Clinical audit on management of pediatric urinary tract infection at Assiut University Children Hospital

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Background
Pediatric urinary tract infection (UTIs) is among the most common bacterial infections. It represents an important cause of morbidity and mortality, with a spectrum of severity that ranges from mild self-limiting infection to life-threatening systemic disease.

Aim
The aim was to evaluate management of children with suspected UTI referred to the Outpatient Clinic and the Inpatient Pediatric Nephrology Unit, Assiut University Children Hospital.

Patients and methods
The study included 104 patients with symptoms and signs of UTI who were admitted to pediatric nephrology unit or seen in outpatient nephrology clinic at Assiut University Children Hospital. Management protocol was compared with guidelines of the American Academy of Pediatrics and National Institute for Health and Care Excellence.

Results
Evaluation of the studied patients was perfectly done regarding history taking and examination, but there is defect in neurological and genital examination by 48 and 51%, respectively. Laboratory investigations were done, but there is defect in the following investigations: urine analysis by 17%, dimercaptosuccinic acid scan (DMSA) by 32%, and voiding cystourethrography (VCUG) by 28.8%. Management was perfectly done except for treatment of complications in age group from 2 to 18 years.

Conclusion
UTI diagnosis and good management are very important issues. Evaluation of the studied UTI patients was perfectly done in Assiut University Pediatric Nephrology Unit regarding history taking, examination, and laboratory investigations; however, special care should be directed toward neurological and genital examination and the need of such patients for DMSA scan and VCUG.

Keywords:
Assiut University Children Hospital, audit, pediatric urinary tract infection

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Introduction

Approximately 3% of prepubertal girls and 1% of prepubertal boys are diagnosed to have a urinary tract infection (UTI). Many girls who do not undergo radiographic evaluation after an initial UTI will experience a recurrence within 1 year. Girls with recurrent UTIs are at increased risk of renal scarring, which then increases the risk of progressive kidney disease in adulthood. A recent retrospective study found that 35% of boys and 32% of girls who had their first UTI less than 1 year contracted a recurrent UTI over the next 3 years [1].

UTI is defined as the presence of pathogens in the UTI [2].

Escherichia coli is the most commonly studied organism causing a UTI [3].

Children are generally assumed to have pyelonephritis when submitting urine associated with a high fever, infection, nausea, vomiting, flank pain, or lethargy. On the contrary, cystitis is suspected when the child is afebrile and only has lower urinary tract symptoms, including urinary urgency, frequency, dysuria, smelly urine, and/or suprapubic sensitivity. However, use of clinical symptoms of a child to be classified in UTI of lower urinary tract and upper is not 100% accurate [4].

A clean catch urine sample is the preferred method for collecting urine [5].

The role of renal imaging is to identify risk factors that can be modified to reduce the likelihood of recurrent UTI and renal scarring [6].

UTI treatment depends on the location of the infection (cystitis against pyelonephritis), the patient's

age, severity of presentation, and the pattern of antimicrobial resistance in the community. Empiric treatment for a UTI should be initiated after the urine sample for culture was obtained [7].

The choice of empirical antibiotic is guided by local resistance patterns, but coverage for *E. coli* as the most common infectious organism must be considered [8].

The optimal duration of treatment of pyelonephritis is 7–14 days, depending on the route of administration. In the case of acute pyelonephritis (lobar nephronia), parenteral therapy is prolonged, and it can help to prevent the progression of the abscesses. In acute cystitis, several studies have shown that a short treatment of 2–4 days are as effective as the 7–14 days in the eradication of the lower UTI among children [8].

Aim

The aim was to assess the degree of adherence of medical team at Assiut University Children Hospital to the international guidelines for management of pediatric UTI.

Patients and methods

This study is a clinical audit study, which included 104 patients with symptoms and signs of UTI who were admitted to a pediatric nephrology unit or seen in outpatient nephrology clinic at Assiut University Children Hospital. Overall, 68% of the studied patients were males and 32% were females, and their age ranged from 1 month to 18 years. All children with fever with another cause other than UTI were excluded from the study. The study protocol was approved by the Ethical Committee of Assiut Faculty of Medicine, with registration No. 17100063. Any data taken from the patient were dealt in a confidential manner.

