

Prevalence And Antimicrobial Susceptibility Patterns Of Bacteria Isolated From Urinary Tract Infections (UTIs) In Children At Children Hospital In Baghdad

Nadheema Hammood Hussein*, Khetam H. Rasool*, Butheina Mahamed Taha* and Jumaah D. Hussein**

ABSTRACT

Background: First six to twelve months after initial urinary tract infection, most infections are caused by *Escherichia coli*, although in the first year of life *Klebsiella pneumoniae*, *Pseudomonas*, *Enterobacter* spp and *Enterococcus* spp, are more frequent than later in life, and there is a higher risk of urosepsis compared with adulthood

Objectives: To determine the prevalence of bacterial isolates from Urinary Tract Infections of children at a children hospital in Baghdad and their antimicrobial susceptibility patterns.

Type of the study: Cross-sectional study.

Methods: During six months of study (1 June to 31 December, 2016), 117 urine specimens were collected from a children hospital in Baghdad.

Results: Out 38 isolates of Gram positive and Gram negative bacteria were obtained from urine specimens in a percentage of 5(13.2%) and 33(86.8%), respectively. The lowest incidence was among the 11-15 years old age group (11.9%) whereas the highest incidence was among the 1-5 years old age group (43.6%) ($P \leq 0.05$). Also out of 38 positive cultures, the incidence was higher in females 31(81.6%) than that of males 7(18.4%).

Out of 38 positive cultures, the isolation rate was 5(13.2%) for Gram positive isolates and 33(86.8%) for Gram negative

isolates. The most frequently isolated bacteria was *Escherichia coli* 19(50%) (P -value ≤ 0.05), while the only isolated Gram positive was *Staphylococcus aureus* 5(42.86%) isolates. The most effective antibiotics for *Staphylococcus aureus* isolates were Vancomycin and Amikacin for (100%) and for Gram negative isolates was imipenem (100%). Ampicillin showed the highest resistance rate for both Gram positive and Gram negative isolates (100%) and *Pseudomonas aeruginosa* isolates showed the highest resistant rates to most antibiotics under study.

Conclusions: The most frequently isolated bacteria was *E. coli* from all urine cultures and the most effective antibiotics for *Staphylococcus aureus* isolates were Vancomycin and Amikacin for

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* Department of Biology, College of Science, Al-Mustansiriyah University.

**Fattima-AL-Zahra Hospital for Pediatric and Obstetric /Ministry of Health /Iraq.

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Corresponding to: Khetam H. Rasool

First 6-12 months after initial UTI (2). Most infections are caused by *Escherichia coli*, although in the first year of life *Klebsiella pneumoniae*, *Pseudomonas*, *Enterobacter* spp and *Enterococcus* spp, are more frequent than later in life, and there is a higher risk of urosepsis compared with adulthood (3). In young infants, symptoms of UTI differ from those in older children (4). The prevalence of UTI is higher in infants than in older children (5). Signs and symptoms of UTI are very nonspecific, especially in neonates and during childhood. Fever may be the only symptom of UTI, especially in young children (6). Newborns with pyelonephritis or urosepsis can present non-specific signs and symptoms, sometimes without fever (7). The diagnosis of UTI in infants is based on clinical and laboratory findings, including detailed clinical history and physical examination (1). In febrile children with signs of UTI, antibiotic treatment should be initiated as soon as possible to eradicate the infection, prevent bacteremia, improve clinical outcome, diminish the likelihood of renal involvement during the acute phase of infection, and reduce the risk of renal scarring. As previously stated, before any

antibiotic therapy is started, a urine specimen should be obtained for urinalysis and urine culture (8).

Antibiotic treatment of children with febrile urinary tract infections has almost eliminated the risk of death, which was approximately 20% among children hospitalized for acute pyelonephritis in the early 20th century (9).

Antibiotic resistance is a specific type of drug resistance when a microorganism has the ability of withstanding the effects of antibiotics (10). The emergence of antibiotic resistance in the management of UTIs is a serious public health issue, particularly in the developing world, and the knowledge about the type of pathogens responsible for UTIs and their susceptibility patterns may help the clinicians to choose the right empirical treatment (11). This study was aimed to determine the prevalence of bacterial isolates from Urinary Tract Infections (UTIs) of children at a children hospital in Baghdad and their antimicrobial susceptibility patterns.

