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Prevalence of Urinary Tract Infection in Children Admitted to Benghazi Children's Hospital

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Abstract **Original Research Article**

Urinary Tract Infections (UTIs) are predictable bacterial infections which occur frequently especially during infancy. The aim of the present study was to evaluate the etiology and antimicrobial resistance patterns among infants and children who approached our hospital for the treatment of UTIs. In this observational study which was carried out from January 2009 to December 2010. Two hundred and six (206) urine samples, which were collected from children admitted to Benghazi Children's Hospital (Nephrology department) with suspected UTIs, were studied. Demographic characteristics, etiological agents, and antimicrobial resistance were evaluated. 58 patients (28.2%) had a positive urine culture, and the majority of UTIs were occurring in females. The most common presenting symptoms were fever, dysuria, and abdominal pain. The most common isolated pathogen was *Escherichia coli* (67.2%), followed by *Klebsiella pneumonia* (20.7%), *Pseudomonas aeruginosa* (3.4%), *Proteus mirabilis* (3.4%), *Klebsiella oxytoca* (1.7%), *Enterobacter casseliflavus* (1.7%) and *Enterobacter cloacae* (1.7%). In the current study, most of the infected cases were females, and fever was the most common presenting symptom. All isolated bacteria were highly sensitive to Meropenem (98.1%), Imipenem (96.3%), Amikacin (96.2%), Cefoxitin (81.1%), and Ciproflaxacin (80%), and had a high resistance rate to Ampecillin (89.1%) and Cephalothin (60.4%). This phenomena may be contributed to the frequent useage and miss-use of antibiotics without medical prescription.

Keywords: Urinary tract infection, urine culture, Antibiotic susceptibility.

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INTRODUCTION

Urinary tract infection (UTI) is defined by the presence of multiplying organisms in the urinary tract, which is usually sterile (Svanborg,C. and Godaly, G. 1997). UTI is a term applied to a variety of clinical conditions ranging from asymptomatic presence of bacteria in the urine to severe infection of the kidney with resultant sepsis (Nguyen, H. T. 2008). UTI may be caused by any pathogen that colonizes the urinary tract (eg, Bacteria, Fungi, Parasites, and Viruses). UTI of bacterial infection affects any part of the urinary tract (Alinea, M.C.D. and Mantaring, J.B.V. 2002). Its clinical spectrum ranges from asymptomatic to severe infection inflammatory markers due to a colonization of the urinary tract like bacteriuria, pyuria, or an infection of the upper urinary tract consisting of the kidney and its pelvis, which is known as pyelonephritis. Infection of the lower tract may involve the bladder (cystitis), urethra (urethritis), or prostate (prostatitis), the genital organ that surrounds and communicates with the first segment of the male urethra, because all portions of the urinary tract are joined by a fluid medium. Infection at any site may spread to involve other areas of the system (Elder, J. 2004), (Ryan, K. J. 2004). Clinical symptoms of UTI usually include frequent dysuria, abdominal pain, back pain, fever, and urgency. Repeated infections may even cause complications leading to renal scarring, it may also signify an underlying anatomic abnormality (Zorc, J. J.;Kiddoo, D.A. and Shaw, K.N. 2005). Follow-up urine cultures may be needed to definitively diagnose a UTI (Svanborg,C. and Godaly, G. 1997). The current study concern is about UTI caused by bacteria, which is considered the most common bacterial infections among children and the most frequent cause of hospital admissions and outpatient consultations in pediatric practice (Alinea, M.C.D. and Mantaring, J.B.V. 2002), (Elder, J. 2004). Presence of more than 100,000 cfu/ml after doing a urine culture, a patient is considered suffering from UTI regardless of

symptoms, or as the growth of a known bacterial pathogen more than10,000 cfu/ml in association with a positive dipstick or urinalysis (Zorc, J.J.; Levine, D.A. et al .2005). Common bacterial pathogens include gram-negative species such as *Escherichia coli*, *Klebsiella*, *Proteus*, and gram-positive organisms, including group B *streptococci*, *Enterococcus spp*., and *Staphylococcus aureus*.

