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Bacteriological Profile of Urinary Tract Infection and Their Antibiotic Susceptibility Pattern In View Of Emerging Drug Resistance.

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ABSTRACT

Bacterial infection of the urinary tract is one of the common causes for seeking medical attention in the community. Effective management of Urinary tract infection is based on the identification of the type of bacteria and its sensitivity pattern. Hence it has become necessary to know the pattern of drug resistance in particular setting, for appropriate treatment and outcome of the patient. A total of 1150 urine samples were analyzed retrospectively in our study. Of which 922 (80.1%) showed significant bacteriuria comprises of higher females 642 (69.6%) than males 280 (30.3%). The common pathogens were Gram negative (68.65%). *E.coli* was the predominant isolate 47.23% followed by *Klebsiella sps*, Pseudomonas, Acinetobacter, Proteus and Citrobacter. Majority of Gram-negative bacteria showed high susceptibility towards Amikacin, Nitrofurantoin, Gentamicin and Norfloxacin. Less sensitivity was observed in Ampicillin and Cotrimoxazole. Hence it is necessary to determine the changing pattern of microbial flora and their antibiogram for the regular surveillance and monitoring of drug resistance strains.

Keywords: Urinary tract infection (UTI), significant bacteriuria, Uropathogens, antibiogram.

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INTRODUCTION

Urinary tract infections (UTI) are considered to be one of the most common infection in human with high rate of morbidity and mortality in the world [1]. Worldwide, about 150 million people are diagnosed with UTI each year, costing the global economy in excess of six billion US dollars [2].

UTI occur more frequently in women than in men. It is estimated that one woman in five develops UTI during her lifetime. This is mainly due to close proximity of genital tract and short urethra [3]. Other risk factor which makes women prone to UTI includes elderly, pregnancy, catheterization and sexual intercourse [4]. Whereas infections in male patients remain uncommon, but anatomical abnormalities and prostatic diseases, begins to interfere with emptying of bladder causes UTI in men.

The spectrum of bacteria which commonly causes UTI are *Escherichia coli, Staphylococcus saprophyticus, Citrobacter spp, Enterobacter aerogenes, Pseudomonas aeruginosa,* and *Proteus vulgaris* and less common organisms *are Klebsiella spp, Staphylococcus aureus* and *Salmonella spp* [5].

Increasing drug resistance among uropathogens has become an important emerging public health problem. The Infectious Disease Society of America (IDSA) identified some microorganisms for new effective therapies. Those microorganisms were called "ESKAPE pathogens" which include *Enterococcus faecium, S. aureus, Klebsiella spp., Acinetobacter spp., Pseudomonas spp.,* and *Enterobacter spp.*

Data on the distribution of antimicrobial susceptibility of UTI causing organisms changes from place to place. Various factors such as the type of UTI (complicated or uncomplicated), gender, age and previous history of antibiotic therapy of each UTI patient should also be considered to find out the correct global data on susceptibility. Because, mostly the antibiotic treatment for UTI are initiated before the laboratories results which may lead to frequent misuse of antibiotics.

The susceptibility data provided by regional microbiology laboratories helps to choose the empirical choice of antimicrobials to treat UTI; however, these conditions are limited to complicate UTI as the samples of complicated UTI are rarely sent to laboratories. The resistance pattern of community acquired uropathogens has not been extensively studied in India. Hence it is necessary to monitor the rising drug resistance pattern of uropathogens on a regular basis. This will be helpful for the proper selection of antimicrobial agents there by reducing the nosocomial infections due to the emergence of drug resistance pathogens.

MATERIALS AND METHODS

A total of 1150 urine samples collected from March to December 2015 of suspected UTI cases (both In Patient and Out Patient) attending Shri Sathya Sai Medical College & Research Institute were studied retrospectively. Specimen collection, culture, identification and antimicrobial susceptibility test were done according to the standard Protocol [6].