Method:

Clinical specimens: A total of 1012 urine specimens were collected from children patients with urinary tract infections

Period of Study : This study was conducted during the period extended from 1 June, 2016 till 31 December, 2016 at a children hospital in Baghdad.

Isolation and Identification of bacterial isolates: Urine specimens were cultured and the bacteria were isolated from all urine specimens according to standard microbiology methods. After that microorganisms were identified at species level by using VITEK 2 Compact system (Bio-Merieux, France).

Antibiotic Susceptibility Test: Antimicrobial susceptibility testing towards different groups of antibiotics (Bioanalyse (Turkey)) including; Amikacin (AK) (30 µg), Ampicillin (AMP) (30 µg), Aoxicillin/ Clavulanic acid (AMC) (20/10 µg), Aztreonam (ATM) (30 µg), Ceftriaxone (CRO) (30 µg), Ceftazidime (CAZ) (30 µg), Cefepime (FEP) (30 µg), Chloramphenicol (C) (30 µg), Tobramycin (TB) (10 µg), Gentamicin (GEN) (10 µg), Trimethoprim/Sulfamethoxazole (TMP) (1.25/23.75) and Imipenem (IMP) (10 µg), for Gram negative bacteria.

On the other hand antibiotics discs (Bioanalyse (Turkey)) including; Ampicillin (AMP) (30 µg), Aoxicillin/ Clavulanic acid (AMC) (20/10 µg), Vancomycin (VA) (30 µg), Pencillin G (P) (10 units), Tobramycin (TB) (10 µg), Erythromycin (E) (15 µg), Amikacin (AK) (30 µg), Aztreonam (ATM) (30 µg), Ceftriaxone (CRO) (30 µg), Ceftazidime (CAZ) (30 µg), Gentamicin (GEN) (10 µg) and Trimethoprim/Sulfamethoxazole (TMP) (1.25/23.75) were used for Gram negative bacteria and antimicrobial susceptibility testing was carried out by using standard Kirby Bauer (disk diffusion) method (12). Mueller-Hinton agar medium inoculated with 0.5 MacFarland turbidity standards and incubated at 37°C for 24 hour and bacterial growth inhibition zones around the discs were measured and interpreted according to the Clinical and Laboratory Standard Institute (13).

Statistical analysis: The Chi-square (χ^2) test was employed for comparison among groups. P value ≤ 0.05 was considered statistically significant.

Results:

Study patients : Urine specimens were collected from 117 children patients with urinary tract infections along six months of study (from 1 June, 2016 till 31 December, 2016). The age of children patients ranged from less than 1 month to 15 years.

Distribution of Urinary Tract Infections according to age and sex of infected patients : The age and sex distribution of the infected patients was summarized in table-1. Among the children infected patients which their ages ranged from less than 1 month to 15 years, the lowest incidence was among the 11-15 years old age group (11.9%) whereas the highest incidence was among the 1-5 years old age group (43.6%) (significant difference at $P \leq 0.05$). Also the incidences were (21.4%) and (23.1%) among the less than one year and 6-10 years old age group, respectively. On the other hand, the table also shows that the incidence was higher (significant difference at $P \leq 0.05$) among females (67.5%) than that of males (32.5%), and the incidence may be

attributed to the fact that the female's urethral opening is near sources of bacteria from the anus.

Urine culture: The frequency of positive urine (growth of bacteria) in the studied patients was 38 (32.5%) cases out of 117 urine specimens. Out of 38 positive growth of urine cultures 31 (81.6%) positive bacterial growth cultures were from females and 7 (18.4%) positive bacterial growth cultures were from male (significant difference at $P \leq 0.05$) as shown in figure-1. From figure-2, we noticed that the majority of positive urine cultures were from patients within the age group 1-5 years 18 (47.4%) and the lowest percentage of positive bacterial growth cultures within the age group 11-15 years 3 (7.8%), while the percentages were 12 (31.6%) and 5 (13.2%) among the less than one year and 6-10 years old age groups, respectively.

