British Microbiology Research Journal
10(6): 1-8, 2015, Article no.BMRJ.20208
ISSN: 2231-0886, NLM ID: 101608140

SCIENCEDOMAIN *international*
www.sciencedomain.org

Prevalence and Microbial Resistance of Uropathogenic Bacteria Isolated from Neonatal and Pediatric Patients in Western of Iran

Mansour Mansouri[1], Davoud Afshar[2*], Mozhgan Hemati-Harsini[3], Abolfazl Davoodabadi[2], Abbas Farahani[4] and Amir Hasanzadeh[5]

[1]Department of Biological Chemistry, Faculty of Sciences and Technology, Pharmceutical Sciences Branch, Ialamic Azad University, Tehran, Iran.
[2]Department of Pathobiology, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran.
[3]Biology Department, Science and Research Branch, Islamic Azad University, Tehran, Iran.
[4]Department of Microbiology, School of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
[5]Division of Microbiology, Department of Pathobiology, School of Public Health and Institute of Public Health Research, Tehran University of Medical Sciences, Tehran, IR, Iran.

Authors' contributions

This work was carried out in collaboration between all authors. Authors MM, DA, MHH, AD and AF designed the study, author AH performed the statistical analysis, authors DA and AF wrote the protocol, and wrote the first draft of the manuscript and managed literature searches. Authors MM, DA, AD and AF managed the analyses of the study and literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BMRJ/2015/20208
Editor(s):
(1) Giuseppe Blaiotta, Department of Food Science, Via Università, Italy.
Reviewers:
(1) Dorota Wojnicz, Wroclaw Medical University, Poland.
(2) R. Jasmine, Bishop Heber College, Trichy, India.
(3) Teresita Sainz Espunes, Universidad Autónoma Metropolitana, Mexico.
Complete Peer review History: http://sciencedomain.org/review-history/11600

Original Research Article

Received 16th July 2015
Accepted 23rd August 2015
Published 28th September 2015

ABSTRACT

Backgrounds: Urinary tract infections (UTIs) are the most common bacterial infections disease among children, pediatric and neonatal patients. These infections are found frequently in children. The global evolution of antibiotic resistance among urinary tract isolates has recently been reported.

**Corresponding author: E-mail: davoodafshar@yahoo.com;*

The aim of the present study was to investigate the prevalence and antibiotic resistance pattern of uropathogenic bacteria isolated from patients with urinary tract infections.
Materials and Methods: A total of 1754 urine specimens were obtained from children with UTI who referred to Emam Hossien hospital in Kermanshah city, Iran. The urine samples were cultured on the appropriate bacteriological media and identified by conventional bacteriological tests. Antibiotic succeptibility testing was then performed by disk diffusion method.
Results: Of 1754 samples, 193 (11%) urine samples were positive based on do the urine cultures method. Out of 193 urine specimens, were positive for: *E. coli*, *Kelebsiella* spp., *Enterococus* spp., coagulase-negative staphylococcocci, *Pseudomonas* spp., *Staphylococcus aureus*, *Citrobacter* spp., *Serratia* spp., *Streptococcus* (viridans group) and *Proteus* spp. A sample was positive for *Acinetobacter* spp. Furthermore, *E. coli* infections showed high resistance to ampicillin (82%), trimethoperim-sulfamethoxazole, nalidixic acid (69%), and nitrofurantoin (61%).
Conclusion: Our results revealed that urinary tract pathogens isolated from Iranian children are particularly resistant to some commonly used antimicrobial agents. Regarding to antimicrobial susptibility pattern in urinary tract pathogens showed that high levels of resistance to different antibiotics and treatment options are limited, and infection control measures remain of high importance. Routine surveillance and monitoring studies should be performed to provide knowledge to physicians on the updated and most effective empirical prescribing practice in the treatment of UTIs.

Keywords: Urinary tract infections; antibiotic resistance; gram-negative bacteria; gram-positive bacteria.

