ORIGINAL RESEARCH

A Study of Pathogenic Bacteria Isolated from Symptomatic Urinary Tract Infection and Their Antibiotic Sensitivity

[1]Mahi Ishani, [2]Tiwari Palak, [3]Lal Darbari

[1]Junior Resident, Department of Nursing Home (Medicine), Hindu Rao Hospital, Delhi, India
[2]Senior Resident, Department of Nursing Home, Hindu Rao Hospital, Delhi, India
[3]Physician, Chief Medical Officer (SAG), Department of Medicine, Hindu Rao Hospital, Delhi, India

Correspondence:
Darbari Lal
Physician, Chief Medical Officer (SAG), Department of Medicine, Hindu Rao Hospital, Delhi, India
Email: dr_darbarilal@rediffmail.com

ABSTRACT

Background: Urinary tract infection isamong the most common bacterial infections ingeneral population.The etiology as well as antibiotic sensitivity pattern of UTI varies with the widespread availability of antimicrobial agents; As a result of widespread use of antimicrobial agents, UTIs are becoming increasingly difficult to treat as pathogens with increasing resistance to commonly used antimicrobials are encountered more frequently in clinical practice.

Methods: A cross-sectional study done during April 2021-April2022. All positive urine culture and sensitivity reports of males and females aged 10-80years were included. A total of200 positive urine culture cases were taken from the culture and sensitivity register from Microbiology department of Hindu Rao Hospitaland details were tabulated using a questionnaire.

Results: Out of200 adults, males were 62 (31 %) and females were 138 (69 %). E. coli (63.1%) was the most common organism, followed byEnterococcus (17.68), Klebsiella Pneumoniae (11.1%) Pseudomonas and Staphylococcus. The incidence of UTI was morein female patients in the agegroup of21-30years.E.coli andKlebsiella weresensitive to Amikacin (97.1%), Nitrofurantoin (90.7%), Gentamycin and Imipenem. Both organisms were resistant to Ampicillin (>90%).

Conclusions: In this study, females were predominately affected and on culture the most common organisms were E. coliand Klebsiella. These organisms were most sensitive to Amikacin, Nitrofurantoin and resistant predominantly to Ampicillin. While planning treatment for UTI the sensitivity and resistance pattern ofuropathogensto common antimicrobial agents must betaken into account.

Keywords: Antibiotic Sensitivity, Urinary Tract Infection, Uropathogens.

INTRODUCTION

Acute urethritis and Cystitis caused by a microorganism come under broad term Urinary tract infection (UTI). It is a common disorder, accounting for 1–3% of consultations in general medical practice.[1] The prevalence of UTI in women is about 3% at the age of 20, increasing by about 1% in each subsequent decade. In males, UTI is uncommon, except in the first year of life and in men over 60, when it may complicate bladder outflow obstruction.

Urine is an excellent culture medium for bacteria, providing favourable environment for growth of infectious agents such as E. coli, Enterococcus and Klebsiella etc. UTI is diagnosed based on the combination of typical clinical features and abnormalities found on urine analysis. Although, urine culture prior to treatment is not mandatory but because of development of resistance to multiple drugs it is important for effective treatment. Investigation is necessaryin patients with recurrent infection or after failure of initial treatment, during pregnancy, or in patients susceptible to serious infection, such as the immunocompromised, those with diabetes or an indwelling catheter, and older people. Knowledge of frequently encountered uropathogens along with their antimicrobial sensitivity profile is invaluable in treating individual patients, as well as designing appropriate protocols. This study was conducted to offer insight into the bacteriological profile and antimicrobial susceptibility patterns in patients of symptomatic UTI encountered at Hindu Rao Hospital, Delhi.

MATERIALS AND METHODS

This is a cross-sectional study conducted Hindu Rao Medical College &Hospital from 2021-2022. Prior to the study, all relevant permissions were obtained from the competent hospital authorities. Patients presenting with typical symptoms of UTI such as pyrexia, dysuria, frequent urination, loin pain were offered urine culture and antibiotic sensitivity. Parameters like age and gender were considered. Any significant comorbidities such as uncontrolled diabetes, anatomical defects and immunocompromised state were excluded from this particular study in order to obtain data reflective of the general population. Pathogens isolated and the antibiotic sensitivity was taken into account. Required clinical history and examination findings were noted. Data was manually collected from hospital records ensuring anonymity and data privacy. Analysis was done using Microsoft Excel wherever necessary.