Frequency of bacteria among urine cultures: Frequency of isolated bacteria causing urinary tract infections were summarized in table-2. From this table, *Escherichia coli* the most frequently isolated bacteria from urine cultures, 19 (50%) isolates (significant difference at $P \leq 0.05$) out of 38 bacterial isolates (Gram positive and Gram negative bacteria) isolated from urine cultures. Out of 38 positive bacterial growth cultures of urine samples, the isolation rate of Gram positive and Gram negative bacteria was 5 (13.2%) and 33 (86.8%), respectively (significant difference at $P \leq 0.05$) as shown in figure -3. On the other hand out of 33 Gram negative bacteria, the percentage of *Escherichia coli* isolation was 57.75% and it is a highest percentage and the lowest percentage was *Proteus mirabilis* (5.2%) (significant difference at $P \leq 0.05$). The only Gram positive bacteria isolated was *Staphylococcus aureus* (13.2%) as shown in table -2. *Escherichia coli* is the predominant pathogen in childhood UTI, found in 90% of girls and in 80% of boys at the first episode of UTI. An important factor for the predominance of *E. coli* is the ability of this pathogen to attach to the urinary tract endothelium (14).

Antibiotic Susceptibility Test: Resistance of bacteria to the antibiotics has become an increasingly pressing clinical issue in many countries. Results in table -3, shows the antimicrobial resistance patterns for Gram negative bacteria (33 isolates), in which the highest resistant antibiotic is Ampicillin (100%) for all Gram negative bacteria under study followed by Amoxicillin/ clavulanic acid which showed (100%) resistant rate by *Pseudomonas aeruginosa*, *Proteus mirabilis* and *Enterobacter cloacae* while showed (89.47%) and (80%) resistant rates for *Escherichia coli* and *Klebsiella pneumoniae*, respectively. The antimicrobial susceptibility patterns for Gram positive bacteria (5 isolates of *Staphylococcus aureus*) were summarized in figure -4, in which the highest resistant antibiotic is Ampicillin (100%) resistant rate followed by Aoxicillin/ Clavulanic acid and Trimethoprim/ Sulfamethoxazole (80%) resistant rate. While results show from the figure showed that the lower resistant antibiotics are Vancomycin and Amikacin for (100%) sensitivity rate. These bacterial isolates showed different susceptibility towards other antimicrobials used in this study (figure -4).

Table- 1: Distribution of Urinary Tract Infections according to age and sex.

Age groups	Patients with Urinary Tract Infections					
	Male		female		Total	
	No.	(%)	No.	(%)	No.	(%)
<1 years	8	21.1	17	21.5	25	21.4
1-5years	16	42.1	35	44.3	51	43.6*
6-10 years	8	21.1	19	24.1	27	23.1
11-15 years	6	15.7	8	10.1	14	11.9
Total	38	32.5	79	67.5*	117	100

