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RESEARCH ARTICLE

BACTERIAL PROFILE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF URINARY TRACT INFECTION IN KHARTOUM, SUDAN

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ABSTRACT

The traditional uropathogens are changing many of their features, particularly because of antimicrobial resistance. The present study aimed to provide etiology and antibiotics sensitivity about UTI among patients attending Khartoum Hospitals. The study was carried out using 332 urinary bacterial isolates collected from different hospitals in Khartoum State. All isolates were identified and tested for their antimicrobial resistance to various antibiotics *in vitro* by the Kirby-Baur disk diffusion method. High rate of UTIs was caused by *E. coli* (47.3%) followed by *S. saprophyticus* (28.6%) while less rate was caused by *Enterobacter* spp (1%). *E. coli* was mostly isolated from female patients (102 out of 157) and from age group 11- 49 years old (80 out of 157). The maximum sensitivity was seen for piperacillin/tazobactum (91.8%) followed by imipenem (90.7%) and norofloxacin (86%). The maximum resistance was seen against tetracycyline (61.7%) followed by nitrofrontoin (54.2%) and azithromycin (36.1%). In conclusion, *E. coli* was the main UTI pathogen in Sudan followed by *S. saprophyticus* with an increasing incidence rate of S. *aureus.* Piperacillin/ tazobactum was the most active drug for UTIs treatment. Regular monitoring of antimicrobial drugs resistance is necessary to improve the guidelines for empirical antibiotic therapy.

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INTRODUCTION

Urinary tract infections (UTIs) are just a few of the diseases that have become hard to treat with antibiotics. They rank the second most common bacterial infections in the general population with an estimated overall incidence rate of 18 per 1000 person per year. In addition, UTIs are major causes of hospital admissions and are associated with significant morbidity and mortality as well as a high economic burden (Bader, 2010). There are two types of UTIs: lower and upper. Lower UTIs occur in the urethra (*urethritis)* or bladder (*cystitis*). Upper UTIs are infections that involve kidneys (pyelonephritis), ureters (ureteritis), or both. Upper UTIs can occur in both men and women as a complication of a lower UTI. Complicated UTIs are UTIs resulting from anatomic obstructions of the urinary tract or catheterization. It is estimated that 250 million UTIs occur yearly on a global basis, being costly to both patients and health care funding system (Ronald *et al*, 2001). UTIs are very rare among 2- to 13- year-old girls, but some young girls experience multiple repeated episodes of recurrent cystitis or pyelonephritis (Stamm and Norrby, 2001). The incidence of acute UTIs in young women has been shown to be 0.5–0.7 per year (Hooton *et al*., 1996). The vast majority of UTIs are due to the persons own fecal bacteria. Members of Enterobacteriaceae, specifically *E. coli*, are the main causes of UTIs. *Staphylococcus saprophyticus* (*S. saprophyticus*) is the second most common cause, and lesser percent are caused by other Enterobacteriaceae (*Proteus* and *Klebsiella*), *Enterococcus* or *Pseudomonas* species (Nicolettia *et al*., 2010). The traditional UTI pathogens are changing many of their features, particularly because of antimicrobial resistance. The etiology of UTI is also affected by underlying host factors that complicate UTI, such as age, diabetes, spinal cord injury, or catheterization (Ronald, 2002).

One of UTI complications is the emergence of antibiotic-resistant strains. Inadequate empiric antibacterial therapy has been associated with increased mortality rates in patients with UTIs. Moreover, patients who enter hospitals for the treatment of resistant bacterial infections or acquire resistant infections while in the hospital are adding to the already too high costs of healthcare and are a source of resistant bacteria and/or resistance-encoding genes (Haber *et al*., 2010). The irrational use of antibiotics is a major global public health problem. Most of antibiotics in Sudan are purchased privately without a

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prescription, from pharmacies or street vendors in the informal sector because the use of antibiotics without medical guidance is largely facilitated by inadequate regulation of the distribution and sale of prescription drugs (Awad *et al.*, 2007; Togoobaatar, *et al.*, 2010). Updated knowledge of causal bacteria and their susceptibility patterns are important for proper selection and use of antibiotics as well as for an appropriate prescribing policy. Few published data regarding the etiology of UTI and antibiotics sensitivity among patients attending urology clinics. Some studies investigated epidemiology of UTI and antibiotics sensitivity among selected populations "for example; hospital patients, pregnant women or pediatrics patients" (Ahmed M, Mohsin , 2012; Hamdan *et al*., 2011; Ali and Osman, 2009). The present study aimed to provide etiology and antibiotics sensitivity about UTI among Sudanese patients in Khartoum, Sudan.