PROCEDURE

The following procedure was adhered to during the collection of specimen:

A. Patient preparation:

For Female patients:

1. Wash hands thoroughly before beginning the procedure and put on disposablegloves.
2. Use betadine swabs to cleanse the perineal area.

a. Separate the folds of the labia and wipe the betadine swab fromfront to back (anterior to posterior) on one side, then discard swab ortowelette.
b. Using a second betadine swab, wipe the other side from front toback, then discard.
c. Using a third betadine swab, wipe down the middle from front toback, then discard.
d. Pat dry periurethral area with clean dry gauze to remove excessive betadinewhile keeping the labia separated.

For Male patients:

1. Wash hands thoroughly before beginning the procedure and put on disposablegloves.
2. If the patient is not circumcised, pull the foreskin back (retract the foreskin) onthe penis to clean and hold it back during urination.
3. Using a circular motion, clean the head of the penis with betadine swab. Discard the swab or towelette.

B. Urination should begin, passing the first portion into the bedpan, urinal, or toilet.

C. After the flow of urine has started, the urine specimen container should be placed underthe patient collecting the midportion (midstream “clean catch”) without contaminating the container.

D. Any excess urine can pass into the bedpan, urinal, or toilet.

E. Cover the urine container immediately with the lid being careful not to touch the inside of the container or the inside of the lid.
F. Transfer urine to specimen tube if tubes are used for transport instead of urine containers.
G. Attach label to tube or container and place specimen in the transport bag.
H. Remove gloves and wash hands.
I. Record date and time of collection and initials of the person collecting (or submitting) the specimen on the specimen container. Transport specimen to the Laboratory within 2 hours of collection or refrigerate and transport to the lab as soon as possible.

Table 1: Distribution of Urine Culture Isolates

	Values	
Organism	**Count of Sr No**	**Count of Sr No2**
E. Coli	125	63.13%
Enterococcus	35	17.68%
Kleb. Pneumoniae	22	11.11%
Pseudomonas Aeruginosa	5	2.53%
Klebsiella	5	2.53%
Staph. Aureus MRSA	2	1.01%
Proteus Mirabilis	2	1.01%
MRSA	1	0.51%
Candida	1	0.51%
Grand Total	**198**	**100.00%**

Table 2: Age and sex distribution of patients with positive Urine culture

		Values	
sex	**age2**	**Count of Sr No**	**Count of Sr No2**
F	0-10	8	5.84%
	11-20	13	9.49%
	21-30	50	36.50%
	31-40	23	16.79%
	41-50	20	14.60%
	51-60	6	4.38%
	61-70	11	8.03%
	71-80	4	2.92%
	81-90	1	0.73%
	91-100	1	0.73%
F Total		**137**	**69.19%**
M	0-10	4	6.56%
	11-20	4	6.56%
	21-30	9	14.75%
	31-40	4	6.56%
	41-50	9	14.75%
	51-60	15	24.59%
	61-70	10	16.39%
	71-80	5	8.20%
	81-90	1	1.64%
M Total		**61**	**30.81%**
Grand Total		**198**	**100.00%**

