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Uropathogens and their antimicrobial susceptibility among healthy primary school children in Gaza City.

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Abstract:

Children in the primary school age are under high risk of developing urinary tract infection (UTI), that are considered as serious health problems affecting children each year. The aim of this study was to determine the prevalence of UTI among healthy primary school children and to identify the most common uropathogens and determine their antimicrobial susceptibility to common antimicrobials in Gaza city. This is a cross sectional study wherein urine samples were collected from 383 healthy students distributed among 6 schools in Gaza city, each student was provided with sterile urine cup to collect early midstream urine. Written instructions for proper urine collection was provided to each student along with a questionnaire which was filled by the student`s family. All urine samples were processed during 2 hours from collection; culture on blood agar and MacConkey agar, urine analysis and microscopic examination were performed and sensitivity test was done for positive sample that has bacterial count ≥100,000 CFU/ml.

The prevalence of UTI was 10.6%, 15.0% among female and 6.2% among male. Gram-negative bacteria were responsible for 73.6% of UTIs. Escherichia coli was the most predominant uropathogen with 36.8%, followed by Proteus mirabilis 18.4% and Pseudomonas

aeruginosa 15.8%. Antimicrobial susceptibility results showed that E. coli is sensitive for Amikacin, Ceftazidime, Nalidixic acid and Ofloxacin. Proteus group is sensitive for Amikacin, Ceftazidime, Ceftriaxone, Cefuroxime and Ofloxacin. Pseudomonas species were sensitive for Amikacin, Ceftriaxone and Ofloxacin .

In conclusion, the overall prevalence of UTI is 10.6% in Gaza City in the age group from 6-12. UTI is more common in female. Gram negative bacteria are responsible for 73.6% of UTIs and E. coli is the most predominant uropathogens.

Keywords: Urinary Tract Infection, UTI children, Gaza, Palestine

Introduction:

Urinary tract infection (UTI) means the presence of microorganism (usually bacterial) in the normally sterile posterior urethra, bladder, ureters, renal pelvis or renal parenchyma **(Evans, 2006)**, which is a common bacterial infection that can affect infants and children **(Jadresic, 2010).**

The incidence of UTI varies with age and differs between the sexes. Acute UTIs are relatively common in children. By seven years of age, 8% of girls and 2% of boys will have at least one episode **(White, 2011).** The incidence is high in the first months, and more common in boys. By school age UTI is far more common in girls. It is estimated that around 1% of boys and 3% of girls have a UTI during the first decade and around 40% of girls suffer recurrent infection **(Evans, 2006).** Based on evidence from Swedish and UK data, approximately 10% of girls and 3% of boys will have had a UTI before the age 16 years **(Jadresic, 2010).** In Gaza strip, several studied were performed on UTI in community but according to authors knowledge this first study which conducted on healthy schoolchildren.

Asymptomatic bacteriuria is found in 1–2% of girls aged 4–12 years. Symptomatic infections are rare in girls under 13 years of age, but the incidence increases during adolescence **(Lee and Neild, 2007).**

In another study conducted in Tunisia on a group of children aged between 2 months and 14 years with a mean age 5 years, the frequency of UTI was found to be 1.85% **(Ghedira et al., 2004).** The actual incidence of UTI is unclear but patterns in northern of England suggest that 3.6% of boys and 11.3% of girls have had a UTI by the age of 16 years (Smith, G. 2004) . From a study in Nablus city, UTI prevalence was 7.5% in females and 0% in males **(Sawalha, 2009).**

The most common uropathogens include *Escherichia coli, Klebsiella, Proteus, Enterobacter, Citrobacter, Staphylococcus saprophyticus, and Enterococcus* **(White, 2011).** In a Turkish study, the most common causative agent was *E. coli* (87% of cases) followed by *K. pneumoniae* (10%) and others such as *Enterococcus* spp. (1.5%), *Enterobacter* spp. (0.5%) and *P. mirabilis* (0.5%) **(Yuksel, et al., 2006).** In another study, the most prevalent pathogens in several recent pediatric studies were *E. coli* (54%-67%), *Klebsiella* (6%-17%), *Proteus* (5%- 12%), *Enterococcus* (3%-9%) and *Pseudomonas* (2%-6%) **(Bell and Mattoo, 2009).**