1. INTRODUCTION

Urinary tract infection (UTI) is a critical health problem and it is an infection that can happen anywhere along the urinary tract and is continued as one of the most frequently diagnosed cases [1,2]. In fact, UTIs are the leading cause of gram-negative bacteremia in patients of all ages and are associated with a high risk of morbidity and mortality, especially in the elderly, and account for significant health care costs [3]. These infections are found frequently in children, which can be asymptomatic or symptomatic and also characterized by a wide spectrum of symptoms ranging from mild irritative voiding to bacteremia, sepsis or death. In recent years, the incidence of antibiotic resistance has been increasing among urinary pathogens as a result of wide spread use of antibiotics [4,5]. Several studies have demonstrated that the geographical variability of pathogens occurrence in cases of UTI between inpatients and outpatients is limited by the predominance of gram-negative species, particularly *E. coli* and *Entrobacter* spp. [6,7]. The global evolution of antibiotic resistance among urinary tract isolates has recently been reported [8-10]. In developing countries, more than 80% of bacterial strains causing UTIs are now resistant to trimethoprim-sulphamethoxazole. Antibiotics are commonly used for the treatment of UTIs particularly uncomplicated cystitis [11]. Various studies have reported an increase in the incidence of UTIs in Iran, indicaing that treatment has become more complicated due to the emergence of pathogens with higher resistance to antimicrobial agents. The aim of present study was to determine the prevalence and antibiotic resistance pattern of uropathogenic bacteria isolated from urinary tract of suspected children with age range of newborn to 8 years olds during time period of 2010 to 2012 who were admitted to the Microbiology Laboratory of Emam Hossein Hospital in Kermanshah, Iran.

2. MATERIALS AND METHODS

2.1 Specimen Collection and Isolation

The specimens were obtained from all suspected pediatric and neonatal children with UTI who were admitted to Emam Hossein Hospital, in Kermanshah, Iran during a time course of November 2010 to March 2012. At first, physical examination and complete history were taken for each patient and all urine samples (1745 urine specimens: 933 females and 821 males) were then obtained. Following obliteration for another source of infection from the urogenital superficial region by povidone-iodine, the urine specimens were collected by midstream clean-catch method. After inoculation on EMB (Eosin Methylene Blue Agar), Blood agar and MacConkey agar followed by overnight incubation at 37ºC, a general urine analysis including white blood cell (WBC) count and the amount of bacteria using a direct microscopy was performed.

2.2 Isolation and Identification Procedures for *E. coli* and Other Bacterial Pathogens

The number of bacterial colonies as colony formation unit (CFU) was determined after overnight incubation at 37℃. Bacterial colony number of $>10^5$ was considered as pathologic count for *E. coli*. It was also portrayed as significant bacteriuria and the isolates were further subjected to antibiogram analysis [12,13]. Coagulase-negative and coagulase-positive *Staphylococcus spp* were identified by standard biochemical tests such as production of coagulase, colonial morphology, DNase and the API 20 staph test (Bio Merieux). The isolated bacterial strains were further differentiated microbiologically according to standard laboratory methods. Classification of positive urinary specimens was carried out based on the guidelines of Infectious Disease Society of America (IDSA) [14]. Isolated strains were differniated by Gram staining and conventional biochemical methods [15].

2.3 Antimicrobial Susceptibility Testing

Antibacterial disc diffusion tests were performed according to the Clinical and Laboratory Standard Institute (CLSI) standards with antibacterial tablets manufactured by ROSCO Diagnostica. The antibiotics selected for the panel were following: trimethoprim-sulfamethoxazole (SXT, 30 µg), ampicillin (AM, 10 µg), nalidixic acid (NA, 30 µg), cefixim (CFM, 30 µg), ciprofloxacin (CP, 5 µg), ceftriaxone (CRO, 30 µg), cefotaxim (CTX, 30 µg), ofloxacin (OFX, 5 µg), gentamicin (GM, 10 µg), amikacin (AN, 30 µg), nitrofurantoin (FM, 300 µg), imipenem (IPM, 10 µg), penicillin (P, 10 µg), vancomycin (V, 30 µg), oxacillin (OX, 5 µg), cloxacillin (CX, 5 µg), cephalothin (CF, 30 µg), and erythromycin (E, 15 µg).