MATERIALS AND METHODS

The study was carried out using 332 urinary bacterial isolates collected from different hospitals in Khartoum State. The isolates were collected from patients attending Khartoum Teaching Hospital, Soba Teaching Hospital, Sahirron Hospital, National Health Laboratory and Ibrahim Malik Teaching Hospital. The isolates were collected during the period from May 2011 to January 2012. The Identification was based on colony characteristics and further identified by Gram staining and standard biochemical tests (Cheesbrough, 2000).

Antibiotic Susceptibility Tests

All the isolates were tested for their antimicrobial resistance to various antibiotics *in vitro* by the Kirby-Baur disk diffusion method. They were tested with against vancomycin (V) (30 µg), gentamicin (GN) (10 µg), and All Gram negative bacteria were tested with norfloxacin (NOR) (10) amikacin (AK) (30 µg), ceftriaxone (CRO) (30 µg), co-trimoxazole (SXT) (1.25/23.75 µg), azithromycin (AZM) (15), nitrofurantoin (NF) (300) µg), cefepime (FEP) (30), piperacillin/tazobactum (TZP) (100/10), amoxyclav (AMC) (20/10), imipenam (IPM) (10) and tetracycline (TE) (30 µg). Plates were incubated at 37°C overnight. After overnight incubation, the diameter of each zone of inhibition was measured in mm. The susceptibility testing results were recorded according to the Clinical and Laboratory Standards Institute (CLSI) guidelines (CLSI, 2010).

RESULTS

A total of a three hundred and thirty two urine specimens (n = 332) were collected from patients with symptoms of UTIs from different hospitals in Khartoum State. Among the study population 195 patients (58.7%) were females (F) while 137 (41.3%) were males (M) (Table 1). Patients enrolled in the study were divided into three age groups: less than 10 years old, 11- 49 years' old, and more than 50 years old. The highest frequency of isolates 177 (53.3%) was in the age group 11-49 years, followed by the age group of more than 50 years 87 (26.3%) while the lowest frequency of isolates 68 (20.5%) in the age group of less than 10 years as shown in Table 2.

Table 1. Frequency of isolates according to gender type

Isolate	F	M	Total (%)
E. coli	102	55	157 (47.3%)
S. saprophyticus	55	34	89 (28.6%)
K. pneumonia	17	15	32 (9.6%)
S. faecalis	9	11	20 (6%)
Ps. aeruginosa	6	4	10 (3%)
S. aureus	6	10	16 (4.8%)
P. mirablis	4	5	09 (2.7%)
K. oxycota	6	1	07 (2.1%)
Enterobacter spp	0	3	03 (1%)
Total	195 (58.7%)	137 (41.3%)	332 (100%)

Table 2. Frequency of isolates according to age groups

Isolate	<10 y	11- 49 y	> 50 y	Total (%)
E. coli	45	80	32	157 (47.3%)
S. saprophyticus	19	52	18	89 (28.6%)
K. pneumonia	3	35	6	32 (9.6%)
S. faecalis	2	20	10	20 (6%)
Ps. aeruginosa	8	5	7	10 (3%)
S. aureus	5	3	8	16 (4.8%)
P. mirablis	0	4	5	09 (2.7%)
K. oxycota	1	3	3	07 (2.1%)
Enterobacter spp	0	3	0	03 (1%)
Total	68 (20.5%)	177 (53.3%)	87 (26.3%)	332 (100%)