According to study in northern occupied Palestine (1995–1999–2002), the most frequent Gram-negative organism isolated was *E. coli*: (67.3%), (67.5%) and (66.8%) in 1995, 1999 and 2002, respectively **(Chazan, et al., 2004).** The previous study in Nablus showed that Gram negative bacteria was the most common of uropathogens responsible for UTI with a 59.3% percentage in comparison to 40.7% for gram positive bacteria, and showed that *E. coli* was the most predominant pathogen followed by *S. aureus* and *K. pneumonia*e with 51.8%, 29.6%, 5.6% percentages respectively **(Sawalha, 2009).**

The resistance rates will vary from region to region and depend on whether the infection develops in the community or in hospital **(Sheerin, 2011).** UTI treatment can be a problem in near future due to increasing antibiotic resistance **(Brad et al., 2010)**.

The aim of this study was to determine the prevalence of community UTI among healthy primary school children and to

identify the most common causative bacteria and their antimicrobial susceptibility in Gaza city.

Materials and methods:

The study was done in six primary schools in Gaza city. According to Ministry of Education, there are 215,913 students in the primary school of Gaza city distributed as 99,300 male and 116,613 female. Using Sample Size Calculator **(http: //www.surveysystem.com/sscalc.htm, 2011),** random 383 students are required for statistically valid results. Early morning, midstream urine samples were collected from healthy children (6-12) years of age who agreed to provide a urine sample and answer a questionnaire.

Urine was mixed and cultured on blood and MacConkey agar media by using standardized loop (1µ), and then plates were incubated at 37 $^{\circ}$C for 24 hours. In addition, routine urine analysis was done using Dip stick technique for leukocyte esterase and nitrite (Uri_screen10, RFE 20110) and microscopic examination to examine the number of WBCs and other microscopic features.

A single colony from positive bacterial cultures (≥100,000 CFU/ml) was subcultured onto Blood agar plates by streaking to insure purity. Gram stain was used for initial differentiation. Gram positive isolates were identified using catalase, coagulase, and haemolysis on blood agar. While gram negative isolates (rods) were identified using oxidase and API 20 E system (BioMerieux, France).

The Antimicrobial susceptibility testing (AST) was performed by growing the isolates in the presence of a given antibiotic using disk diffusion method. Amoxicillin, Amikacin, Amoxicillin+clavulanic acid, Cefaclor, Cefazolin, Ceftazidime, Ceftriaxone, Cefuroxime, Cephalexin, Gentamycin, Nalidixic acid and Ofloxacin antibiotics were tested against bacterial isolates **(CLSI, 2009).**

A questionnaire was used in this study, which included both open and closed end questions; (age, sex, symptoms,). The Data collected, summarized, tabulated and analyzed (chi square) using Statistical Package for Social Sciences (SPSS) software.

Results:

The overall prevalence of UTI among health primary school children in Gaza city was (10.6%) 38/358, (15.0%) 27/180 in females and (6.2%) 11/178 in males. Data presented in figure 1 showed that *Escherichia coli* was the most predominant pathogen followed by *Proteus* group and *Pseudomonas* species with 36.8%, 18.4%, 15.8% respectively.

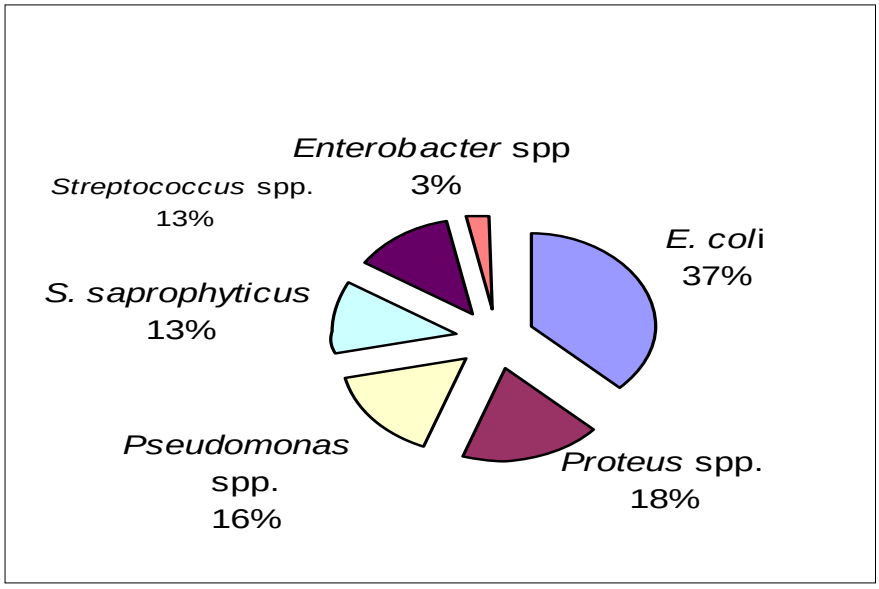

Figure (1): Frequency of isolated uropathogens from the study sample

Gram negative bacteria was the most common among the uropathogens responsible for UTI with a 73.6% percentage in comparison to 26.4% for gram positive bacteria, as shown in table 1.

