Prevalence of bacterial agents causing urinary tract infections in children below 5 years of age and their antibiotic sensitivity

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Abstract:

Urinary tract infection (UTI) is a common childhood problem, if not diagnosed and treated promptly may lead to serious problems like renal scarring and renal failure. This study was conducted to assess the most common bacterial agents responsible for UTI and the most effective antibiotics. Four hundred eighty five (485) cases included in this study selected according to certain criteria. One hundred thirty patients (26.8%) had positive cultures for UTI. Most common bacterial agent was E. coli responsible for (30.7%) of cases. Amikacin and Gentamycin were found to be the most commonly effective antimicrobial agents against these bacteria. The study showed a significant sex preponderance in infantile age group (male: female 1.8:1) while UTI predominated in females beyond infancy (3.2-3.5:1). The study showed clearly the importance of testing antibiotics sensitivity of these bacteria for successful management of UTI.

Key wards; urinary tract, antibiotics

ملخص البحث

يعتبر التهاب المجاري البولية لدى الأطفال من الأمراض الشائعة والمهمة والتي تأتي أهميتها من الأضرار البالغة التي يمكن أن تحدث فيما لو تأخر التشخيص أو العلاج من قبيل تليف الكليتين وفشلهما أجريت هذه الدراسة لتقييم أنواع البكتريا المسببة لإلتها بات المجاري البولية لدى الأطفال وحساسية هذه الأنواع للمضادات الحيوية.أخضع ٤٨٥ طفلاً مصاباً بالتهابات المجرى البولي لمقاييس محددة كي يتم شمولهم بهذه الدراسة.وجد في الدراسة أن ١٣٠ طفلاً (٢٦,٨٪) كانت لهم نتائج زرع بكتيري موجبة، ووجد أن النوع البكتيري الأكثر شيوعاً هو (الاشريشا القولونية) والتي كانت مسؤولة عن (٣٠,٧٪) من الحالات.وجد في الدراسة أن عقار (أميكاسين) و (جنتامايسين) هما العقاران الأكثر فعالية ضد تلك الأنواع البكتيرية. وجد في الدراسة فرق ملحوظ بين إصابة الذكور والإناث من الأطفال في السنة الأولى من العمر (ذكور:إناث=١,٨:١) كما وجد أيضاً أن هنالك فرقاً إحصائياً بين إصابة الذكور والإناث بعد السنة الأولى حيث زادت إصابات الإناث هنا عن الذكور بنسبة (٣,٢-١:٣,٥).أظهرت الدراسة الأهمية البالغة لفحص حساسية البكتريا للمضادات الحيوية في نجاح علاج التهابات المجرى البولي لدى الأطفال.

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Introduction

Urinary tract infections (UTI) are the most common source of serious bacterial infection in young children. Over all 3% to 5% of young febrile children have UTI [(1)].Approximately 3-5% of girls and 1% of boys acquire a UTI. In girls, the first UTI usually occurs by the age of five years, in boys most UTI occur during the first year of life.[(2)]To make the diagnosis of a UTI the urine must be cultured. A UTI may be suspected based on the symptoms or findings on urinalysis or both, but a culture is necessary for confirmation and appropriate therapy.[(3)] Although the finding of pyuria is a good supportive evidence of UTI, up to 50% of patients with significant bacteruria will not demonstrate significant number of white cell (more than 5 white cell per high power field) in the centrifuged urine specimen. [(4)]

UTI have been considered as important risk factor for the development of renal insufficiency or end-stage renal disease. [(2)]

If the child is asymptomatic and the urinalysis result is normal, it is unlikely that the urine is infected, however if the child is symptomatic a UTI is possible even if the urinalysis result is negative. [(3)] UTI recurs at least once in about 20% of boys and 30% of girls, and more than once in about 4% of boys and 8% of girls. [(5)]

Prompt diagnosis and rapid treatment of UTI with antimicrobials drugs will reverse acute changes and may limit future complication. [(6) (7) (8)]

This prospective study was done from 1st May to 1st September 2006 in AlZahraa hospital to evaluate the most common bacterial causes of UTI and their antibiotic sensitivity.

Patients and Methods

Four hundred eighty five (485) patients studied in Al-Zahraa hospital from May to September 2006 were included in this study.

The criteria required in the patients to be included in this study were:

1-Age less than five years

2-No antibiotics were given to the patient prior to taking the culture samples.

3-No definite source of fever found by examination (bronchiolitis, stomatitis, cellulites, otitis media….etc)

After full detailed history and complete physical examination, urine was collected by adhesive urine bag or clean catch mid-stream urine into sterile tube after proper cleaning of the perineum with gauze moistened with water.