2.4 Statistical Data Analysis

The number of patients and antibiotic resistance pattern of uropathogens were compared for each antibiogram test using Chi-square and Fisher exact tests by SPSS statistics software version 11.0. Statistical significance difference were considered at value of $p<0.05$.

3. RESULTS

A total of 1754 urine specimens were collected from pediatric patients in both gender (female 933 cases and male 821 cases) with proportion of 53:47%. The age range of the patients was between 1 week-8 years (Fig. 1). Of these, 193 (11%) were showed significant positive growth for uropathogenic bacteria either gram-positive or gram-negative. Among isolated gram-negative uropathogens, one specimen was positive for *Acinetobacter* spp. while the most common isolates were positive for other uropathogenic bacteria with significant proportion of 136 (70.5%) for *E. coli*. The most common isolated bacterial species were as following: *Klebsiella* spp. (7.3%), *Entrobacter* spp. (5.7%), coagulase-negative staphylococci (5.2%), *Pseudomonas* spp. (2.6%), *Staphylococcus aureus* (2.6%), *Citrobacter* spp. (2.1%), *Serratia* spp. (1.5%), *Streptococcus* (viridians group) (1.5%), *Proteus* spp. (1%), *Acinetobacter* spp. (0.5%). In respect to the antimicrobial susceptibility test (AST), *E. coli* isolates were exhibited highest susceptibility (93%) to imipenem and low susceptibility (18%) to ampicillin. The highest susceptibility of *Klebsiella* spp. was observed (86%) to imipenem and low susceptibility(14%) to ampicillin. The highest susceptibility of *Entrobacter* spp. was observed to (82%) imipenem and, similar to two latter species, highest resistance was demonstrated (91%) to ampicillin.The most level resistance of *Pseudomonas* spp. (80%) was to trimethoprim-sulfomethoxazol, cefixim, ampicillin and nitrofurantoin. Also the low level resistance was (20%) to imipenem, amikacin and ciprofloxacin. Isolated *Citrobacter* spp. showed the highest resistance (75%) to trimethoprim-sulfomethoxazol and ampicilin. *Serratia* spp. strains were the most sensitive (100%) to ceftriaxone, amikacin and imipenem. *Proteus* spp. isolates showed 100% resistance to trimethoprim-sulfomethoxazol, ampiciclin and nalidixic acid and no resistance to ciprofloxacin, amikacin and imipenem. The *Acinetobacter* spp. exhibited 100% of resistance to trimethoprim-sulfamethoxazole, ampicillin, nalidixic acid, cefixim, ciprofloxacin, cefotaxim and nitrofurantoin. Suseptibility level of gram-positive isolates was portrayed as following: Coagulase-negative Staphylococci exhibited susceptibility of 10% to penicillin, nalidixic acid and vancomycin and showed 20% resistance to imipenem. *Staphylococcus aureus* isolates were 100% resistant to nalidixic acid,whereas their resitance to oxacilin and nitrofurantoin was low (20%). *Streptococcus* (viridans group) isolates was 100% resistant to ampicillin, nalidixic acid and cloxacillin while 33% of *Streptococcus* strains were resistant to ceftriaxone, imipenem, but 0% of Streptococcus strains were resistant to