Table (1): Distribution of gram negative and gram positive bacteria among uropathogens

Gram negative		Gram positive	
E. coli	36.8%	*S. saprophyticus*	13.2%
Proteus group	18.4%	*Streptococcus* species	13.2%
Pseudomonas species	15.8%		
Enterobacter species	2.6%		
Total	73.6%	Total	26.4%

The results of antimicrobial susceptibility profiles of the isolates uropathogens (shown in table 2) showed variability against the tested pathogens. Ofloxacin showed the highest activity (100%) against both gram positive and gram negative isolates. Amikacin showed high activity against gram-negative isolates.

Table (2): Susceptibility profiles of uropathogens to common antibiotics.

Antibiotics/ Isolate	**AM**	**AK**	**AC**	**CE**	**CZ**	**CA**	**CT**	**CX**	**CN**	**GM**	**NA**	**OF**
E. coli	50	100	38.5	71.4	NA	85.8	78.6	76.9	NA	NA	92.3	100
***Proteus* group**	14.3	100	50	71.4	NA	85.7	100	100	NA	NA	57.1	100
***Pseudomonas* spp.**	50	100	33.3	66.7	NA	33.3	83.3	60	NA	NA	50	100
***Enterobacter* spp.**	0	100	NA	0	NA	100	100	100	NA	NA	100	100
S. saprophyticus	25	NA	75	NA	20	NA	NA	100	100	100	NA	100
***Streptococcus* spp.**	100	NA	NA	NA	0	NA	NA	100	0	0	NA	100

AM- Amoxicillin, AK-Amikacin, AC- Amoxicillin+clavulanic acid, CE- Cefaclor, CZ- Cefazolin, CA-Ceftazidime, CT- Ceftriaxone, CX-Cefuroxime, CN- Cephalexin, GM-Gentamycin, NA- Nalidixic acid, OF-Ofloxacin, NA- Not Applicable

A higher percentage of UTI was demonstrated among female than male students (table 3). This difference was statistically significant (p= 0.05)

Table (3): Gender and UTI.

Gender	UTI	
	Negative	Positive
Male	93.8%	6.2%
Female	85.0%	15.0%

Increase the number of white blood cells in the urine sample increases the probability of the presence of UTI. The presence of pus cell showed statistically significant correlation with positive cultures (P= 0.05) (Table 4).

Table (4): Pus count and culture results.

WBCs	Culture	
	Negative	Positive
0-4	90.7%	9.3%
4-8	66.7%	33.3%
8-12	33.3%	66.7%

Discussion:

In this study there was a significant difference (p=0.005) between the frequency of UTI and gender, Females are more susceptible for UTI in comparison to males (see Table 3). This finding is in agreement with many previous studies. The prevalence of UTI in female and male in Gaza city is higher than in Nablus, Sweden,

Nigeria and Oregon. That in Nablus the prevalence of UTI was 7.5% in girls and 0% in boys **(Sawalha, 2009),** in Sweden 10% of girls and 3% of boys **(Jadresic, 2010),** in Nigeria the prevalence is 7.3% with no significant gender difference **(Jombo, 2010),** in Oregon, USA 8% of girls and 2% of boys **(White, 2011).**

In our study, the gram-negative bacteria was the most common of uropathogens responsible for UTI with a 73.6% in comparison to study in Nablus the gram-negative bacteria was 59.3%, and *E. coli* is the most common bacteria that cause UTI. This is similar to other studies in different countries, but the second most common bacteria in our study is *Proteus* and this similar to study in Nigeria **(Jombo et al., 2010).** Studies in Nablus **(Sawalha, 2009),** north occupied Palestine **(Chazan et al. 2004),** Romania **(Brad et al., 2010),** Canada **(Zhanel, et al. 2005),** Turkey **(Yuksel et al., 2006)**, showed that the second most common bacteria is *K. pneumoniae*.