The urine samples were sent immediately to the laboratory for urine culture processing. Cultures were considered contaminated if more than one organism or non-pathogens (Acinetobacter species, Candida, Streptococcus viridians,

Staph-ylococcus non-aureus …etc) were isolated. Cases with contamination or negative cultures were excluded from the study. All patients who had positive cultures were sent for abdominal ultrasound to exclude structural and anatomical abnormalities.

Results

Four hundred eighty five (485) patients were included in this study, three hundred fifty five (355) patients were excluded because of negative cultures, one hundred thirty (130) patients showed positive urine cultures. The target of our study was one hundred thirty (130) patients with urine culture positive who were subdivided into three groups according to the age.

Group A: (1 month-1 year). Positive urine cultures were found in 52 patients (40%), 34 males (65.3%), 18 females (34.7%), Male: Female Ratio 1.8:1. The most common bacterial agents isolated were E-coli 19 (36.5%), Enterobacter 18 (34.6%), Klebsiella 8 (15.3%), Proteus 4 (7.6%), and Staph.3 (5.7%).

Group B: (1year -3 years). Positive urine cultures were found in 60 patients (46.1 %). 14 males (23.4 %), 46 females (76.6%), Male: Female ratio 1:3.2 (Table 1). The most common bacterial agents responsible for UTI were E. coli 22 (36.6%), Enterobacter 16 (26.7%), Klebsiella 13 (21.7%), Proteus 4 (6.6%), Staphylococal. 4 (6.6%), Pseudomonas 1 (1.6%).

Group C: (3 year-5 year). Positive urine cultures were found in 18(13.9%), 4 males (22.3%), 14 females (77.7%), Male: Female ratio 1: 3.5. The most common bacterial agents responsible for UTI were E. coli 7(38.8%), Enterobacter 3 (16.7%), and Klebsiella 8 (44.5%). From the total patients included in this study with positive urine cultures, UTI appeared to be most common in females (male: female ratio 1: 3.2 -3.5). The most common bacterial agents responsible for UTI in all age groups were E. coli (30.7%), Enterobacter (28.4%), Klebsiella (22.3%), Proteus (6.1%), Staph. (5.3%), and Pseudomonas (0.7%). The numbers of males who were uncircumcised with positive urine culture were 31 (59.7%), while those with positive urine cultures in circumcised patients were 21 (40.3%).

E. coli was found to be mostly sensitive to Amikacin (35.4%), Gentamycin (31.2%), Nitrofurantoin (12.5%) and nalidixic acid (10.4%).

Enterobacter was found to be mostly sensitive to Amikacin (40%), Nitrofurantoin (16.2%) and Ceftazidime (16.2%).

Klebsiella was found to be sensitive to Amikacin (34.4%) and Ceftazidime (12.5%).

Proteus was found to be sensitive to Nitrofurantoin (50%) and Amikacin (25%). 669889

Staph. was found to be sensitive to Amikacin (28.5%) and Nitrofurantoin (28.5%).
Pseudomonas was sensitive to Amikacin (100%). (Table 2)
The abdominal ultrasound findings in those with positive cultures were as follows:
Normal U/S were found in 65 patients (50%).
Pus collection in the urinary bladder were found in 26 patients (20%).
Increased urinary bladder wall thickness was found in 25 patients (19.2%).
Increase in kidney size were found in 5 patients (3.8%).
Renal stone were found in 5 patients (3.8%).
Pelvicalyceal system dilatations were found in 4 patient (3%)

Discussion

Male: female ratio in this study showed male preponderance in those below one year (male: female 1.8:1) while beyond infancy female predominate (3.2-3.5:1).
In other studies male to female ratio was 2.8-5.4: 1 during first year of life and there was a striking female preponderance beyond infancy (10:1) [3] [7] [9]. This may be explained by increased number of uncircumcised boys, and the bacterial pathogens arise from the flora beneath the prepuce.
In this study, the most common microorganisms in all age groups identified by urine culture were E.coli (30.7%). The next common microorganisms were Enterobacter (28.4%), Klebsiella (22.3%), Staph. (5.3%), and Pseudomonas (0.7%).
In other studies the urine culture obtained by urethral catheterization showed that the predominant urinary tract pathogens were E. coli 93% , Enterococcus 2% and 1.25% of each of Staph., group A β-hemolytic streptococci, Enterobacter cloacae and Pseudomonas[10].Published data suggest that (85%) of the time , a positive culture result in a bag collected specimen is likely to be false positive.[11]However, Newman and colleagues didn't find an excess of positive urine culture among infants whose urine were collected in bags if performed adequately and such factors are considered (the time between voiding and removal of the bag from the perineum and between specimen collection and refrigeration or processing). [12]
In this study, we found the E. coli was more sensitive to amikacin (35%) and gentamycin (31.2%). Enterobacter was sensitive to amikacin (40%) and nitrofurantoin (16.2%). Klebsiella was sensitive to amikacin (34.4%) and ceftazidime (20.6%).Proteus was sensitive to nitrofurantoin (50%) and amikacin (25%).Staph. was sensitive to amikacin (28.5%) and gentamicin (28.5%).In a study done in Kathmandu, Nepal, the antibiotic sensitivity of urinary