RESULTS

Out of 1150 analyzed urine samples, 922 (80.1%) showed significant bacteriuria which comprises of 280 (30.3%) males and 642 (69.6%) females. The remaining 228(19.8%) samples were found to be sterile. Isolation rate was higher in females as compared to males (chart 1).

Maximum patients showing significant bacteriuria belongs to 21-40 years age group with 87.76% followed by 41-60 years age group with 82.43% and 61-80 years age group with 66.84% respectively. Among the females, UTI was commonly seen in 21-40 years age group whereas in males it was common between 41-60 years age group [Table 1].

In our study the predominant isolates were gram negative 633 (68.65%) followed by gram positive 289 (31.3%). Among the gram negative *E.coli* was commonly isolated uropathogen (47.23%), followed by *Klebsiella pneumonia* (16.74%), *Klebsiella oxytoca* (12.32%) *Pseudomonas aeruginosa* (6.95%) and *Acinetobacter sps* (8.2%), whereas *Proteus sps* and *Citrobacter sps* accounts less (5.2%, 3.3%) respectively. In gram positive organisms most common bacteria isolated was Coagulase negative staphylococcus (CONS)

accounting for (31.14%) followed by *Staphylococcus aureus* (25.6%), Enterococcus sps (23.18%) and Group D streptococci (20.6%).

The antibiogram of the tested isolates were shown in [Table 2&3]. Among the tested antibiotics the highest susceptibility for gram negative bacteria was shown by Nitrofurantoin followed by quinolones, aminoglycosides (Amikacin, Gentamicin) and less sensitive to Cotrimoxazole and Ampicillin. The most predominant isolate was *E.coli,* gave highest susceptibility to Amikacin 84.2% followed by Nitrofuration 78.9%, Norfloxacin 74.5%, Ciprofloxacin 65.8%. Whereas Ampicillin, Nalidixic acid and Cotrimoxazole were found to be less sensitive (39.1%, 42.4%, 47.8%). Second most isolate was *Klebsiella sps*, overall it showed 60% sensitivity to almost all the drugs tested. So this decrease in the susceptibility may be due to emergence of drug resistant strains. *Pseudomonas aeruginosa, Acinetobacter sps*, *Proteus sps* and *Citrobacter sps* also showed similar susceptibility pattern like *E.coli* with susceptibility of 77.2%, 100%, 100% to Amikacin.

Among gram positive organisms tested CONS was commonest isolate showing 100% susceptibility to Amikacin, vancomycin and Linezolid, followed by ciprofloxacin with 90%. Similar pattern of susceptibility was observed for other isolated organisms such as *S.aureus*, group D streptoccoci and Enterococci.

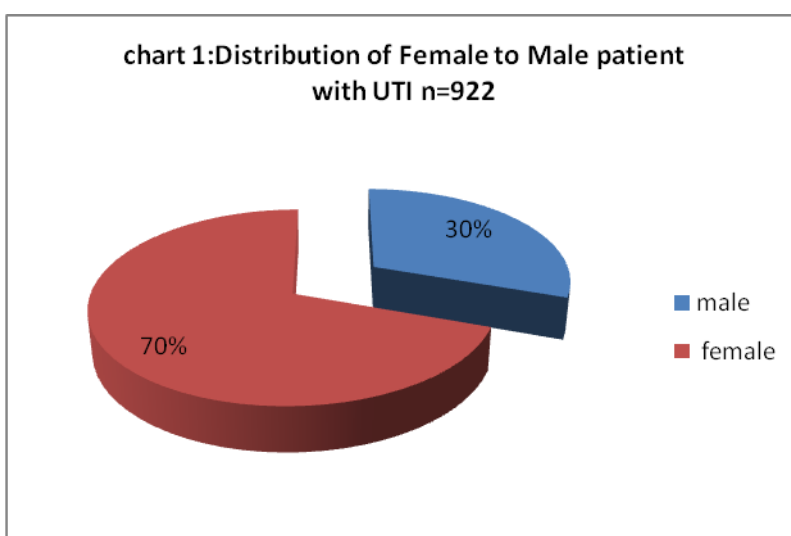chart 1:Distribution of Female to Male patient with UTI n=922

Table 1: Age/gender wise distribution of Urinary tract infection.