*significant difference at $P \leq 0.05$

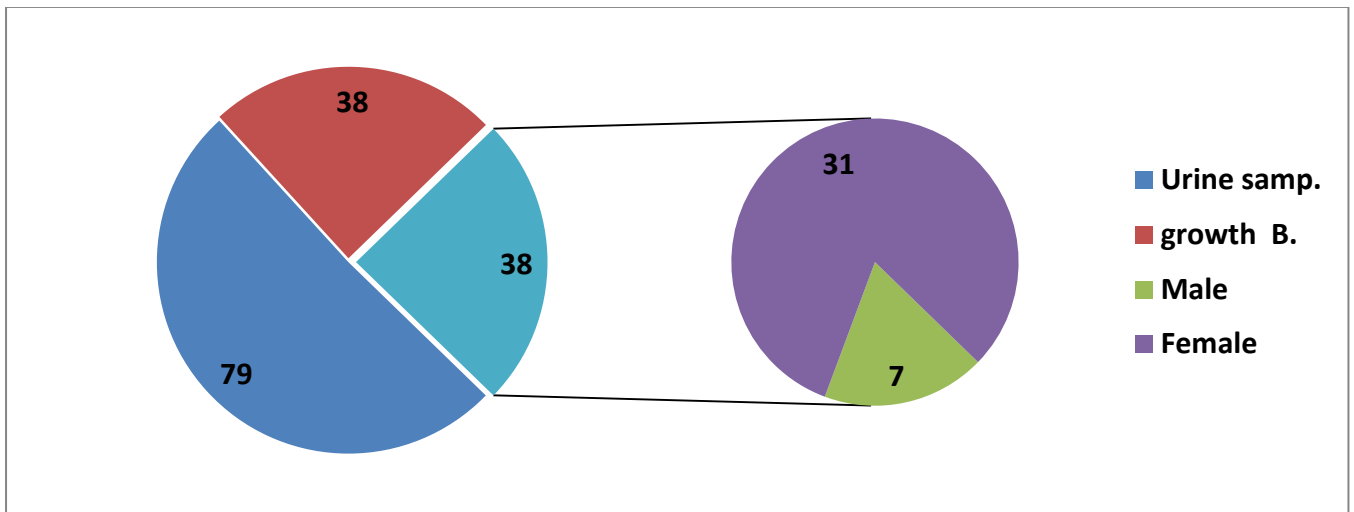


Figure -1: Frequency of positive bacterial growth cultures according to sex

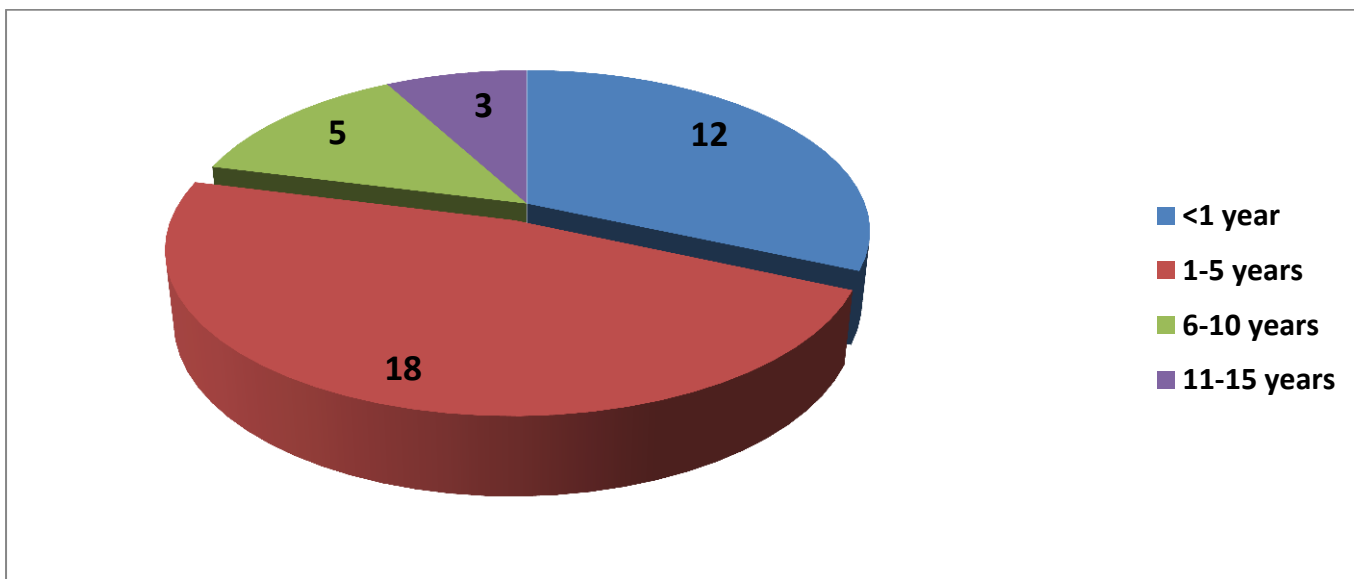


Figure -2: Frequency of positive bacterial growth cultures according to age

Table-2: Frequency of bacterial isolates from urine cultures.

