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The prevalence of urinary tract infections (UTIs) in the pediatric hospital of Benghazi city, Libya.

Ismaeel H. Bozakouk [a,*], Ibrahim I. I. Abdalla[b], Khawla S. Al Orify[a], Mohamad Bumedian[a] and Farag Bleiblo[a,c]

[a] *Department of Microbiology and Department of Botany, Faculty of Science, University of Benghazi, Benghazi, Libya.*

[b] *Microbiology Department, Faculty of Medicine, University of Benghazi, Benghazi, Libya.*

[c] *Department of Chemistry and Biochemistry and the Bimolecular Sciences Program, Laurentian University, Sudbury, P3E 2C6, ON, Canada.*

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* Corresponding author:
E-mail address: Ismaeel.bozakouk@uob.edu.ly
I. H. Bozakouk

ABSTRACT

Urinary tract infections (UTIs) are a frequent clinical problem and may have adverse clinical consequences especially for infants and young children. There have been no studies conducted to determine the incidence rate of UTIs among children in Benghazi and the guidelines for the laboratory diagnosis and antimicrobial susceptibility testing remained largely unmanaged. Accordingly, we investigated the prevalence of pediatric UTIs during the first six months of the year 2015 in the pediatric hospital of Benghazi city. About 2100 urine samples were collected from patients presented with clinical signs of UTIs. In both hospitalized patients admitted to different hospital units and from the outpatient department (OPD), the overall bacterial UTIs rate was 15.43% (324 UTI-positive samples). In OPD, the rate of UTIs in boys was 61.83% compared to 45.33% in girls. However, UTIs were more frequent in girls than boys as indicated from samples received from the other hospital internal units. The most common cause of UTIs was *Escherichia coli* (64.32%). Other responsible agents have included *Klebseilla*, *Proteus*, *Enterobacter*, *Pseudomonas*, *Aeromonas* and *Streptococcus*. The rate of resistance to amoxicillin and norfloxacin was about 40%. Similarly, the other antibacterial drugs routinely used for UTI susceptibility testing revealed less than 30% resistance. Therefore, important factors such as incidence rate of UTIs, standard laboratory diagnosis, and antimicrobial susceptibility testing require a special consideration in children for optimal UTIs treatment.

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1. Introduction

Bacterial UTIs are considered one of the most frequent diseases that affect children and adolescents. About 1 % of boys and 3 – 8 % of girls become susceptible to UTIs (Riccabona, 2003). Children who had a history of UTIs are more susceptible of recurrence of infection with 13 - 19 % (Lee et al., 2012). Although several bacteria species have been identified as the causative agents of UTIs (uropathogenic), *E. coli* strains are the most predominant agents among uropathogens (Kala and Jacobs, 1992; Schalger, 2001; Riccabona, 2003 and Copp et al., 2011). These strains cause about 85 % of community-acquired UTIs and about 50 % of nosocomial UTIs (Bergeron, 1995). Other causative agents include *Klebsiella*, *Pseudomonas*, *Enterobacter, Proteus*, *and Staphylococcus* (Bennett et al., 1995; Dahle et al., 2012, Komala and Samath Kumar, 2013). The importance of UTIs is reflected not only by their morbidity rates in children but by other underlying and associated factors including anatomical abnormalities or renal tissue damages may increase the clinical severities to bacteraemia and septic shock (Shim et al., 2009).

In infants and new-borns, the clinical presentation of UTIs tend to be nonspecific and unwell diagnosed comparing to adult patients, which possibly resulting in renal damage and the exacerbated stages of the infection may lead to loss of renal function (Desai et al., 2016). Symptoms of UTIs in paediatrics and young infants present with sepsis or fever and lack specific symptoms, whereas older children present classical features such as dysuria, frequency, loin pain, poor feeding, vomiting, diarrhoea (Royal College of Physicians, 1991 and Desai et al., 2016). Therefore, the diagnosis of UTI is taking place based on clinical symptoms in association with a positive urine culture (Mc Taggart et al., 2014). Successful management of UTIs requires the initiation of antibiotic therapy and clinically relevant testing remains a critical to guide the use of antibiotics for UTIs treatment. However, unmanaged and misuse of antibiotics may contribute to the emergence of drug–resistant isolates leading to more serious complications (Royal College of Physicians, 1991).