Table 3. Antibiotic susceptibility pattern of isolated bacteria

	Antibiotic	% Sensitive	Intermediate %	Resistant %
1	V	75.3% (250)	0.9% (3)	23.8% (79)
2	GN	67.8% (225)	16.9% (56)	15.3% (51)
3	NOR	86 % (285)	3% (10)	11% (37)
4	AK	72% (239)	3.9% (13)	24.1% (80)
5	CRO	70% (232)	4.5% (15)	25.5% (85)
6	SXT	49% (162)	9. % (30)	42 % (140)
7	AZM	60% (199)	3.9% (13)	36.1% (120)
8	NF	41% (136)	4.8% (16)	54.2% (180)
11	FEP	73.5% (244)	13.8% (46)	12.7% (42)
12	TZP	90.8% (302)	6.6% (22)	2.6% (8)
13	AMC	50.3% (167)	19 % (63)	30.7% (102)
14	IPM	90.7% (301)	7.5% (25)	1.8% (6)
15	TE	25% (83)	13.3% (44)	61.7% (205)

The present study showed that high rate of UTIs was caused by *E. coli* (47.3%) followed by *S. saprophyticus* (28.6%) while less rate was caused by *Enterobacter* spp (1%). Among the study population studied 58.7% were females while 41.3% were males. while less rate was caused by *Enterobacter* spp (1%). *E. coli* was mostly isolated from female patients (102 out of 157) and from age group 11- 49 years old (80 out of 157) as shown in tables 1&2. The antibiotic sensitivity pattern of the isolates revealed that the maximum sensitivity was seen for piperacillin/tazobactum (91.8%) followed by imipenem (90.7%) and norofloxacin (86%). The maximum resistance was seen against tetracycilne (61.7%) followed by nitrofrontoin (54.2%) and azithromycin (36.1%) as shown in Table 3.

DISCUSSION

The present study showed that high rate of UTIs was caused by *E. coli* (47.3%) followed by *S. saprophyticus* (28.6%) while less rate was caused by *Enterobacter* spp (1%). *E. coli* was mostly isolated from female patients(102 out of 157) as shown in table1 and from age group 11- 49 years old (Table 2).

Among the study population studied 58.7% were females while 41.3% were males. That is in agreement with the fact that UTIs are far more common among women than among men. This is mostly due to the shortness of the female urethra. Bacteria from fecal matter at the anal opening can be easily transferred to the opening of the urethra. *E. coli* is responsible for most uncomplicated cystitis cases in women, especially in younger women. Other studies had also reported a similar frequency of UTI caused by E. coli (Sabharwal, 2012); Okonko *et al*., 2009).

The present study showed an increasing incidence rate of *S. aureus* among the studied patients. Many findings confirm that *S. aureus* has become an important etiologic agent of UTIs (Al-Ruaily Khalil, 2011; Akerele *et al*., 2000; Okonko *et al*., 2009; Manikandan *et al*., 2001**).** S. aureus is a relatively infrequent urinary tract isolate in the general population. However, recent studies have reported the increasing prevalence of *S. aureus* in UTIs (Nwanze *et al*., 2007; Akortha and Ibadin, 2008). *S. saprophyticus* was found to be the second cause of UTI predominant in younger women. It was thought 10 to 20% of acute UTI's are caused by S. saprophyticus (young sexually active females) (Ronald, 2003). The antibiotic sensitivity pattern of the isolates revealed that the maximum sensitivity was seen for piperacillin/tazobactum (91.8%) followed by imipenem (90.7%) and norofloxacin (86%). That was closed to many findings (Nowé, 1994) and near to Dalela *et al*., (2012) who reported susceptibility to imipenem (95.1%) and piperacillin/tazobactum (71.8%). In the present study norfloxacin, showed a low resistance in comparison to other studies which reported higher rates (Keah *et al*., 2007; Akram *et al*., 2007; Manjunath *et al*., 2011).