The objective of our study was to investigate the most common bacteria, antibiotics susceptibility, resistance patterns, and generate a basis for the empiric antibiotic treatment of childhood UTI in our region.

MATERIALS AND METHODS

In this study, data are belonging to the urinary culture of 206 consecutive children with the diagnosis of UTI. Patients were selected among children who admitted to the Department of Nephrology in Benghazi Children Hospital, Libya (the main big referral Pediatric hospital in the Estrean part of Libya , about 350 beds capacity). The time frame for the current estimates was from January 2009 to December 2010 and age for the studied cases was between four days (4 days) to fifteen years (15 years). Their files were reviewed retrospectively. Data about, gender, age, symptoms, urinalysis, urine culture results were included.

Before any antimicrobial agent is given, urine sampling must be performed. Approximately 50 ml urine samples which were taken from urine bag, by suprapubic aspiration of urine, or midstream urine after standard cleaning of the genital area were sent to the laboratory within thirty minutes (Kayas, L.; Yolbas, I.; Ece, A *et al*., 2011). Dipsticks and microscopes are commonly used for urinalysis. Most dipsticks test for nitrite, leukocyte esterase, and using Multisticks of Medi-Test combi 10®SGL. A dipstick test that is positive for leukocyte esterase and nitrite is highly sensitive for UTI (Roberts, K. B. 2011), (Whiting, P.; Westwood, M.; Bojke, L *et al*., 2006). A test that is negative for leukocyte esterase and nitrite ruled out UTI (Whiting, P.; Westwood, M.; Bojke, L *et al*., 2006). Then; 15 ml urine samples after 3000 rpm of a centrifuge in the centrifuge tube for 5 minutes were investigated. A drop of the sample from the sediment of dipped part of the tube for bacteria, leukocyte, and epithelial cells was examined using a microscope under a high power field (Kayas, L.; Yolbas, I.; Ece, A *et al*., 2011). The presence of more than 5 WBCs/HPF indicates pyuria. Microscopy is used to detect pyuria and bacteriuria. Bacteriuria alone has a higher sensitivity than pyuria alone, although if both are positive, there is a high likelihood of having UTI (Whiting, P.; Westwood, M.; Bojke, L *et al*., 2006).

The classical definition of UTI was the presence of more than 10^5 colony-forming unit (CFUs) /ml and the presence of any CFU/ml of the organism isolated from a suprapubic bladder aspiration. While Less than 10^4 (CFUs) /ml is not significant, 10^4–10^5(CFUs) /ml is a doubtful significance (Cheesbrough, M. 2006). In addition, the presence of two or more types of microorganism or the presence of bacteria less than 10^3/ml was accepted as contamination (Kayas, L.; Yolbas, I.; Ece, A *et al*., 2011).

Statistical Analysis

Data were expressed in Percentage. A frequency table (Crosstabs procedure) is used to create contingency tables, which describe the interaction between two categorical variables.

RESULTS

A total of 206 files were reviewed, 129 (62.6%) of the cases were females and 77 (37.4%) were males. The urine culture in this study showed, no growth culture result was observed in 91(44.2%) of urine samples of the patients, 28.2% (58 of 206 patients) showed positive urine culture. However, contaminated growth observed in nine patient urine samples (4.4%), while non significant growth result were only 2.4% (5 of 206 patients), and not done urine culture 20.9% (43 of 206 patients) (Table 1).

Total female cases included in this study (129 of 206 total children) 34.9% (45 of 129females) showed a positive urine culture, 38.8% (50 of 129 females) had a negative urine culture, 19.4% (25 of 129 females) urine culture not done, 3.9% (5 of 129 females) had contaminated urine culture and 3.1% (4 of 129 females) urine culture showed non significant growth. While, 16.9% (13 of 77 males) had a positive urine culture, 53.2% (41 of 77 males) had a negative urine culture, 23.4% (18 of 77 males) urine culture not done, 5.2% (4 of 77 males) had contaminated urine culture and 1.3% (1 of 77 males) had non significant growth of urine culture (Table 2).