In the other hand this study showed no significant correlation between the financial status of family, having abdominal pain, difficulty in urination, urination frequency, involuntary urination during sleep, unpleasant smell of urine, holding the urine for a long time, amount of fluid consumed and the result of urine culture.

According to our results for antimicrobial susceptibility, *E. coli* is sensitive for Amikacin 100%, Ceftazidime 85.8%, Nalidixic acid 92.3% and Ofloxacin 100%. However, according to other study, antibiotic resistance is increasing and *E. coli* in the community is seldom resistant to quinolones or nitrofurantoin. However, only 50% of isolates were sensitive to amoxicillin **(Lee, 2007).** From a study in USA and Canada the resistance rates were higher than those obtained in this study **(Zhanel et al. 2005).**

In conclusion, the results showed high percentage of community acquired UTI among schoolchildren in Gaza city. This requires close monitoring and more attention should be paid by school officials to detect and manage early cases to prevent deteriorations and complications.

References:

Bell, L. ; Mattoo, T. Update on Childhood Urinary Tract Infection and Vesicoureteral Reflux, Seminars in Nephrology 2009, 29, 349-359.

Brad, G.; Sabau, I.; Marcovici, T.; Mariş I.; Dăescu, C.; Belei O.; Vetesi, T.; Nilima, K.; Hoduţ A.; Popoiu, CM. Antibiotic Resistance in Urinary Tract Infections in Children, Jurnalul Pediatrului 2010, 13, 73-77.

Chazan, B.; Sakran, W.; Raz, R.; Colodner, R.; Improved Antimicrobial Susceptibility of Community-Acquired Uropathogens in Northern "Israel" (1995–1999–2002), International Journal of Antimicrobial Agents 2004, 24, 89-92.

CLSI. Performance Standards for Antimicrobial Susceptibility Testing: Nineteenth Informational Supplement 2009. CLSI document M100-S19, P. 136-139. Wayne, PA; Clinical Laboratory Standards Institute.

Evans, J. Investigation of Urinary Tract Infection in Children, Current Pediatrics 2006, 16, 248-253.

Jadresic, L. Diagnosis and Management of urinary tract infections in children, Pediatrics and Child Health 2010, 20, 274-278.

Ghedira, L.; Messaoudi, A.; Meriem, C.; Guediche, MN.; Profile of Antimicrobial Resistance of Agents Causing Urinary Tract Infections in Children 2004, Tunis Med, 82(3), 299-305.

http://www.surveysystem.com/sscalc.htm. (Last accessed in November 2014).

Jombo, G.; Gyuse, AN.; Odey, F.; Ibor, S.; Bolarin, DM.; Utsalo, SJ.; Denen,P.; Okwori, EE. A Survey of Antimicrobial Susceptibility Patterns of Bacterial Isolates

from Community Acquired Significant Bacteriuria among Pre-School Children in A Municipality in Calabar, International Journal of Biological & Medical Research 2010 1, 172-176.

Lee, J.; Neild, G. Urinary Tract Infection, Obstruction and Infection 2007, 35, 423-428.

Sawalha, R. Prevalence of Urinary Tract Infection among Children of Primary Schools in Nablus 2009, An-Najah National University Faculty of Graduate Studies (unpublished master thesis).

Sheerin, N. Urinary Tract infection, Obstruction and Infection 2011, 39, 384-389.

Smith, G. Management of Urinary Tract Infection, Current paediatrics 2004, 14, 556-562.

White, B. Diagnosis and Treatment of Urinary Tract Infections in Children, American Family Physician 2011, 83, 409-415.

Yuksel, S, Ozturk, B, Kavaz, A, Ozçakar ZB; Acar B; Güriz H; Aysev D; Ekim M; Yalçinkaya F. Antibiotic Resistance of Urinary Tract Pathogens and Evaluation of Empirical Treatment in Turkish Children with Urinary Tract Infections 2006, International Journal of Antimicrobial Agents, 28, 413–416.

Zhanel, G.; Hisanaga, T.; Laing, N.; DeCorby, M.; Nichol,K.; Palatnick,L.; Johnson, J.; Noreddin, A.; Harding,G.; Nicolle,L.; Hoban, D.; the NAUTICA Group. Antibiotic Resistance in Outpatient Urinary Isolates: Final Results From The North American Urinary Tract Infection Collaborative Alliance (Nautica) 2005, International Journal of Antimicrobial Agents, 26, 380-388.