Age (years)	Total no. of samples (%)	No of positive samples		Total no of positive samples (%)
		No of Males (%)	No of Females (%)	
<20	160 (13.9%)	50 (17.8%)	58 (9.03%)	108 (11.7%)
21-40	425(36.9%)	70 (25%)	303 (47.1%)	373 (40.4%)
41-60	353 (30.6%)	120(42.8%)	171(26.63%)	291 (31.56%)
61-80	187(16.2%)	30 (10.7%)	95(14.7%)	125 (13.55%)
>80	25(2.17%)	10 (3.57%)	15(2.3%)	25 (2.7%)
Total	1150(100%)	280 (100%)	642 (100%)	922 (100%)

Table 2: Percentage of Antibiotic Susceptibility Pattern of Gram Positive urinary isolates

NAME OF THE ORGANISM	Total	AK %	GEN %	AMP %	CIP %	NA %	NX %	COT %	NIT %	HLG %	VA %	LZ %
CONS	90	100	84.4	74.4	90	78.8	84.4	74.4	93.3	-	100	100
Staphlococcus aureus	74	83.1	83.1	77.0	74.3	67.5	79.7	71.6	83.7	-	100	100
Enterococcus sps	67	94	79.1	76.1	73.1	58.2	79.1	64.1	100	94	100	100
Group D Streptococcus	58	100	100	72.4	77.5	72.4	96.5	68.9	100	-	100	100

Table 3: Percentage of antibiotic Susceptibility Pattern of Gram negative urinary isolates

NAME OF THE ORGANISM	Total	AK %	GEN %	AMP %	CIP %	NA %	NX %	COT %	NIT %
E.coli	299	84.2	76.9	39.1	65.8	42.4	74.5	47.8	78.9
Klebsiella pnuemonia	106	67.9	68.8	33.96	74.5	60.3	77.3	61.3	66
Klebsiella oxytoca	78	85.8	49.9	38.4	69.2	46.1	84.6	53.8	83.3
Acinetobacter sps	52	100	78.8	57.6	75	63.4	78.8	63.4	75
Psuedomonas aeruginosa	44	77.2	72.7	34	72.7	45.4	72.7	50	65.9
Citrobacter sps	21	100	90.4	42.8	90.4	52.3	52.3	47.6	100
Proteus mirabilis	16	100	100	50	100	100	100	75	62.5
Proteus vulgaris	17	100	100	58.8	100	35.2	100	52.9	47.0

DISSCUSION

UTI impose a huge burden on health care systems due to high prevalence of infection in both community and nosocomial settings [7]. Effective management of patients suffering from bacterial UTIs commonly relays on the identification of the type of organisms that caused the disease and the selection of an effective antibiotic agent to the organism in question. This can be achieved by continuous surveillance of antibiotic susceptibility patterns of uropathogens at local level. [8]

UTIs are commonly reported among females than in males because of the short urethra, its proximity to the anus and its termination beneath the labia. All this factors predisposes high frequency of colonization of colonic gram negative bacilli among female [9]. In our study, gender wise and age wise analysis showed a higher incidence of UTI in female of 21-40 years age group, this shows the fact that urinary tract infections are more common in the reproductive age group. However in case of males it was higher among 41-60 years age group, which could be due to co morbid conditions like diabetes mellitus, prostate hypertrophy and other related problem of old age. This correlates with other studies by Bashir MF et al (10) and Getenet B. et al [11].

In our analysis 80% of cases were found to have UTIs which is alarmingly high, this increase in the rate may be due to improper hygiene, poor sanitation and unawareness. Prevalence rate was high as compared to the other studies [12-14].