Table 1: Distribution of patients according to urine culture result

Urine culture	No.	(%)
Contaminated	9	(4.4%)
Negative	91	(44.2%)
Not done	43	(20.9%)
Non significant growth	5	(2.4%)
Positive	58	(28.2%)
Total	206	(100%)

Table 2: Distribution of patients according to gender and urine culture results

	Urine culture					Total
Gender	**Contaminated**	**Negative**	**Not done**	**Non significant growth**	**Positive**	
Male	4	41	18	1	13	77
	5.2%	53.2%	23.4%	1.3%	16.9%	100.0%
Female	5	50	25	4	45	129
	3.9%	38.8%	19.4%	3.1%	34.9%	100.0%
Total	9	91	43	5	58	206
	4.4%	44.2%	20.9%	2.4%	28.2%	100.0%

According to age groups the results showed that in group 1 (<1 year), positive urine culture was 41.0% (16 of 39 patients), this rate was similar with negative urine culture, and 12.8% (5 of 39) culture not done, 5.1% (2 of 39 contaminated culture result, non significant growth not detected in this age group. In group 2 (2-4 years) result showed negative urine culture 46% (23 of 50 patients), 24% (12 of 50 patients) urine culture not done, non significant growth 6% (3 of 50 patients) and contaminated growth 2% (1 of 50 patients). Third group (5-7years): Negative urine culture 37% (17 of 46 patients), not done urine culture 21.7% (10 of 46 patients), non significant growth 0% (0 of 46 patients) and contaminated growth 8.7% (4 of 46patients).

Whereas, the results showed that the age range from group 4 (8-10 years) showed negative urine culture in 44.7% (17 of 38 patients), not done urine culture 23.7% (9 of 38 patients), non significant growth 2.6% (1 of 38 patients) and no contaminated growth was detected, Fifth group(≥ 11years): Negative urine culture 54.5% (18 of 33 patients), not done urine culture 21.2% (7 of 33 patients), non significant growth 3.0% (1 of 33 patients) and contaminated growth 6.1% (2 of 33 patients) (Table 3).

Table 3: Distribution of patients according to age and urine culture results

	Urine culture					Total
Age/year	**Contaminated**	**Negative**	**Not done**	**Non significant growth**	**Positive**	
≤1	2	16	5	0	16	39
	5.1%	41.0%	12.8%	0%	41.0%	100.0%
2-4	1	23	12	3	11	50
	2.0%	46.0%	24.0%	6.0%	22.0%	100.0%
5-7	4	17	10	0	15	46
	8.7%	37.0%	21.7%	0%	32.6%	100.0%
8-10	0	17	9	1	11	38
	.0%	44.7%	23.7%	2.6%	28.9%	100.0%
≥11	2	18	7	1	5	33
	6.1%	54.5%	21.2%	3.0%	15.2%	100.0%
Total	9	91	43	5	58	206
	4.4%	44.2%	20.9%	2.4%	28.2%	100.0%

Results showed that the most common clinical finding was fever 57.8% (119 of 206 patients), while the lowest clinical manifestation was urgency 5.3% (11 of 206 patients), followed by frequency 11.7% (24 of 206 patients), loin pain 18% (37 of 206 patients), changing color of urine 29.1% (60 of 206 patients), abdominal pain 31.1% (64 of 206 patients), vomiting 33.5% (69 of 206 patients) and dysuria 47.1% (97 of 206 patients) (Table 4).