Bacterial Isolates	NO.	%
<i>Escherichia coli</i>	19	50
<i>Klebsiella pneumoniae</i>	5	13.2
<i>Enterobacter cloacae</i>	4	10.5
<i>Pseudomonas aeruginosa</i>	3	7.9
<i>Proteus mirabilis</i>	2	5.2
<i>Staphylococcus aureus</i>	5	13.2
Total	38	100

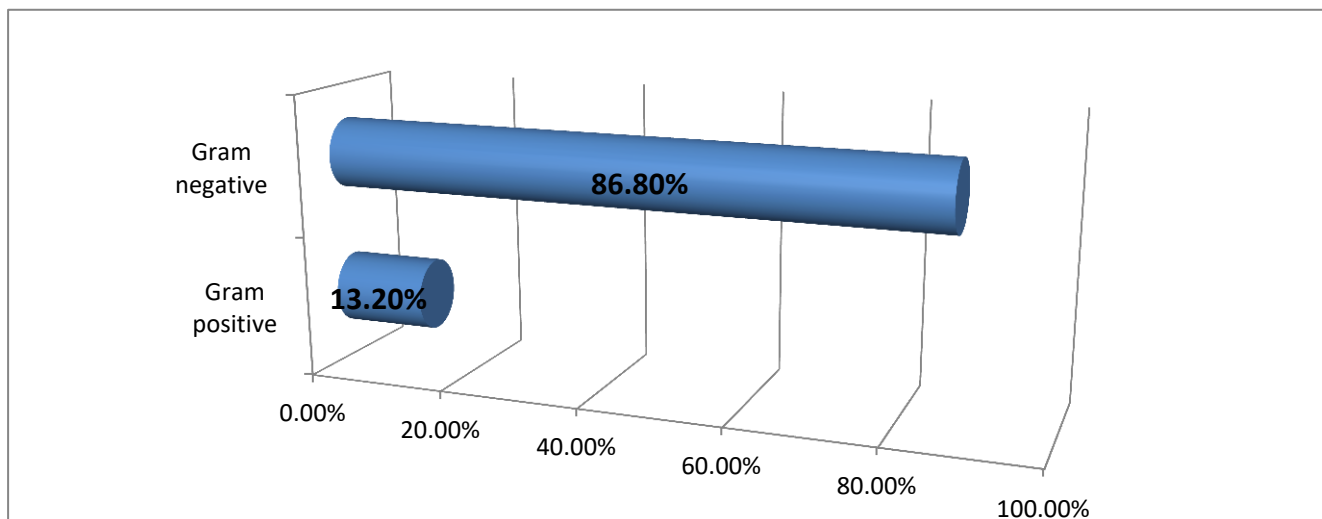


Figure -3: Frequency of Gram positive and Gram negative bacteria isolated from urine cultures

Table -3: Antimicrobial resistance patterns for Gram negative bacteria

Antibiotics	Bacterial Isolates									
	<i>Escherichia coli</i>		<i>Klebsiella pneumoniae</i>		<i>Pseudomonas aeruginosa</i>		<i>Proteus mirabilis</i>		<i>Enterobacter cloacae</i>	
	R	S	R	S	R	S	R	S	R	S
Amikacin	1	18	0	5	2	1	0	2	1	3
Amoxicillin-clavulanic acid	17	2	4	1	3	0	2	0	4	0
Ampicillin	19	0	5	0	3	0	2	0	4	0
Aztreonam	5	14	3	2	3	0	2	0	1	3
Cefepime	9	10	2	3	3	0	1	1	1	3

Ceftazidime	11	8	2	3	3	0	2	0	1	3
Ceftriaxone	14	5	3	2	3	0	2	0	2	2
Chloramphenicol	13	6	4	1	3	0	2	0	3	1
Gentamicin	2	17	2	3	3	0	1	1	1	3
Imipenem	0	19	0	5	0	3	0	2	0	4
Tobramycin	4	15	1	4	2	1	1	1	1	3
Trimethoprim-sulphamethoxazole	10	9	4	1	3	0	2	0	3	1
Total	19		5		3		2		4	