Fig 1: Percentage of various Organism found in Urine Culture

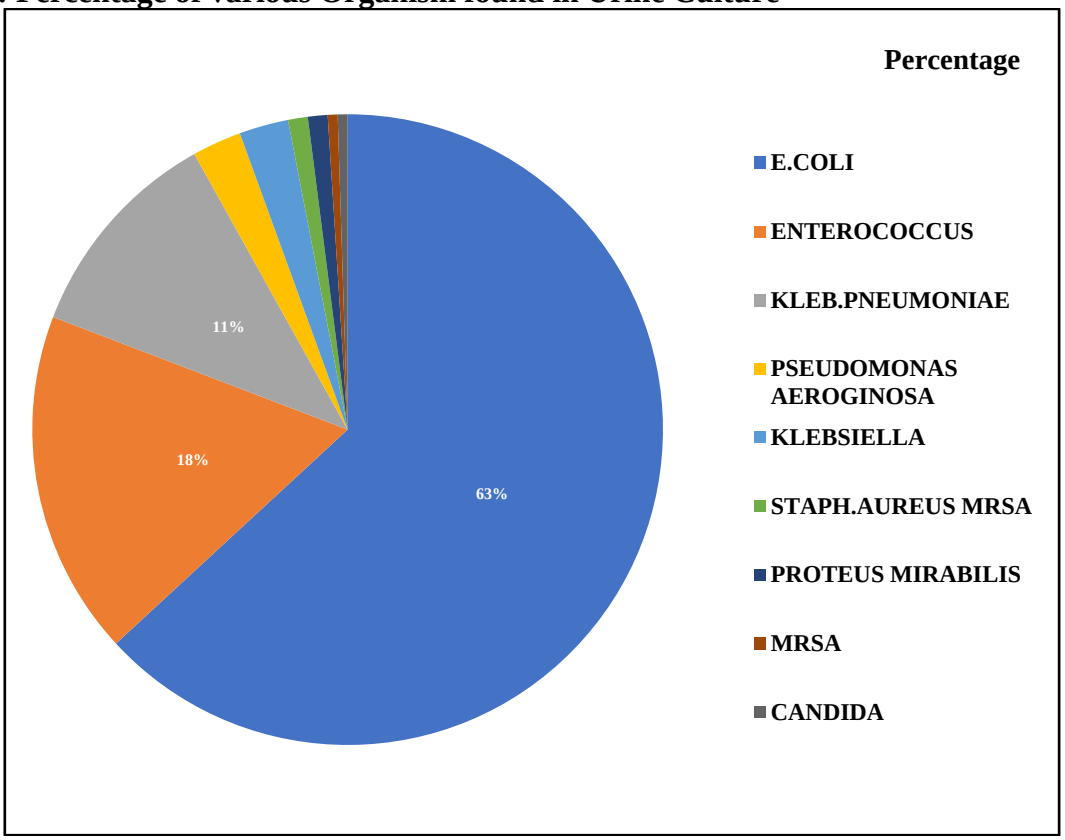


Fig 2: Age wise distribution of positive Urine Culture in Female patients.