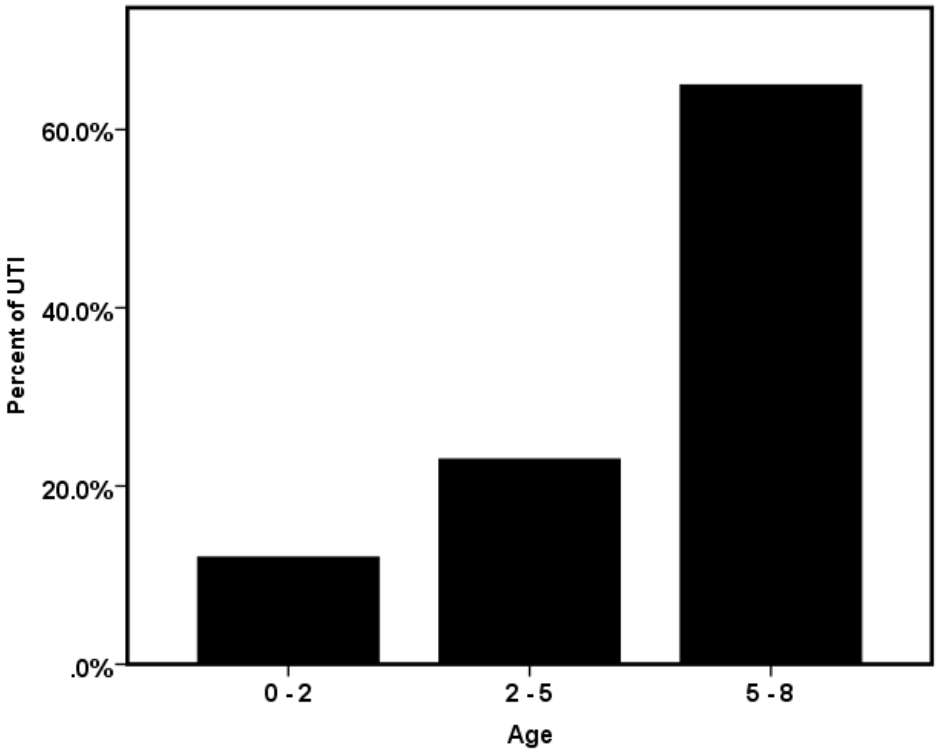

Fig. 1. Prevalence of UTI among pediatric patients according to the age

nitrofurantoin, vancomycin and oxacillin (Tables 1 and 2). However, there was no significant difference between antimicrobial resistance and gender and age of pediatric patients ($\chi 2 = 1.442$, $P = 0.23$).

4. DISCUSSION

Urinary tract infection (UTI) is one of the most common occurred in female and male and important cause of mortality and morbidity in pediatrics patint [16]. The most common causative organisms are intestine flora, typically gram-negative bacteria. Previous studies revealed that *E. coli* is still the principal etiological agent of UTI and consist of 77-80 percent of cases. To treat pediatric patients with UTIs and to prevent the recurrence, a course of antibiotics therapy is routinely prescribed [4, 17]. Empirical clinical practise antibiotics should be prescribed for the coverage of several UTI causing bacteria including *Enterococcus* spp., *Proteus* spp., *Klebsiella* spp., *Citrobacter* spp., *Serratia* spp., *Acinetobacter* spp., *Staphylococcus aureus, Staphylococcus epidermidis* and *Streptococcus* spp. [18,19]. There are a great deal of study reporting that these pathogens are the most common cause of UTI worldwide [20]. The patints with pyelonephritis are sensitive for infected by Uropathogenic Bacteria. For suspected pyelonephritis, parenteral antibiotics are recommended [21-25].

Earlier studies suggested to up accession of *E. coli* strains separated in most group and ages in UTIs women in Canada and 16 European countries revealed [26]. A study by Hansson et al. [19] indicated that *E. coli* is the most common pathogen in males (79%) and females (89%) with UTI [27,28]. As demonstrated in Tables 1 and 2, *E. coli* strains are the most common uropathogen bacteria (70.5%), followed by *Klebsiella* spp. (7.25%) and *Enterococus* spp. (5.7%). Only one *Acinetobacter spp*. was isolated from UTIs. Among gram-positive cocci, the most dominant pathogens causing UTI were coagulase-negative *Staphylococcus spp*. (5.2%). These results showed that these pathogens are still important causes of UTI worldwide and antibiotic resistance in uropathogens bacteria is remained as a critical health issue and such resistance pattern is increasing in all around the world [29,30].

Table 1. Prevalence and antimicrobial resistance of gram-negative uropathogens

Uropathogens	No.	SXT%	AM%	NA%	CFM%	CP%	CRO%	CTX%	OFX%	GM%	AN%	FM%	IPM%
E. coli	136	73	82	69	58	37	40	53	10	37	26	58	7
Klebsiella spp.	14	43	86	21	64	36	43	57	36	43	50	50	14
*Enterobacte*r spp.	11	73	91	64	64	36	45	45	36	36	55	55	18
Pseudomonas spp.	5	80	80	60	80	20	60	60	40	40	20	80	20
Citrobacter spp.	4	75	75	50	25	25	50	50	50	25	25	50	25
Serratia spp.	3	100	100	66	66	66	0	66	33	33	0	66	0
Proteus spp.	2	100	100	100	50	0	50	50	50	50	0	50	0
Acinetobacter spp.	1	100	100	100	100	100	0	100	0	0	0	100	0