Fluoroquinolones have been prescribed more frequently for treatment of UTIs. Norfloxacin had been reported to reduce the incidence of acute, uncomplicated and catheter-related UTIs (Rutschmann and Zwahlen, 1995; Saginur and Nicolle, 1992). In the present study, the maximum resistance was seen against tetracycline (61.7%). That is lower than Santo *et al*., (2007) who reported 73% resistant rate and higher than Noor *et al*.,(2004) who reported 41% resistant rate to tetracycline. In the present study, nitrofurantoin was found to have resistant rate of (54.2%). Sabharwal (2012) found low resistance rate (10%) to nitrofurantoin while Akram *et al*.(2007) found a very high resistance rate (80%) to nitrofurantoin in patients with community acquired UTI. Generally, the possible reasons behind the resistance to antibiotics in Sudan may be these antibiotics have been in use for a long period and must have been abused and as a result the organisms must have developed mechanisms of changing their mode of action. In conclusion, *E. coli* and *staphylococci* are the most common UTI pathogens in Sudan with an increasing incidence rate of *S. aureus* and piperacillin/ tazobactum was the most active drug for UTIs treatment followed by imipenem and norofloxacin. Regular monitoring of antimicrobial drugs resistance is necessary to improve the guidelines for empirical antibiotic therapy.

REFERENCES

Ahmed, M., Mohsin, S. 2012. Pattern of Nosocomial. Urinary Tract Infections among Sudanese Patients. *British Microbiology Research Journal*, 2(2): 53-61.

Akerele, J., Akonkhai, I., Isah, A. 2000. Urinary pathogens and antimicrobial susceptibility: A retrospective study of private diagnostic laboratories in Benin City, Nigeria. *J Med Lab Sci.,* 9:47–52.

Akortha, E.E., Ibadin, O.K. 2008. Incidence and antibiotic susceptibility pattern of Staphylococcus aureus amongst patients with urinary tract infection (UTIS) in UBTH Benin City, Nigeria. *Afr J Biotechnol.,* 7:1637–1640.

Akram, M., Shahid, M., Khan, A.U. 2007. Etiology and antibiotic resistance patterns of community-acquired urinary tract infections in the JNMC Hospital Aligarh, India. *Ann Clin Microbiol Antimicrob.,* 6:4.

Ali, E. M.A., Osman, A. H. 2009. Acute Urinary Tract Infections in Children in Khartoum State: Pathogens, Antimicrobial Susceptibility and Associated Risk Factors. *Arab Journal of Nephrology and Transplantation*, 2(2):11-5

Al-Ruaily, M.A. and Khalil, O.M. 2011. Detection of (*mecA*)gene in methicillin resistant *Staphylococcus aureus* (MRSA) at Prince A / Rhman Sidery Hospital, Al-Jouf, Saudi Arabia. *Journal of Medical Genetics and Genomics,* 3 (3):41 – 45.

Awad, A.I., Ball, D.E., Eltayeb, I.B. 2007. Improving rational drug use in Africa: the example of Sudan. *East Mediterr Health J*., 13 (5):1202-1211.

Bader, M.S., Hawboldt, J., Brooks, A. 2010. Management of complicated urinary tract infections in the era of antimicrobial resistance. *Postgrad Med*., 122(6):7-15.

Cheesbrough, M., 2000. District Laboratory Practice in Tropical Countries Part 2," Cambridge University Press, Cambridge.

CLSI, 2010. Clinical and Laboratory Standards Iinstitute. Performance standards for antimicrobial susceptibility testing. Twentieth informational supplement ed. CLSI document M100-S20. Wayne, PA.

Dalela, G., Gupta, S., Jain, D.K., Mehta, P. 2012. Antibiotic Resistance Pattern in Uropathogens at a Tertiary Care Hospital at Jhalawar with Special Reference To Esbl, AmpC b-Lactamase and Mrsa Production. *J Clin D R.* 6(4):645-651

Haber, M., Levin, B.R., and Kramarz, P. 2010. Antibiotic control of antibiotic resistance in hospitals: a simulation study. *BMC Infect Dis*., 10: 254.

Hamdan, H. Z., Ziad, A. H. M., Ali, S. K., Adam, I. 2011. Epidemiology of urinary tract infections and antibiotics sensitivity among pregnant women at Khartoum North Hospital. *Ann Clin Microbiol Antimicrob*., 10: 2.

Hooton, T.M., Scholes, D., Hughes, J.P., *et al*. 1996. A prospective study of risk factors for symptomatic urinary tract infection in young women. *N Engl J Med*;335:468–74.