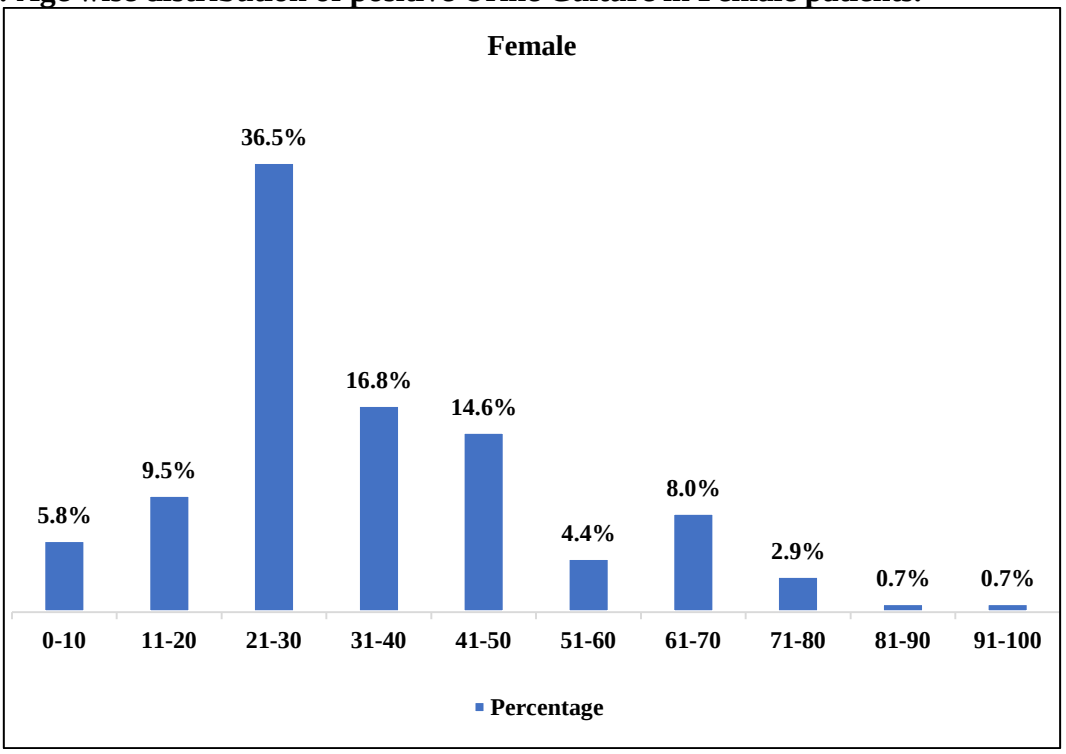


Fig 3: Age wise distribution Positive Urine Culture in Male patients.

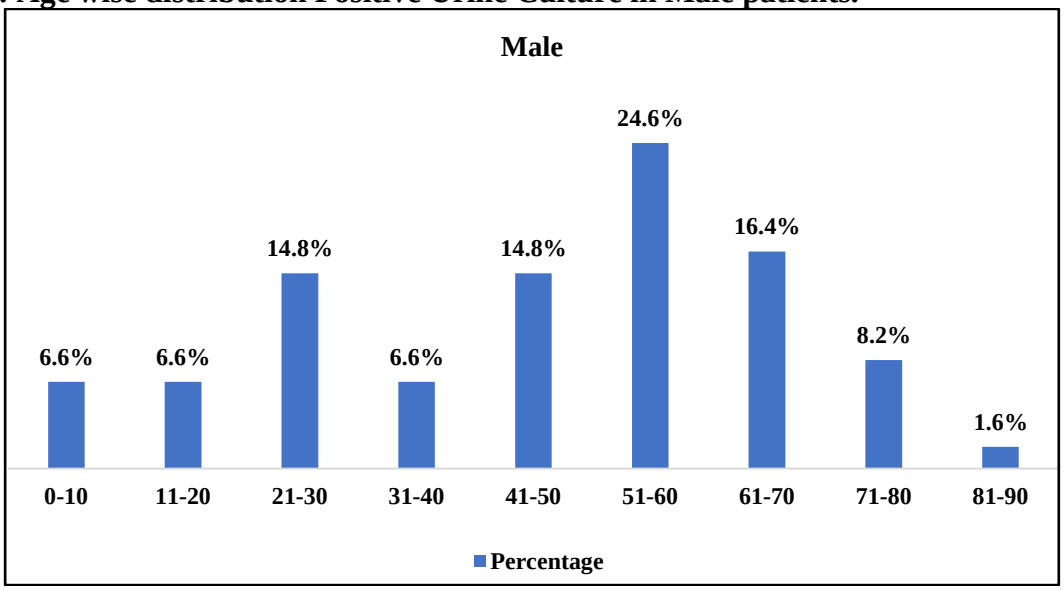
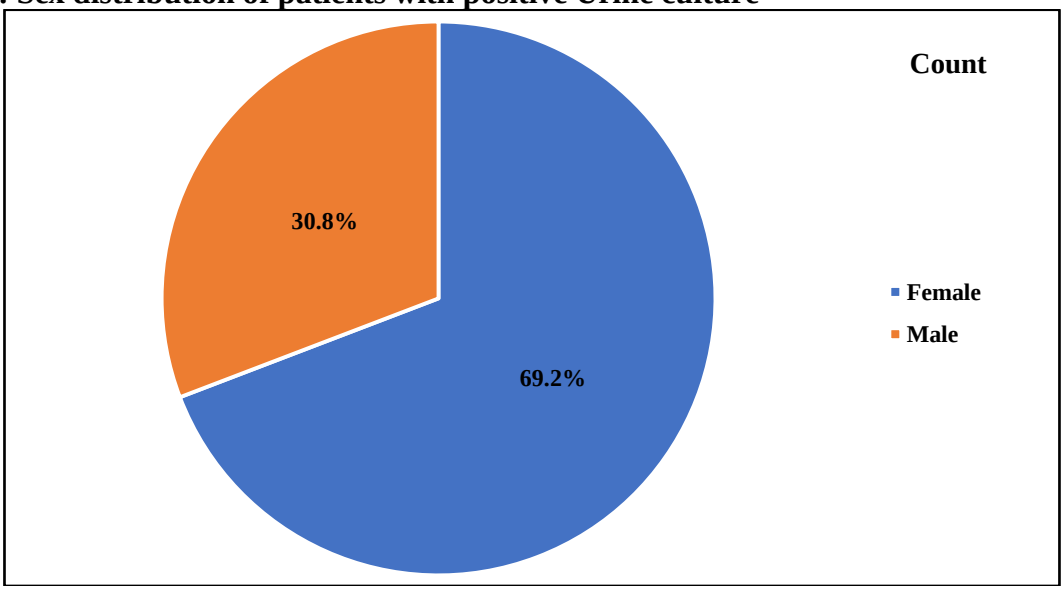