Trimethoprim-Sulfamethoxazole (SXT), ampicillin (AM), nalidixic acid (NA), cefixim (CFM), ciprofloxacin (CP), ceftriaxone (CRO), cefotaxim (CTX), ofloxacin (OFX), gentamicin (GM), amikacin (AN), nitrofurantoin (FM), imipenem (IPM)

Table 2. Prevalence and antimicrobial resistance of gram-positive uropathogens

Uropathogens, antibiotics & number of isolates	Coagulase negative *Staphilococcus*		*Staphilococcus aureus*		*Streptococcus* (viridians group)	
	Resistant	Susceptible	Resistant	Susceptible	Resistant	Susceptible
Ampicillin (10 µg)	70%	30%	80%	20%	100%	0
Amikacin (30 µg)	40%	60%	40%	60%	66%	34%
Ceftriaxone (30 µg)	80%	20%	80%	20%	33%	67%
Cephalothin (30 µg)	50%	50%	60%	40%	66%	34%
Cloxacillin (5 µg)	80%	20%	80%	20%	100%	0
Erythromycin (15 µg)	70%	30%	60%	40%	66%	34%
Gentamicin (10 µg)	50%	50%	60%	40%	66%	34%
Imipenem (10 µg)	20%	80%	40%	60%	33%	67%
Nalidixic acid (30 µg)	90%	10%	100%	0	100%	0
Nitrofurantoin (300 µg)	30%	70%	20%	80%	0	100%
Oxacillin (5 µg)	70%	30%	20%	80%	0	100%
Penicillin (10 µg)	90%	10%	80%	20%	66%	34%
Trimethoprim-sulfamethoxazole (30 µg)	70%	30%	60%	40%	66%	34%
Vancomycin (30 µg)	90%	10%	20%	80%	0	100%
No.	10		5		3	

Overall, our study demonstrated that trimethoprim-sulfamethoxazole and ampicillin are not effective against gram-negative uropathogenic bacteria, however, these bacteria were susceptible to other studied drugs. The wide spectrum activity of imipenem (10.5%), ofloxacin (32%), gentamicin (33%) and amikacin (22%) have made them as one of the best therapeutic options for UTIs. Ampicillin resistance in UTI isolates was 89.2%, which is comparable to obtained results from Canada, European and African studies [4–6,12,31].

Although, UTI caused by gram-negative bacteria effectively treated with ceftriaxone (36%) and ciprofloxacin (40%) but these antibiotics are not suitable therapeutic options for gram-positive (*Staphylococcus aureus* and Coagulase-negative *Staphylococci*) urinary tract infections. In respect to antimicrobial susceptibility test, the highest susceptibility level of isolated gram-positive bacteria was observed to nitrofurantoin (83.3%) and imipenem (79%) and these antibiotics thereby would be prescribed as an empirical treatment regimen for UTIs. Gram-negative bacteria that were less common in UTI had maximum sensitivity to cephalosporins antibiotics, nalidixic acid and imipenem. In present study, *Staphylococcus aureus* showed high sensitivity (about 80%) to nitrofurantoin and oxacillin. None of *Staphylococcus aureus* strains were completely resistant to vancomycin; however, 20% of strains were diagnosed as hetero-VRSA (hVISA) strains by according to the protocols previously described by Mohajeri et al. [32].

In urinary tract infections by *Streptococcus viridians*, 100% susceptibility were observed to nitrofurantoin and vancomycin and also 67% susceptibility to ceftriaxon and imipenem.