All data were collected about clinical evaluation of patients and general and supportive measures done in the studied patients. Moreover, data were collected about medical treatment of those patients.

Such data were compared against guidelines for management of pediatric UTI of the American Academy of pediatrics and National Institute for Health and Care Excellence.

Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, USA) version 20.0. Quantitative data were expressed as mean ± SD. Qualitative data were expressed as frequency and percentage.

Result

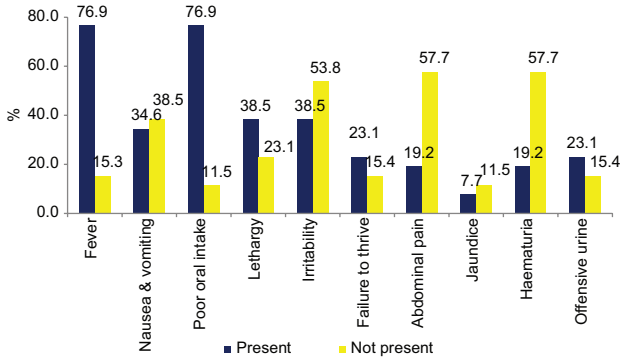
The present work included 104 patients with symptoms and signs of UTI who were admitted to the pediatric nephrology unit or seen in the outpatient nephrology clinic at Assiut University Children Hospital:

(1) Overall, 68% of the studied patients were males and 32% were females with 59.6% of the studied patients were admitted to nephrology unit and 40.3% of the studied patients were seen in the outpatient clinic. Data are shown Table 1.
(2) In patients aged from 1 month to 2 years, data of all symptoms are recorded in all patients. The most common presenting and recorded symptoms were fever (76.9%) and poor oral intake (76.9%), followed by lethargy (38%), irritability (38%), and nausea and vomiting (34%). Data are shown in Fig. 1.
(3) Fig 2 shows that symptoms of the studied patients aged from 2 years to 18 years, who were divided into upper and lower urinary symptom groups. In upper urinary symptoms, fever is the most asked and recorded symptom (60.8%), followed by nausea and vomiting (58.9%), but other symptoms are less frequently asked. In lower urinary symptoms, dysuria is the main asked symptom (92.6%), followed by itching and frequency (55.6%).
(4) Table 2 shows that vital signs (weight, temperature, and blood pressure) are routinely examined in 100% of case, followed by abdominal examination (98%), then genital examination (49%), and finally, neurological examination (46%).
(5) Table 3 shows that urine analysis was done for all studied patients (100%), followed by abdominal ultrasound (92.3%), complete blood count (80.0%), kidney function test (77.8%), and urine culture (68.2%). Specific investigations such as DMSA and VCUG were done in 32% and 28% of cases, respectively.
(6) Table 4 shows treatment consideration according to age from 1 month to 2 years:
    (a) 88.8% of hospitalized patients are properly indicated to be hospitalized.
    (b)Treatment chosen according to type of UTI:

In case of lower UTI, treatment was properly chosen in 100% by usage of amoxicillin-clavulanic and ceftriaxone.

In case of upper UTI, treatment is properly chosen in 92% by usage of amoxicillin-clavulanic and ceftriaxone. Trimethoprim sulfamethoxazole was used in 60% and ampicillin in 8%. Treatment is properly chosen by

Figure 1



Distribution of recorded symptoms of urinary tract infection in patients aged 1 month to 2 years.

Table 1 Distributions of varieties of ages, sex, and special cases among the studied patients

	Inpatient	Outpatient
Number of patients	62/104 (59.6%)	42/104 (40.3%)
Male		
1 month to 2 years	16/62 (25.8%)	3/42 (7.1%)
2-18 years	24/62 (38.7%)	28/42 (66.6%)
Female		
1 month to 2 years	6/62 (9.7%)	1/42 (2.3%)
2-18 years	16/62 (25.8%)	10/42 (23.8%)
Male with special case		
1 month to 2 years	13/16 (81.2%)	3/3 (100%)
2-18 years	12/24 (50%)	8/28 (28.5%)
Female with special case		
1 month-2 years	5/6 (83.3%)	1/1 (100%)
2-18 years	10/16 (62.5%)	2/10 (20%)