Fig 4: Sex distribution of patients with positive Urine culture



RESULTS AND DISCUSSION

Out of 200 specimens analysed, females accounted for 69% (138) and males were 31% (62). The infection is higher in females due to biological factors such as the short urethra, anal-genital proximity, and use of spermicides.[2]Additional risk factors include prior history of UTIs, vaginal intercourse within the past 2 weeks, use of contraception with spermicide, low vaginal estrogen levels.[3,4]Majority of the pathogen isolated was E. coli, which was found in 63.1% (125) and is parallel to studies done in Dehradunby Biswas et al[5], and in Haryanaby Arora G et al.[6] This was followed by Enterococcus 17.68% (35) similar to Lee DS et[7]and Bouza E et al[8], Klebsiella Pneumoniae 11.1% (22) , Pseudomonas 2.5% (5) and Staphylococcus 1% (2). Similar frequency of isolates of *E coli* has been obtained in studies performed in different regions of Iran with maximum distribution of 78.1% in the west.[9-13]

The incidence of UTI in the female population was predominantly in patients aged between 21-30 years, while in the male population it was found to be in those aged between 51-60 years. This finding is closely resembling the prevalence demonstrated in Nigerian women by Akinloye et al[14] and is similar with Panamanian Ministry of Health concern regarding UTI as

a significant cause of morbidity in the region.[15] The high incidence of UTI among younger women could be due to their fertile age with more sexual activity. The relationship between UTI and sexual activity is well established in younger women. Vaginal bacteria during intercourse, gain access to the urinary tract by colonizing the periurethral mucosa and ascending to the bladder through the urethra.[16]

Most common organisms were found to be sensitive to Nitrofurantoin (87%), followed by Amikacin (73%), Gentamycin (64%) and Imipenem. Nitrofurantoin is especially used to treat UTIs caused by Gram-negative bacteria, particularly Escherichia coli.[17] Whereas, the most frequently encountered resistance was to Ampicillin (>90%), similar to study by Simon-Oke IA et al.[18] In study in Taiwan, the rates of resistance in *E. coli* and *Klebsiella* were 100% and 70%, respectively.[19] *E. coli* resistance to ampicillin in studies conducted in Bangladesh was 80%[20],Ethiopia 80%[21],Mexico 79%[22],UAE 72%.[23] This antibiotic resistance of these bacterial agents is different in diverse parts of the world. Hence, in the treatment of urinary infections, antibiotic selection should be based on knowledge of the region, and international reports are not an appropriate choice for antimicrobial drug selection.[24,25]

Fig 5: Distribution of Antibiotic Sensitivity: NIT-Nitrofurantoin, AK-Amikacin,G-Gentamycin