Table 4: Distribution of patients according to the clinical manifestations with Urinary Tract Infection

Symptoms	**Yes**		**No.**		**Total**
	No.	**%**	**No.**	**%**	
Fever	119	57.8	87	42.2	
Dysuria	97	47.1	109	52.9	
Urgency	11	5.3	195	94.7	
Frequency	24	11.7	182	88.3	
Loin pain	37	18	169	82	
Change Color of Urine	60	29.1	146	70.9	
Abd. Pain	64	31.1	142	68.9	
Vomiting	69	33.5	137	66.5	
Total					206(100%)

This study showed that WBCs in urine more than 5 cells/hpf reached 86.2% (50 of 58 patients), and WBCs in urine less than 5 cells/hpf reached 1.7% (1 of 58 patients),while 12.1% of the cases (7 of 58 patients) WBCs were not checked in the urine before cultured (Table 5).

Table 5: Distribution of patients according to positive urine culture and WBCs in urine

WBC	Yes		No		Total	
	No.	%	No.	%	No.	%
<5/ hpf	1	1.7%	76	51.4%	77	37.4%
>5/ hpf	50	86.2%	44	29.7%	94	45.6%
Not done	7	12.1%	28	18.9%	35	17.0%
Total	58	100.0%	148	100.0%	206	100.0%

Current study showed that the most causative agent of UTI was *E.coli* with 39 isolates (97.2%) from all bacteria isolated, followed by *Klebsiella pneumonia,* 12 isolates (20.7%), *Pseudomonas aeruginosa,* 2 isolates (3.4%), and *Proteus mirabilis*, 2 isolates (3.4%). The lowest causative agents of UTI was for *Enterococcus casseliflavus*, *Enterobacter cloacae,* and *Klebsiella oxytoca* with only 1 isolate each (1.7%), (Table 6).

Table 6: Distribution of patients according to the type of bacteria isolated from urine.

Type of Bacteria	No.	%
E.coli	39	67.2%
Enterobacter cloacae	1	1.7%
E.casseliflavus	1	1.7%
klebsiellaoxytoca	1	1.7%
Klebsiella pneumonia	12	20.7%
P. aeruginosa	2	3.4%
Proteus mirabilis	2	3.4%
Total	58	100.0%

Table 7, showed the sensitivity pattern of bacteria isolated from patients in UTI to different antibiotics used in children hospital-Benghazi. The antibacterial effect of antibiotics showed the highest activity against most bacteria isolated in this study was Meropenem reach to (98.1%), followed by Imipenem (96.3%), Amikacin (96.2%).Cefoxitin (81.1%). Some antibiotics had similar effect like Gentamicin, Nitrofurantoin and Ciprofloxacin showed (80%). Cefepime (71.7%). Aztreonam (71.2%), Piperacillin, Tazobactam (69.2%). Cefotaxime, Cefuroxime showed(66.7%),Trimethoprim/Sulfamethoxazole (50%), Amoxicillin/Clavulanate (35.7%), lowest antibacterial effect showed by Cephalothin (15.1%) followed by Ampicillin (10.9%) only.

Table 7: Distribution of the patients according to susceptibility of antibiotics

Susceptibility of antibiotics	Sensitive		Resistance		Intermediate		Total	
	.No	%	.No	%	.No	%	.No	%
Amikacin	51	96.2	1	1.9	1	1.9	53	100
Gentamicin	44	80	7	12.7	4	7.3	55	100
Imipenem	52	96.3	1	1.9	1	1.9	54	100
Meropenem	52	98.1	1	1.9	-	-	53	100
Cephalothin	8	15.1	32	60.4	13	24.5	53	100
Cefuroxime	36	66.7	17	31.5	1	1.9	54	100
Cefoxitin	43	81.1	9	17	1	1.9	53	100
Cefotaxime	36	69.2	16	30.8	-	-	52	100
Cefepime	38	71.7	15	28.3	-	-	53	100
Aztreonam	37	71.2	14	26.9	1	1.9	52	100
Ampicillin	6	10.9	49	89.1	-	-	55	100
AmoxicillinClavulanate	20	35.7	22	39.3	14	25	56	100
PiperacillinTazobactam	36	69.2	10	19.2	6	11.5	52	100
TrimethoprimSulfamethoxazole	28	50	27	48.2	1	1.8	56	100
Nitrofurantoin	40	80	3	6	7	14	50	100
Ciprofloxacin	44	80	8	14.5	3	5.5	55	100

DISCUSSION

Urinary Tract Infection, especially in early childhood, if not treated with suitable antibiotics, can cause serious problems such as hypertension and renal failure and continues to be a very important health problem with high morbidity and mortality rate in developing countries, and high influence on health costs in most countries.