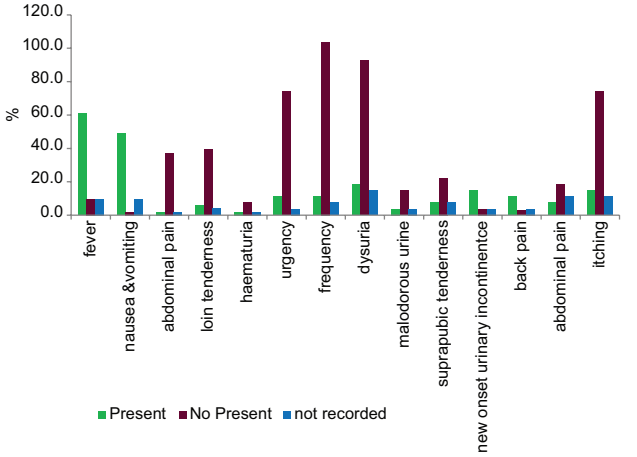
Table 2 Frequency of recording of data of physical signs among the studied cases

	Recorded [*n* (%)]	Not recorded [*n* (%)]
Weight	104 (100)	0
temperature	104 (100)	0
Blood pressure	104 (100)	0
Abdominal examination	102 (98.08)	2 (1.92)
Suprapubic tenderness		
Flank tenderness		
Back tenderness		
Genital examination	51 (49.04)	53 (50.96)
Congenital anomalies		
Trauma		
Urethral discharge		
Urethral mass		
Local irritation		
Neurological examination	48 (46.15)	56 (53.85)

usage of trimethoprim sulfamethoxazole in 16% in less than 2 months of age.

(c) Duration of usage antibiotic: treatment of cystitis was proper in duration in 100% of cases, but in acute pyelonephritis cases, 80% had proper and 20% had improper treatment.

Figure 2



Distribution of recorded and nonrecorded symptoms of upper and lower urinary system in studied patients aged from 2 to 18 years.

(d) Efficacy of treatment: 82.6% of cases responded properly and 17.3% did not respond properly.
(e) Overall, 84.6% of patients in this category were instructed for follow-up but 34.6% were not instructed.
(f) Moreover, 65.4% of patients in this category are special cases and received prophylaxis treatment.

(7) Table 5 shows treatment consideration according to age from 2 to 18 years:
(a) Overall, 87.8% of hospitalized patients are properly indicated to be hospitalized.
(b) Treatment choice according to type of UTI:

In case of lower UTI, treatment was properly chosen in 100% by usage of amoxicillin-clavulanic (77%) and ceftriaxone (51.9%), as well as trimethoprim sulfamethoxazole (55.6%).

In case of upper UTI, treatment was properly chosen in 58.7% by usage of amoxicillin-clavulanic and ceftriaxone (62.7%), trimethoprim sulfamethoxazole (19.6%), ampicillin (3.9%), and cefotaxime (5.9%).
(c) Duration of usage antibiotic in that age: treatment of cystitis was proper in duration in 70.4% and was improper in 29.6%. However, in acute pyelonephritis cases, 56.9% received proper and 43.1% improper treatment.
(d) Efficacy of treatment: 74.1% of cases had effective and 25.9% had ineffective treatment
(e) Overall, 84.6% of patients in this category are instructed for follow up, but 15% were not instructed.
(f) Moreover, 28% of patients in this category were special cases and are treated and received prophylaxis treatment.

Discussion

Children are generally assumed to have pyelonephritis when submitting urine associated with a high fever, infection, nausea, vomiting, flank pain, or lethargy. On contrary, cystitis is suspected when the child is afebrile and only has lower urinary tract symptoms, including urinary urgency, frequency, dysuria, smelly urine, and/or suprapubic sensitivity. However, the use with clinical symptoms of a child to be classified in UTI participation of lower urinary tract and upper is not 100% accurate [4].

In the present study, we tried to highlight the management of UTI in Assiut University Children Hospital and the degree of agreement of this management with the American Academy of Pediatrics[9] and National Institute for Health and Care Excellence[5] protocols.

All patients' ages in the present study were recorded. We noticed that UTI is more prevalent in boys than in girls at an age younger than 1 year, and this was in agreement with Bell *et al.* [10].