Mostly UTIs are caused by the colonic bacteria which comprise mainly of gram negative bacteria. But in our analysis 68.65% of the infection was caused by gram negative bacteria and the remaining 31.3% by gram positive bacteria. According to various report *E.coli* was consider as the commonest invading pathogen of UTIs [15,16]. Similarly our analysis also showed *E.coli* as the most common organism isolated (47.23%), followed by *Klebsiella* spp (29.06%), other organisms such as Psuedomonas, Acinetobacter, Proteus and Citrobacter.

Among gram-positive bacteria, CONS and *Staphylococcus aureus* were the most frequent organism with incident of 31.14%, 25.6% among the total gram positive isolates. Isolation of CONS *and S. aureus* from the urine should be around suspicion of bacteremic infection of the kidney acquired by haematogenous spread so a pure culture of the organism is considered to be significant regardless of the number of colony forming unit [17]. *Enterococcus faecalis* and Group D streptococci accounts for (23.18%, 20.6%) of infection respectively. Infection due to them may be usually associated with the use of instruments or catheterization [18].

Resistance to antimicrobial agents started since the use of first agent and has become an increasing world-wide problem [19]. Our study revealed varied pattern of drug resistance to various antibiotics tested. Most of the gram negative isolates in our analysis showed less than 50% of resistance to commonly used antibiotics such as Ampicillin and Cotrimoxazole, this implies that these antibiotics cannot be used as empirical therapy for UTIs in our setting. Similar reports are reported from various studies [20-22].

In our study, Amikacin was found to be the most effective drug against all the gram negative organisms tested, followed by Ciprofloxacin, Norfloxacin, gentamicn and Nitrofuratoin. Hence these drugs can be used as a drug of choice for acute, uncomplicated UTIs.

Among gram-positive bacteria, Nitrofuratoin, Amikacin, vancomycin and linezolid were found to be the most effective drug of choice. Ampicillin was found to be the least sensitive drug. Similar pattern was observed by Uwaezuoke, J.C et al., 2006 [23]. Hence proper use of these antibiotics will be helpful in controlling the emergence of drug resistance.

CONCLUSION

In our study Gram-negative bacteria were the major cause of urinary tract infection. *Escherichia coli* were the most predominant isolate than others in causing significant bacteriuria. Majority of Gram-negative bacteria showed high susceptibility towards Amikacin, Nitrofurantoin, Gentamicin and Norfloxacin.

However, we suggest that this study should be continued to determine the changing pattern of microbial flora and their antibiogram. Also it is recommended to follow culture and sensitivity report before prescribing antimicrobial drugs for treatment of suspected UTI. There should be definite hospital antimicrobial drug policy in order to prevent emergence of multi drug resistance organisms and the study should be continued for detection of MDR strains, ESBL, AmpC producing strains and further studied up to genetic level.