In the present study, urine analysis was conducted in all 206 cases. Among all urine analysis, overall infection rate was 28.2% while 44.2% presented no growth of microorganisms. Similar results were observed by Bay and Anacleto (2010), who reported that the UTI rate reached (30%), while the rate of infection in this study was slightly higher compared to the infection reported by Barros *et al.,* (2011) which was only (14.8%). This discrepancy may be due to many factors such as patient and hospital characteristics, and criteria used for diagnosing. The factors that influence UTI include host factors and agent factors. Host factors are the resistance of host to infection, these include local and systemic resistance of host. Agent factors include the dose of bacterial contamination and pathogenicity.

In the current study, most of the infected cases were females. Similar results were observed by Bay and Anacleto (2010), and Barros *et al*., (2011), who reported that, according to results, the female sex was the most affected. This may be due to their shorter urethra which provides an easy access of bacteria to the bladder.

This study showed that the increasing of age was slightly identified as a specific risk to UTI. While Chang, Shortliffe (2006), Hanson (1976), and Encarnacion (2012) found in the first few months of life that infants are at a higher risk for UTI. This susceptibility has been attributed to the incompletely developed immune system. The study showed that fever was the most common presenting symptom accounting for 57.8% of patients. Similar studies by Kayas *et al*., (2011), and Bay and Anacleto (2010) reported that the most common complaints of children were fever, dysuria, vomiting, and abdominal pain. The overall bacterial growth in urine WBC >5 rate reached 86.2% among patients during this study period, this indicates the presence of infection. Similar results were observed by Simerville *et al*., (2005), and Gordon *et al*., 2013). *E.coli* was the predominant bacteria isolated in this study. The *E.coli* reached 67.2% of all isolated bacteria. Similarly, Younis *et al*., (2009) reported that *E. coli* was determined to be the predominant microorganism with 71% in patients. In addition, a study by Ipek *et al*., (2011) showed that the highest UTI rate was for *E.coli* (81.7%). Another study by Encarnaion (2012) reported that *E. coli* remained the most important bacteria responsible for UTI (75%). Kayas *et al*., (2011) also found that the most frequent microorganism was E.coli (63.08%).

E. coli, a common nosocomial contaminant epidemics, have been traced to many items in the hospital environment. Thus, the results of our study indicated that the presence of *Escherichia coli* as the etiological agent and as a major uropathogen in children had not been changed.

All species were tested for susceptibility to antibiotics using the disc diffusion method and BD phoenix system. The study of sensitivity test to antibiotics showed that all bacteria were sensitive to Meropenem (98.1%), Imipenem (96.3%), Amikacin (96.2%), Cefoxitin (81.1%), and Ciproflaxacin (80%). Similar studies showed that all bacterial growth were sensitive to Amikacin, Imipenem, Ciprofloxacin and Gentamicin (Encarnacion, 2012, Kayas *et al.,* 2011) and (Barros *et al*., 2011) .

The present study showed a high resistance rate to Ampicillin (89.1%) and Cephalothin (60.4%), this phenomena may be contributed to the frequent and miss-use of the antibiotic without medical prescription. This result was in agreement with that reported by Ipek *et al.,* (2011), Encarnacion, (2012) and Kayas *et al.,* (2011).

Multiple drug resistant (MDR) bacterial infections are being increasingly reported from all parts of the world. Multi- resistant microbes are an important cause of hospital-acquired infection. Infections associated with such organisms can pose a serious threat to vulnerable patients. Generally, making a frequent use of antimicrobial agents result in a great likelihood of resistance and multi-drug resistance.

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