Given the frequency with which UTIs occurs in children and a little information available on antibiotic susceptibility testing, this study is conducted to determine the incidence of UTIs among children and validate the routinely used antimicrobial susceptibility testing in Children Hospital of Benghazi.

2. Materials and Methods

2.1 Samples collection

All voided urine samples were collected from infants and children presented with suspicious indications of UTIs at the Pediatric hospital in Benghazi city. Midstream urine specimens were collected in a period extended to six months (1st January to end of June, 2015) from patients admitted to the outpatient department (OPD) and hospitalized patients with at least 72 hours stay in different hospital units. All specimens were collected based on a standard consent protocol. To obtain standardized urine samples, parents were trained to collect midstream or clean catch urine from their children. Fresh urine specimens were then sent immediately to the microbiology central laboratory for identification.

2.2 Growth conditions

For isolation and differentiation of urinary pathogens, all urine samples were aerobically cultured on cystine lactose electrolyte deficient (CLED) medium. Some bacterial species were further isolated on MacConkey agar. The antimicrobial susceptibility testing for urine was carried out based on the hospital standard practice using agar diffusion assay (Kirby–Bauer antibiotic testing) on Mueller-Hinton agar. All contaminated urine cultures were excluded.

2.3 Bacterial Identifications

For identification of clinically relevant Gram-negative bacteria isolated from urine, Analytical profile index (*AP1 20E*) system was employed for *Enterobacteriaceae* pathogens as per the manufacturer's instructions. Other microbiological tests including oxidase-reaction, growth on Triple Sugar Iron agar (TSI), Simmons' citrate agar and Urease agar were performed to confirm identification. Gram-positive isolates were further tested for catalase, coagulase, and DNase production.

3. Results and Discussions

UTIs occur frequently in children and the management of the laboratory-based diagnosis of these infections represent challenges that may not be encountered in adults. UTI diagnosis is based on clinical symptoms in association with a positive urine culture. In addition, in infants and young children urine should be collected if there is an unexplained fever (>38°C) and/or symptoms suggestive of a UTI (McTaggart et al., 2014). Therefore, the accurate and reliable diagnosis of UTIs in children is clinically critical. This study was performed to determine the incidence rate of UTIs in the pediatric hospital in Benghazi city. The total number of urine samples collected in this study was 2100. The incidence rate of UTIs among children was about 15.43 %. UTIs occurs in about 14.42 % of OPD comparing to 16.68 % in hospitalized patients. The UTIs rates in the other hospital departments were 11.59 % in the hospital admission wards, 35 % in nephrology department, 26.02 % in the ICU and 47.83 % in the ISO unit. In addition, the results revealed that the prevalence of UTIs was independent of seasonal changes. The rates of UTIs from January to June were 4.2 %, 17.9 %, 12.7 %, 15.7 %, 13.3 % and 19.6 % respectively as indicated in Table 1. The incidence of UTIs in boys was 61.8 % and 45.33 % for girls in OPD. However, higher rates of UTIs was determined in girls comparing to boys within the inpatient groups.

UTIs in outpatient department in boys are higher than girls, whereas, other hospital departments showed UTIs in girls higher than boys with the exception of the isolation department. The percentage of UTIs in boys at the outpatient department is 61.83 %, which represents almost double cases of infections in the inpatient departments (38.79 %). However, the girls UTIs in the inpatient hospital departments showed total percentage of infection (49.61 %) higher than the outpatient department (45.33 %), Fig. 1.