REFERENCES

[1]   Urinary tract infection. Urology channel online. Last update June 2006 cited (August 2nd, 2006): http://.urologychannel.com.thm.
[2]   Foxman B, Barlow R, D Arcy H, et al. Urinary tract infection: Self-reported incidence and associated costs. Ann Epidemiol. 2000; 10:509–15.
[3]   A. J. Schaeffer, N. Rajan, Q. Cao et al., Host pathogenesis in urinary tract infections. International Journal of Antimicrobial Agents. 2001; 17(4): 245–251.
[4]   E. E. Akortha and O. K. Ibadin. Incidence and antibiotic susceptibility pattern of *Staphylococcus aureus* amongst patients with urinary tract infection (UTI) in UBTH Benin City, Nigeria. African Journal of Biotechnology. 2008; 7(11): 1637– 1640.
[5]   B. Foxman and P. Brown. Epidemiology of urinary tract infections: transmission and risk factors, incidence, and costs. Infectious Disease Clinics of North America. 2003; 17(2): 227–241.
[6]   Clinical and Laboratory Standards Institute. Performance standards for antimicrobial susceptibility testing. Twentieth informational supplement ed. CLSI document M100-S20. Wayne, PA:CLSI; 2010.
[7]   ShaistaBano, Sarfraz A Tunio, AmeerAfzalMenom, Hakim Detho, RozinaBano, Kalpanakumari. Evaluation of antibiotic susceptibility patterns of uropathogens circulating in Hydrabad, Pakisthan. Khyber Med Univ J.2014; 6(3):110-115.
[8]   Water G, Harrison B, and Kunin G. Urinary tract infection. N. Eng Med. J. 1996; 248-250.
[9]   Anthony J Schaeffer. Infections of the urinary tract. Cambell's Urology.8th ed., Philadelphia: Saunders, 2002.
[10]   Bashir, M. F., Qazi, J. I., and AhmadN Riaz, S. Diversity of urinary tract pathogens and drug resistant isolates of Escherichia coli in different age and gender groups of Pakistanis. Tropical Journal of Pharmaceutical Research September. 2008; 7(3): 1025-1031.
[11]   Getenet, B., and Wondewosen, T. Bacterial Uropathogens in Urinary tract infections and Antibiotic susceptibility pattern in JIMMA University specialized hospital, Southwest Ethiopia. Ethiop J Health Sci. 2011; 21(2): 141-146.
[12]   Das, R.N., Chandrashekhar, T.S., Joshi, H.S., Gurung, M., Shrestha, N., Shivananda, P.G. Frequency and susceptibility profile of pathogens causing urinary tract infections at a tertiary care hospital in western Nepal. Singapore Med. J. 2006; 47(4): 281.
[13]   Suresh B Sonth, Shivakumar S Solabannavar, Deepa Hadapad and Shilpa Gokale. Study of Bacteriological Profile of Urinary Tract Infections in a Tertiary Care Teaching Hospital Int.J.Curr.Microbiol.App.Sci. 2015; 4(10): 928-933
[14]   V.Vijaya Swetha1, U.Sreenivasa Rao, P. Hema Prakash and S. Subbarayudu. Aerobic bacteriological profile of urinary tract infections in a tertiary care hospital. Int.J.Curr.Microbiol.App.Sci. 2014; 3(3): 120-125

[15] Delzell JE and Lefevre ML. Urinary tract infection during the pregnancy. Am family physician. 2000; 61:713-21.

[16] Gorbach SL, Bartlett JG, Balcklow NR. Urinary tract. In: Gorbach SL, Bartlett JG, Balcklow NR, editors. Infectious diseases. Philadelphia: Lippincott Williams & Wilkins Publishers; 2004. 861-81.

[17] Forbes BA, Sahm DF and Weissfeld AS. Bailey and Scott's Diagnostic Microbiology (11th ed). USA: Mosby 2002.

[18] Collier L, Balows A, Sussman M. Topley and Wilson's Microbiology and Microbial infections (9th ed). London: Oxford University Press1998; 3:601-21.

[19] Sefton AM. The impact of resistance on the management of urinary tract infections. Int J. Antimicrob Agents. 2000; 16:489–491.

[20] Hari P Kattel, Jyoti Acharya, Shyam K Mishra, Basista P Rija, Bharat M Pokhrel. Bacteriology Of Urinary Tract Infection Among Patients Attending Tribhuvan University Teaching Hospital Kathmandu, Nepal Journal Of Nepal Association For Medical Laboratory Sciences.2008;9: 25-29.

[21] Getenet Beyene, Wondewosen Tsegaye Bacterial Uropathogens In Urinary Tract Infection And Antibiotic Susceptibility Pattern In Jimma University Specialized Hospital, Southwest Ethiopia. Ethiop J Health Sci. 2011; 21(2):141-146.

[22] Harsha T R., Vijaya D & Nagarathnamma T. Bacteriological profile & comparison of Antibiotic susceptibility pattern of uropathogens by conventional disk diffusion and Rapid mini API Method. Journal of pharmaceutical and biomedical sciences (J Pharm Biomed Sci.). 2013; 30(30): S7-S12.

[23] Uwaezuoke, J.C., Ogbulie, J.N. Antibiotic sensitivity pattern of urinary tract pathogens in Port–Harcourt, Nigeria. J. Appl. Sci. Environ. Manag. 2006;10(3):103–107.