5. CONCLUSION

In conclusion, our results also revealed that urinary tract pathogens isolated from Iranian childern are particularly resistant to commonly used antimicrobial agents and antibiotic resistance pattern. Susptibility pattern in urinary tract pathogens and its impact on empirical treatment, it is suggested that *in vitro* resistance pattern, routine surveillance and monitoring studies should be performed to provide knowledge to physicians on the updated and most effective empirical prescribing practice in the treatment of UTIs. We suggest that empirical antibiotic prescriptions should be based on the local prevalence of bacteria and also their suseptibilty pattern to commonly used antibiotics. Briefly, prevalence of urinary tract pathogens were observed in Neonatal and Pediatric Patients and high levels of resistance to different antibiotics show that, treatment options are limited, and infection control measures remain of high importance.

ACKNOWLEDGEMENTS

We would like to thank all laboratory personnels in the unit of bacteriology, Department of Medical Microbiology, Emam Hossein Hospital.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Kwok WY, de Kwaadsteniet MC, Harmsen M, van Suijlekom-Smit LW, Schellevis FG, van der Wouden JC. Incidence rates and management of urinary tract infections among children in Dutch general practice: Results from a nation-wide registration study. BMC Pediatr. 2006;6(4):10.
2. Prais D, Straussberg R, Avitzur Y, Nussinovitch M, Harel L, Amir J. Bacterial susceptibility to oral antibiotics in community acquired urinary tract infection. Arch Dis Child. 2003;88:215-18.
3. Bano K, Khan J, Begum H, Munir S, Akbar N, Ahmad Ansari J, et al. Patterns of antibiotic sensitivity of bacterial pathogens among urinary tract infections (UTI) patients in a Pakistani population. Afr. J. Microbiol. Res. 2012;6(2):414-420.
4. Douglas T, Steinke R, Seaton A, PhillipsG, MacDonald TM, Peter GD. Prior trimethoprim use and trimethoprim-resistant urinary tract infection: a nested casecontrol study with multivariate analysis for other risk factors. J of Antimicrob Chemother. 2001;47:781-87.
5. Runehagen R, Kahlmeter G. A 10 year study of the consumption of quinolones, trimethoprim and mecillinam in relation to the development of antimicrobial resistance in a large number of species. Poster 417.ECCMID, Milan, Italy. 2002; 49(2):22-26.
6. Twaij M. Urinary tract infection in children: a review of its pathogenesis and risk factors. J R Soc Health. 2000;120:220-26.