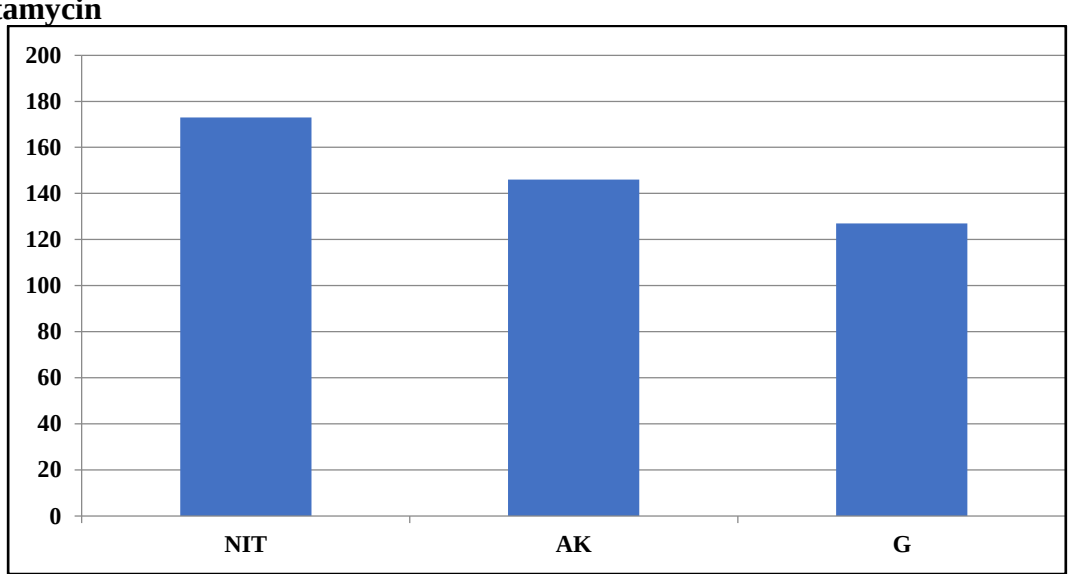


Table 3: Percentage of distribution of Antibiotic Sensitivity

Sensitivity	Frequency	Percentage	
IPM	32	16.0804	16
G	127	63.8191	64
AK	146	73.36683	73
NET	1	0.502513	1
CTR	57	28.64322	29
NIT	173	86.93467	87
IMP	6	3.015075	3
CIP	75	37.68844	38
IPM	0	0	0
V	1	0.502513	1
LZ	29	14.57286	15
VG	1	0.502513	1
LE	37	18.59296	19
LR	2	1.005025	1
NIT	173		

AK	146		
G	127		
NIT	173		
AK	146		
G	127		

CONCLUSION

As UTI is a common condition encountered in hospitals everywhere, its prompt recognition andtimely diagnosis along withinitiating appropriate antibiotics empirically, or if indicated, according to the culture and sensitivityis essential in preventing an uncomplicated UTI progressing into complicated one, which is associated with significant morbidity, mortality and potentially debilitating long term sequalae. E coli is the overwhelmingly common organism isolated in urine culture in most cases. However, the antibiotic susceptibility differs depending on population under consideration. Updated knowledge ofantibiotic sensitivity pattern in a particular area will give clinicians valuable insight into empirical treatment of UTI before the availability of laboratory reports. Such studies need to be repeated on larger scales and frequency to help clinicians take better informed decisions for the benefit of their patients.This will save valuable time, improve patient outcomes and serve to reduce stress on an already overburdened healthcare system.

REFERRENCE

1. Boon A Nicolas, ColledgeRNicki, walkerRBrian,Davidson'sThe principlesandpracticesofmedicine, 20th ed,ChurchillLivingstoneElsevier publication; London, 2006,
2. Schaeffer A, Rajan N, Cao Q, Anderson B, Pruden DL, Sensibar J, et al. Host pathogenesis in urinary tract infections. International journal of antimicrobial agents. 2001;17(4):245–51. pmid:11295403
3. DielubanzaEJ, SchaefferAJ. Urinary tract infections in women, Med Clin North Am, 2011; 95: 27-41.
4. ColganR, WilliamsM, Johnson JR. Diagnosis and treatment of acute pyelonephritis in women, Am Fam Physician, 2011, vol. 84 (pg. 519-26)
5. Biswas R, Rabbani R, Ahmed H, Sarker M, Zafrin N, Rahman M. Antibiotic sensitivity pattern of urinary tract infection at a tertiary care hospital. Bangladesh Crit Care J. 2014;2:21–4.
6. Arora G, Kaur P and Agrawal D: Urinary tract infection in women of the rural population of Haryana: a rising problem. International Journal of Reproduction, Contraception, Obstetrics and Gynaeco 2016; 5:4470-74.
7. Lee DS, Choe HS, Lee SJ, Bae WJ, Cho HJ, Yoon BI, et al. Antimicrobial susceptibility pattern and epidemiology of female urinary tract infections in South Korea, 2010-2011. Antimicrob Agents Chemother. 2013;57:5384–93.
8. Bouza E, San Juan R, Muñoz P, Voss A, Kluytmans J. Co-operative Group of the European Study Group on Nosocomial Infections. A European perspective on nosocomial urinary tract infections I. Report on the microbiology workload, etiology and antimicrobial susceptibility (ESGNI-003 study). European study group on nosocomial infections. Clin Microbiol Infect. 2001;7:523–31.
9. Rezaee MA, Abdinia B. Etiology and antimicrobial susceptibility pattern of pathogenic bacteria in children subjected to UTI: a referral hospital-based study in Northwest of Iran. Medicine (Baltimore) 2015; 94:e1606.
10. Kashef N, Djavid GE, Shahbazi S. Antimicrobial susceptibility patterns of community-acquired uropathogens in Tehran, Iran. J Infect Dev Ctries 2010; 4:202–6.