Table 1: Prevalence of UTIs in Pediatric Hospital of Benghazi city

Departments	Growth (Months)											
	January		February		March		April		May		June	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
OPD	28	15.6	29	14.4	28	12.2	31	16.9	17	9.6	35	17.9
Wards A, B, C	12	12.7	20	22.2	7	7.4	13	7.5	20	11.7	11	11.9
Nephro.	4	23.5	5	26.3	10	32.2	11	57.8	8	34.7	5	35.7
I.C.U.	0	0	3	42.8	0	0	6	50	6	31.5	5	62.5
I.S.O.	0	0	-	-	2	66.6	-	-	2	28.5	7	77.7
Total:	44		57		47		61		53		63	

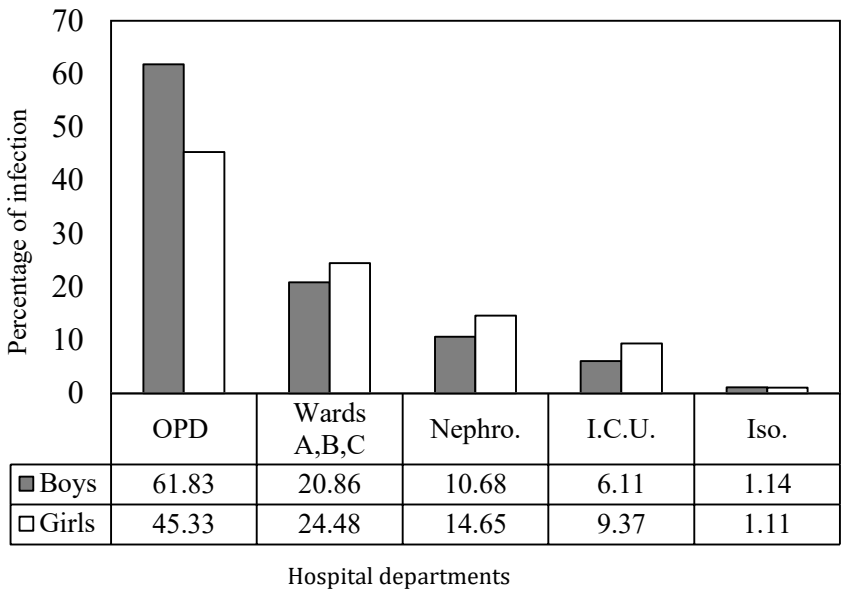

Fig. 1: The Prevalence of UTIs among children by Gender

Among urinary isolates, we identified *Escherichia coli*, *Klebsiella*, *Proteus* and *Enterobacter, Pseudomonas* and *Aeromonas* species. Our results also identified the Gram-positive *Streptococcus sp*. In agreement with others, we determined *E. coli* as the most predominant uropathogens (Dromigny et al., 2002; Raka et al., 2004; Tessema et al., 2007; Farajnia et al., 2009 and Yakubov et al., 2017) followed by *Klebsiella sp*. and *Pseudomonas sp*. as shown in Fig. 2. Some other study has shown *Staphylococcus* and *Pseudomonas sp*. where the typical pathogens (Desai et al., 2016).

For routine antimicrobial susceptibility testing, we examined a number of antibiotics including ciprofloxacin (Cip), Norfloxacin (Nor), Nitrofurantoin (Nit), Clindamycin (Cl), Doxycycline (Do), Levofloxacin Lev), Piperacillin (Pip), Kanamycin (K), Amikacin (A), Amoxicillin (Amc), Chloramphenicol (C). Most of the isolates were sensitive to antibiotic under examination with an average percentage of efficacy less than 30%. The resistance of tested uropathogenic to amoxicillin and norfloxacin was about as shown in Fig. 3. Although amoxicillin has traditionally been used as a first-line antibiotic for UTIs, the emergence of Gram-negative pathogens resistance limited its efficacy (Zorc et al., 2005). Ciprofloxacin and Levofloxacin are showing valuable effect of more than 70 %, another study showed almost no microbial resistance to them (Yakubov et al., 2017), however, these quinolones are not recommended to be used as the first line of treatment in children due to potential for musculoskeletal side effect (Adefurin et al., 2011). A study has revealed Nitrofurantoin does not achieve therapeutic blood concentrations, thus, should not be used to treat febrile UTI's (Ramlakhan et al., 2014). Compare to another study, our finding in uropathogens resistance (30% and 40%) are high (Saperston et al., 2014). Other therapeutic alternatives include cefixime (Suprax), cefpodoxime, cefprozil (Cefzil), or cephalexin (Keflex) that are highly recommended for UTIs in children (Zorc et al., 2005). Physicians should be aware of the recommended antibiotics and updated with the antibiogram patterns of urinary isolates (Brett White, 2011).