Keah, S.H., Wee, E.C., Chng, K.S., Keah, K.C. 2007. Antimicrobial susceptibility of community acquired uropathogens in the general practice. *Malaysian Family Physician*., 2:64-69.

Manikandan, S., Ganesapandian, S., Singh, M., Kumaraguru, A.K. 2001. Antimicrobial susceptibility pattern of urinary tract infection causing human pathogenic bacteria. *Asian J Med Sci*., 3:56–60.

Manjunath, G.N., Prakash, R., Annam, V., Shetty, K. 2011. The changing trends in the spectrum of the antimicrobial drug resistance pattern of uropathogens which were

isolated from hospitals and community patients with urinary tract infections in Tumkur and Bangalore. *Int J Biol Med Res*., 2(2):504-507.

Nicolettia, J., Kustera, S., Sulserb, T., Zbindenc, R., Ruefa, C., Ledergerbera, B., Webera, R. 2010. Risk factors for urinary tract infections due to ciprofloxacin-resistant Escherichia coli in a tertiary care urology department in Switzerland. *Swiss Med Wkly*. 140:13059.

Noor, N., Ajaz, M., Rasool, S.A., Pirzada, Z.A. 2004. Urinary tract infections associated with multidrug resistant enteric bacilli: characterization and genetical studies. *Pak J Pharm Sci*., 17(2):115-23.

Nowé, P. 1994. Piperacillin/tazobactam in complicated urinary tract infections. *Intensive Care Med.,* 20 (3):S39-42.

Nwanze, P.I., Nwaru, L.M., Oranusi, S., Dimkpa, U., Okwu, M.U., Babatunde, B.B., *et al*. 2007. Urinary tract infection in Okada village: Prevalence and antimicrobial susceptibility pattern. *Sci Res Essay*, 2:112–116.

Okonko, I.O., Donbraye-Emmanuel, O.B., Ijandipe, L.A., Ogun, A.A., Adedeji, A.O., Udeze, A.O. 2009. Antibiotics sensitivity and resistance patterns of uropathogens to nitrofurantoin and nalidixic acid in pregnant women with urinary tract infections in Ibadan, Nigeria. *Middle-East J Sci Res*., 4:105–109

Ronald, A. 2002. The etiology of urinary tract infection: traditional and emerging pathogens. *AJM*, 113(1): 14–19.

Ronald, A. 2003. The etiology of urinary tract infection: traditional and emerging pathogens. *Dis. Mon*. 49:71-82.

Ronald, A.R., Nicolle, L.E., Stamm, E., *et al*. 2001. Urinary tract infection in adults: research priorities and strategies. *Int. J. Antimicrob. Agents*, 17:343-8.

Rutschmann, O. T., Zwahlen, A. 1995. Use of norfloxacin for prevention of symptomatic urinary tract infection in chronically catheterized patients. 14: 441-444.

Sabharwal, E. R. 2012. Antibiotic Susceptibility Patterns of Uropathogens in Obstetric Patients. *N Am J Med Sci.,* 4 (7): 316–319

Sabharwal, E.R. 2012. Antibiotic Susceptibility Patterns of Uropathogens in Obstetric Patients. *N Am J Med Sci.,* 4(7): 316–319

Saginur, R., Nicolle, L.E. 1992. Single-dose compared with 3-day norfloxacin treatment of uncomplicated urinary tract infection in women. Canadian Infectious Diseases Society Clinical Trials Study Group. *Arch Intern Med*., 152(6):1233-7

Santo1, E., Salvador, M.M., Marin, J. M. 2007. Multidrug-Resistant Urinary Tract Isolates of Escherichia coli from Ribeirão Preto, São Paulo, *Brazil. BJID*., 11:575-578.

Stamm, W. E., S. Norrby, R. 2001. Urinary Tract Infections: Disease Panorama and Challenges. *J Infect Dis.,* 183 (Supplement 1): S1-S4.

Togoobaatar, G., Ikeda, N., Ali, M., Sonomjamts, M., Dashdemberel, S., Mori, R. 2010. Survey of non-prescribed use of antibiotics for children in an urban community in Mongolia. *Bull World Health Organ.,* 88: 930–936.

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