pathogens was as follows: E. coli was mostly sensitive to amoxicillin and ampicilloin. Klebsiella was sensitive to norfloxacin and to co-trimoxazole. Proteus was sensitive to ampicillin and nalidixic acid. Staph. aureus was sensitive to norfloxacin and nalidixic acid. [13].

This change in antibiotic sensitivity between our study and foreign study for common antibiotics may be explained by emergence of drug resistance for these drugs (amoxicillin, ampicillin) because of over use of antibiotics in daily clinics. In our study, ultrasound results in those with positive cultures were found normal in (50%). There was an increase in kidney size found in (3.8%) and renal stone in (3.8%). There was an increase urinary bladder wall thickness in (19.2%).
However, in another study done in Palestine the corresponding findings was as follows: Ultrasound results were normal in (64.2%). Hydronephrosis and renal stones were found in (37.9%). Lower urinary tract abnormalities were found in (13.7%) [14]. This difference in results may be due to poor follow up of patients with UTI and associated structural abnormalities.

Conclusions

Males were the most commonly involved in the first year of life, while females predominate thereafter.

This change in antibiotic sensitivity between our study and foreign study for common antibiotics may be explained by emergence of drug resistance for these drugs (amoxicillin
were found in 4 patients (3%).

E. coli was the most bacterial agent responsible for UTI, while Pseudomonas was the least one.
The antibiotics commonly used in daily clinics were shown to be less effective against common bacterial pathogens responsible for UTI.

Recommandations

Antibiotics should be used according to antibiotic sensitivity in proven cases of UTI.
Early circumcision might decrease the number of affected patients.
It is very important to follow up any patient with UTI to reduce the recurrence of UTI and further complications.
Laboratory screening and radiological follow up were essential for anticipation and early management of complications of UTI.
Education of the family about self-hygienic control and ways of management of UTI should be adopted.

Table (1): Bacterial pathogens and sex distribution in 130 with positive urine cultures

Micromicro-organism	Age 1 month-1 year		1 year-3year		3 year-5year		TOTAL NO.	TOTAL %
	Female (+ve) culture	Male (+ve) culture	Female (+ve) culture	Male (+ve) culture	Female (+ve) culture	Male (+ve) culture		
E. coli	3	16	21	1	6	1	F=30 M=18	30.7%
Enterobacter	6	12	9	7	2	1	F=17 M=20	28.4%
Klebsiella	5	3	9	4	6	2	F=20 M=9	22.3%
Proteus	2	2	2	2	---	---	F=4 M=4	6.1 %
Staph.	2	1	4	---	---	---	F=6 M=1	5.3 %
Pseudomonas	---	---	1	---	---	---	F=1 M=0	0.7 %
TOTAL NO.	18	34	46	14	14	4	F=78 M=52	
TOTAL %	34.62 %	65.38 %	76.6%	23.4%	77.7%	22.3 %		F=60 % M=40 %

Table (2): Antibiotic sensitivity of the pathogens cultured from 130 patients

Drug / Micro-organism	Amikacin		Gentamycin		Naldixic acid		Nitrofurantin		Ceftazidime		cefoxi
	No.	%	No.	%	No.	%	No.	%	No.	%	No.
E. coli	17	35.4%	15	31.2%	5	10.4%	6	12.5%	3	6.2%	2
Enterobacter	15	40%	3	8.1%	2	5.4%	6	16.2%	6	16.2%	5
Klebsiella	10	34.4%	1	3.4%	3	10.3%	4	13.7%	6	20.6%	5
Proteus	2	25%	1	12.5%	0	0	4	50%	1	12.5%	0
Staph.	2	28.5%	2	28.5%	1	14.2%	2	28.5%	0	0	0
pseudomonas	1	100%	0	0	0	0	0	0	0	0	0

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