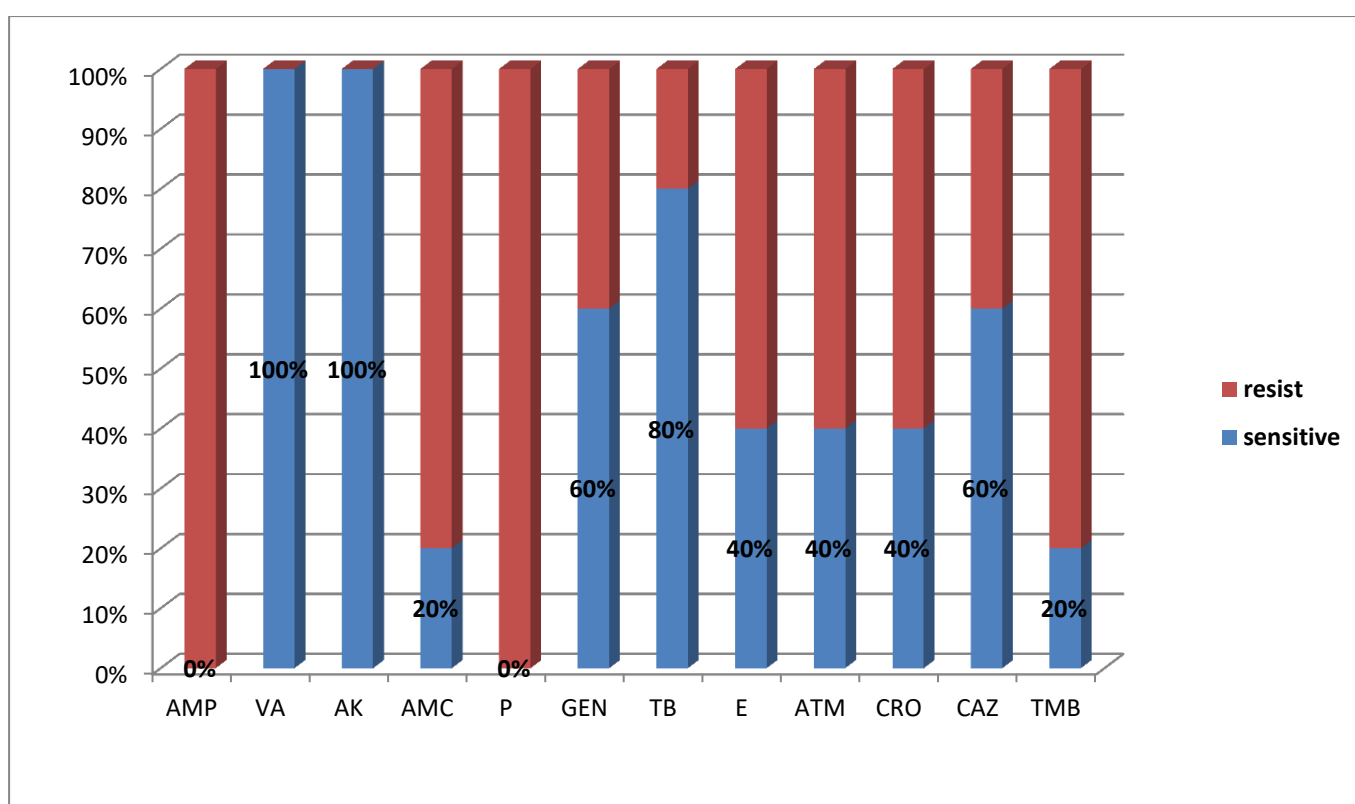


Figure -4: Antibiotic resistance of 5 *Staphylococcus aureus* isolates from urine cultures

Discussion:

Our result showed that the isolation rate of Gram positive isolates was 5(13.2%) and for Gram negative isolates was 33(86.8%), and the most frequently isolated bacteria was *E. coli* 50% from all urine cultures and 57.75% from Gram negative isolates. In a study done by Daoud and Afif (15), *E. coli* accounted for approximately 61% of all clinically significant urinary isolates and 76.8% of all *Enterobacteriaceae*. This is consistent with the findings of previous studies in which *E. coli* was the predominant pathogen isolated from patients with UTIs

(16). Antibiotic resistance is a major clinical problem in treating infections caused by these microorganisms. The resistance to the antimicrobials has increased over the years and resistance rates vary from country to country (17). Our results showed that, the most effective antibiotics for *Staphylococcus aureus* isolates were Vancomycin and Amikacin for (100%) and for Gram

negative isolates was imipenem (100%). Ampicillin showed the highest resistance rate for both Gram positive and Gram negative isolates (100%), and this

agreement with the study done by Daoud and Affif(15) in which the lowest percentage of susceptibility was manifested against ampicillin, whereas an absolute susceptibility was observed with imipenem (100%).

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