7. Bachur R, Harper MB. Reliability of the urinalysis for predicting urinary tract infections in young febrile children. Arch Pediatr Adolesc Med. 2001;155:60-5.
8. Zorc JJ, Kiddoo DA, Shaw KN. Diagnosis and management of pediatric urinary tract infections. Clin Microbiol Rev. 2005;18: 417–22.
9. Turnidge J, Bell J, Biedenbach DJ, Jones RN. Pathogen occurrence and antimicrobial resistance trends among urinary tract infection isolates in the Asia-Western Pacific Region: report from the SENTRY Antimicrobial Surveillance Program, 1998-1999. Int J Antimicrob Agents. 2002;20:10-7.
10. Zhanel GG, Karlowsky JA, Schwartz B, Jensen SB, Hoban DJ. Mecillinam activity compared to ampicillin, trimethoprim/ sulfamethoxazole ciprofloxacin and nitrofurantoin against urinary tract isolates of gramnegative bacilli. Chemotherapy. 1998;44:391-96.
11. Douglas T, Steinke R, Seaton A, Phillips G, MacDonald TM, Peter GD. Priortrimethoprim use and trimethoprim-resistant urinary tract infection: A nested case control study with multivariate analysis for other risk factors. J of Antimicrob Chemother. 2001;47:781-87.
12. Roberts KB.Urinary tract infection: clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24 months. Pediatrics. 2011;128(3):595-610.
13. Jamieson DJ, Theiler RN, Rasmussen SA. Emerging infections and pregnancy. Emerg Infect Dis. 2006;12(11):1638-1643.
14. Warren JW, Abrutyn E, Hebel JR, Johnson JR, Schaffer AJ, Stamm WE. Guidelines for antimicrobial treatment of uncomplicated acute bacterial cystitis and acute pyelonephritis in women. Clin Infect Dis. 1999;29(4):745-58.
15. Forbes BA. Bailey and Scott's diagnostic microbiology. 10th ed. St. Louis, Missouri: Mosby. 1998;283–304.
16. Shirazi MH, Sadeghifard N, Ranjbar R, Daneshyar E, Ghasemi A. Incidence of asymptomatic bacteriuria during pregnancy. Pak J Biol Sci. 2006;9:151-154.
17. Conway PH, Cnaan A, Zaoutis T, Henry BV, Grundmeier RW, Keren R. Recurrent urinary tract infections in children: Risk factors and association with prophylactic antimicrobials. JAMA. 2007;11;298(2):179-86.
18. Shirazi MH, Sadeghifard N, Ranjbar R, Daneshyar E, Ghasemi A. Incidence of asymptomatic bacteriuria during pregnancy. Pak J Biol Sci. 2006;9:151-154.
19. Hansson S, Bollgren I, Esbjorner E, Jakobsson B, Marild S. Urinary tract infections in children below two years of age: a quality assurance project in Sweden. The Swedish Pediatric Nephrology Association. Acta Paediatr. 1999;88:270-74.
20. Rodríguez AJ, Niño Cotrina RA, Neyra Pérez C, Rodríguez CN, Barbella R, Lakatos M, et al. Comparative study of antimicrobial resistance of *Escherichia coli* strains isolated from urinary tract infection in patients from Caracas and Lima. J Antimicrob Chemother. 2001;47:903-904.
21. Weisz D, Seabrook JA, Lim RK. The presence of urinary nitrites is a significant predictor of pediatric urinary tract infection susceptibility to first- and third-generation cephalosporins. J Emerg Med. 2010;39(1): 6-12.
22. Little P, Turner S, Rumsby K, Warner G, Moore M, Lowes JA, et al. Dipsticks and diagnostic algorithms in urinary tract infection: Development and validation, randomised trial, economic analysis, observational cohort and qualitative study. Health Technology Assessment. 2009; 13(19):1-73.
23. Lane DR, Takhar SS. Diagnosis and management of urinary tract infection and pyelonephritis. Emerg Med Clin North Am. 2011;29(3):539-52.
24. Cliford L, Feng YC, Hsiu-Jung L, Hsiao-Chuan Y, Cheng-Hua H. Emergence of reduced susceptibility and resistance to fluoroquinolones in *Escherichia coli* in Taiwan and contributions of distinct selective pressures. Antimicrob Agents Chemother. 2001;22:3084-91.
25. Abelson K, Storby AO, Kahlmeter G. Antimicrobial resistance in *Escherichia coli* in urine samples from children and adults: A 12 year analysis. Acta Pediatr. 2004;93: 487-92.
26. Kahlmeter G. An international survey of the antimicrobial susceptibility of pathogens from uncomplicated urinary tract infections: The ECO-sens project. J Antimicrob Chemother. 2003;51:69-76.

27. Hansson S, Bollgren I, Esbjorner E, Jakobsson B, Marild S. Urinary tract infections in children below two years of age: A quality assurance project in Sweden. The Swedish Pediatric Nephrology Association. Acta Paediatr. 1999;88:270-74.
28. Esmaeili M. Antibiotics for causative microorganisms of urinary tract infections. Iranian Journal of Pediatric infection. 2005;15:163-83.
29. Atifa AA, Osman H, Alawayia MM, Hassan AM, Abdallah BA, Karrar ZH, Sidahmed H. Antimicrobial Agent Resistance In Bacterial Isolates From Patients with diarrhea and Urinary tract infections in Sudan. Am J Trop Med Hyg. 2000;63:259-63.
30. Abelson K, Storby AO, Kahlmeter G. Antimicrobial resistance in *Escherichia coli* in urine samples from children and adults: A 12 year analysis. Acta Pediatr. 2004;93: 487-92.
31. Mostafa S, Abdulla K, Sedigheh R, Navid A. Microbial sensitivity pattern in urinary tract infections in children: A single center experience of 1117 urineculture. Jpn J Infect Dis. 2006;59:380-82.
32. Mohajeri P, Farahani A, Davoodabadi A, Ghaderi O, Rahnema, M, Heidarzadeh S. Prevalence of vancomycin resistance in methicillin-resistant *Staphylococcus aureus*. Journal of Kerman University of Medical Sciences. 2014;21(5):394-404.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/11600