11. Ali A, Tayebah V, Farid K, et al. Antimicrobial susceptibility patterns of community-acquired Gram-negative uropathogens. African J Microbiol Res 2014; 8:332–6.
12. Shakibaie MR, Adeli S, Salehi MH. Antimicrobial susceptibility pattern and ESBL production among uropathogenic Escherichia coli isolated from UTI children in pediatric unit of a hospital in Kerman, Iran. Br Microbiol Res J2014; 4:262.
13. Arabi F, Banazadehi A. Prevalence and antimicrobial susceptibility patterns of uropathogens among patients referring to valieasr laboratory in Najafabad, Isfahan. Iran Mid East J Sci Res 2013; 13:85–90.
14. Akinloye O, Ogbolu DO, Akinloye OM, Terry Alli OA (2006) Asymptomatic bacteriuria of pregnancy in Ibadan, Nigeria: a re-assessment. Br J Biomed Sci. 63(3): 109–12.
15. IndicadoresBásicos de Salud de la República de Panamá y Regiones de Salud. Ministerio de Salud, Panamá. 2006.
16. Hooton TM. Clinical practice Uncomplicated urinary tract infection. N Engl J Med. 2012;366(11):1028–1037.
17. Ingalsbe ML, Wojciechowski AL, Smith KA, et al. Effectiveness and safety of nitrofurantoin in outpatient male veterans. Ther Adv Urol 2015;7(4):186-93.
18. Simon-Oke IA, Odeyemi O and Afolabi OJ: Incidence of urinary tract infections and anti-microbial susceptibility pattern among pregnant women in Akure, Nigeria. Scientific African 2019; 6:1-9.
19. Chen LF, Chiu CT, Lo JY, Tsai SY, Weng LS, Anderson DJ, et al. Clinical characteristics and antimicrobial susceptibility pattern of hospitalized patients with community acquired urinary tract infections at a regional hospital in Taiwan. Healthc Infect. 2013;19:20–5.
20. Sharmin S, Alamgir F, Fahmida M, Saleh AA. Antimicrobial sensitivity pattern of uropathogens in children. Bangladesh J Med Microbiol. 2010;3:18–22.
21. Abejew AA, Denboba AA, Mekonnen AG. Prevalence and antibiotic resistance pattern of urinary tract bacterial infections in Dessie area, North-East Ethiopia. BMC Res Notes. 2014;7:687.
22. Abejew AA, Denboba AA, Mekonnen AG. Prevalence and antibiotic resistance pattern of urinary tract bacterial infections in Dessie area, North-East Ethiopia. BMC Res Notes. 2014;7:1
23. Narchi H, Al-Hamdan MA. Antibiotic resistance trends in paediatric community-acquired first urinary tract infections in the United Arab Emirates. East Mediterr Health J. 2010;16:45–50.
24. Qiao LD, Chen S, Yang Y, Zhang K, Zheng B, Guo HF, et al. Characteristics of urinary tract infection pathogens and theirin vitro susceptibility to antimicrobial agents in China: Data from a multicenter study. BMJ Open. 2013;3:e004152.
25. Molazadeh M, Mola Abbas Zadeh H, Mohammad Zadeh N. The pattern of sensitivity and resistance antibiotics in *E. coli* strains isolated from urine samples of pregnant women in Khoy and Salmas in West Azerbaijan province. Sci J Micro Biotech Islamic Azad Univ. 2012;4:13–20.