7%) and children (4.5%) respectively (Linhares *et al.*, 2013). This is consistent with previous findings in which 51% cases were found between 20-49 years of age. Remaining two age groups; 0-19 years and 50-80 years were 36% and 17% in frequency respectively (Akram *et al.*2007).

Table III: Accurance of UTI in different age groups

Age Group	Number of positive samples (n=85)	Percentage positivity
Infants (0-5 years)	4	5%
Children (5-15 years)	9	11%
Young adults (15-25 years)	36	42%
Elder adults (25-45 years)	25	29%
Elderly (Above 45 years)	17	20%

Out of 85 samples received and analyzed at Mayo hospital during time period of March to June 2015, 37 (44%) samples were from males and 48 (56%) from females. Result of this study is in accordance with previous finding in which infection was found more prevalent in middle aged females (Kodner *et al*., 2010). A ten year surveillance study carried out to determine antimicrobial resistance pattern revealed that 77.6% of analyzed samples belonged to female patients which was much greater than findings of current study (Linhares *et al*., 2013). In another study, percentage of female infected cases was greater (45.2%) as compared to males (18.4%) out of total 1670 studied cases (Dash *et al*., 2013). Factors involved for greater number in middle age group are perhaps sexual intercourse, oral or vaginal contraceptives which lower the level of estrogen leading to hardening of vaginal tissues, use of antimicrobials and short distance of urethra from anus (Virginia & Franco 2005). Other contributing factors may include maternal history and use of spermicides (Kodner *et al.,* 2010).

Analysis of data for socioeconomic status was performed by categorizing the living facilities in three groups as villages, small cities and developed cities. Result of the analysis revealed that 45(53%) samples belonged to villages, 36(42%) from small cities and 4(5%) from developed cities (Fig. 2). The results are comparable with previous findings in which female participants practicing poor hygienic measures and lower education level was the major target of UTI. Unhygienic conditions, lower level of awareness, unavailability of water and toilets within houses, reuse of tampons without proper washing are some contributing factors for increased number of cases at rural setups (Das *et al.,* 2015). It has been also established that lifestyle and socioeconomic status have direct relationship with mortalities resulting from various diseases (Balia & Jones 2008).

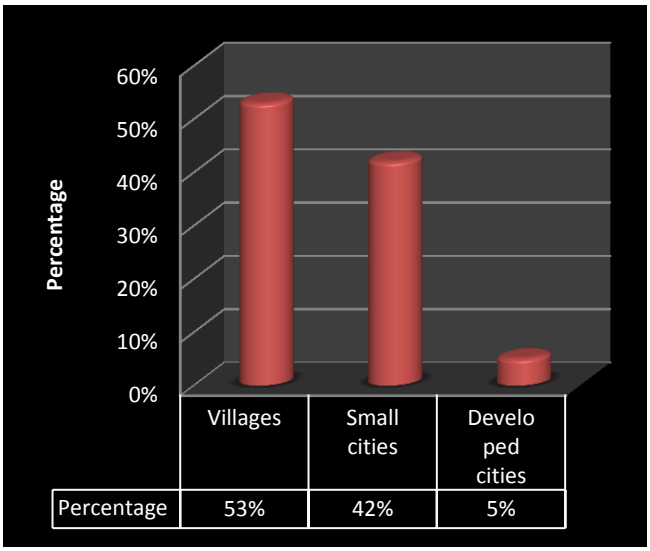

Fig. 2: Percentage positivity of different cities

There are certain limitations in this analysis. The study was performed on open cases of patients visiting Mayo hospital; change in sampling methodology may result in variation of results. Moreover limited numbers of parameters are analyzed based upon reluctance of patients to give additional information i.e. sexual history, exact social status, use of antimicrobial agents/ contraceptives/ spermicides, use of reusable tampons etc. Success in obtaining more information may increase the application of results.

CONCLUSION

It is concluded through analysis that adult females are more prone to urinary tract infections as compared to males of same age group. However above 50 years of age, chances of occurrence are same in both genders. Majority of the patients visiting hospital for UTI belong to small villages having lower socioeconomic status and practicing poor hygienic measures. More research is required to investigate the factors involved in UTI infecting women of lower socioeconomic status.

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