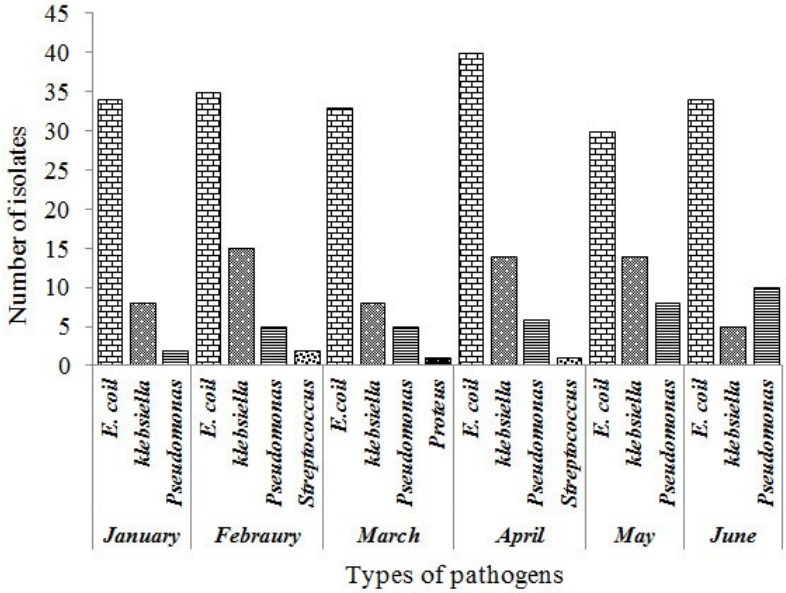

Fig. 2: Types of uropathogens isolated from children hospital departments.

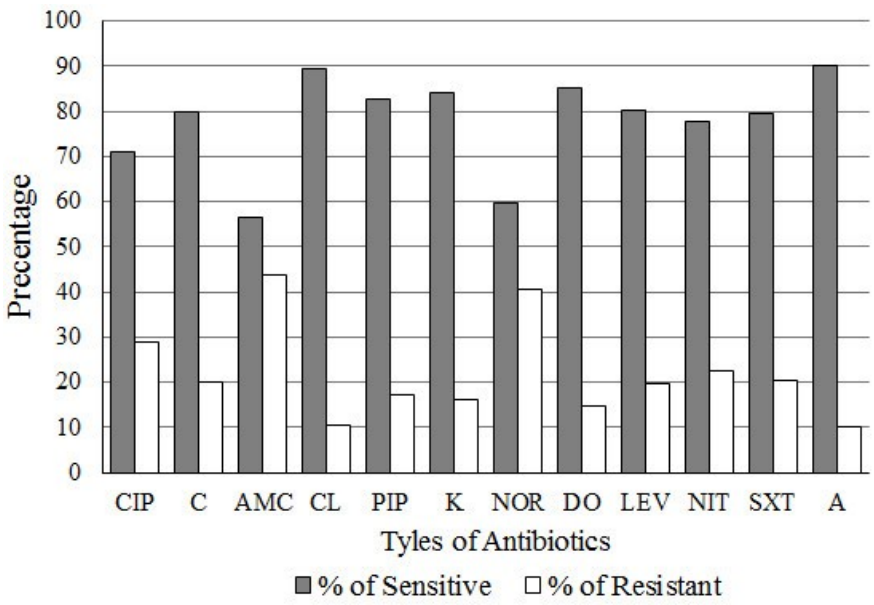

Fig. 3: The evaluation of the routinely used antibiotics susceptibility testing in pediatric hospital of Benghazi city.

4. Conclusion

Urinary tract infections at the pediatric hospital in Benghazi city still a worrying problem. The high rate of microbial resistance of the routinely used antibiotics has recorded.

5. Recommendations

Knowledge of prevalence of UTIs and accurate laboratory diagnosis among different subgroups of children could assist physicians to make an informed therapeutic decisions.

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