Table 3 Frequency of performance of general and specific investigations for the studied patients

	Recorded [*n* (%)]	Not recorded [*n* (%)]
Complete blood count	84 (80.8)	20 (19.2)
Urine analysis (clean catch-mid stream)	104 (100)	0
Urine culture	71 (68.27)	33 (31.71)
Dipstick	17 (16.4)	87 (83.6)
Kidney function test	81 (77.88)	23 (22.12)
Abdominal ultrasound	96 (92.31)	8 (7.69)
KUB X-ray	52 (50.0)	52 (50.0)
DMSA	34 (32.7)	70 (67.3)
VCUG	28.8%	71.2%

This study showed that the most common presenting and recorded symptom in patients aged from 1 month to 2 years was fever in 76.9%. This is in agreement with NICE2013 [11]. The other symptoms recorded were poor oral intake in 76.9%, then lethargy in 38%, irritability in 38%, and nausea and vomiting in 34%.

In the other age group from 2 to 18 years, symptoms are divided into upper and lower urinary tract symptoms. In upper urinary symptoms, fever was the most asked and presented symptom in 60.7%. This is in agreement with NICE2007[5].

In lower urinary symptoms, dysuria was the main presenting symptom in 18.5%. This is in agreement with NICE2007[5].

In the present study, all patients were examined for temperature, weight, and blood pressure. There is defect in genital and neurological examination. Moreover, this is not in agreement with Shaikh *et al.* [12]. So, special attention should be given for genital and neurological examinations by medical staff team, as they carry great importance.

Urine analysis was done for all studied patients (100%), and these results are in agreement with NICE2007[5].

Specific investigations such as DMSA and VCUG were done in 32 and in 28%, respectively. This is against Tse *et al.*[13] and Bush *et al.* [14]. Such investiagtions need special attention as they carry great significance in diagnosis of UTI.

Table 4 Distribution of treatment for the studied patients

1 month to 2 years (26 cases)	Proper [*n/N* (%)]	Not proper [*n/N* (%)]
Indication for hospitalization	23/26 (88.5)	3/26 (11.5)
First line of treatment choice according to type (*n*=1)		
Cystitis	1/1 (100)	
Amoxicillin-clavulanate	1/1 (100)	
Ceftriaxone		
Trimethoprim sulfamethoxazole		
Acute pyelonephritis (*n*=25)		
Amoxicillin-clavulanate	23/25 (92)	2/25 (8)
Ceftriaxone	23/25 (92)	2/25 (8)
Trimethoprim sulfamethoxazole	15/25 (60)	10/25 (40)
Cefotaxime		
Meronam		
Ampicillin	2/25 (8)	4/25 (16)
Duration of antibiotic usage		
Cystitis (4-6 days)	1/1 (100)	5/25 (20)
Acute pyelonephritis (10-14 days)	20/25 (80)	
Effective treatment (symptoms subsided)	21.5/26 (82.6)	4.5/26 (17.3)
Instructions for follow-up and prevention of recurrence	22/26 (84.6)	4/26 (15.4)
Prophylaxis treatment	17/26 (65.4)	9/26 (34.6)

According to age (1 month to 2 years).

Table 5 Distribution of treatment for the studied patients

2-18 years (78 cases)	Proper [*n/N* (%)]	Not proper [*n/N* (%)]
Indication for hospitalization (40 inpatients)	35/40 (87.5)	5/40 (12.5)
Treatment chosen according to type of UTI		
Cystitis (27 cases)		
Amoxicillin-clavulanate		
Ceftriaxone	21/27 (77.8)	
Trimethoprim sulfamethoxazole	14/27 (51.9)	
Meronam	15/27 (55.6)	
Metronidazole		
Acute pyelonephritis (51 cases)		
Amoxicillin-clavulanate		
Ceftriaxone	30/51 (58.8)	11/51 (21.6)
Trimethoprim sulfamethoxazole	32/51 (62.7)	6/51 (11.8)
Cefotaxime	10/51 (19.6)	2/51 (3.9)
Meropenem		
Ampicillin	3/51 (5.9)	1/51 (2)
Cefoperazone		
Vancomycin	2/51 (3.9)	1/51 (2)
Duration		
Cystitis (4-6 days)	19/27 (70.4)	8/27 (29.6)
Acute pyelonephritis (10-14 days)	29/51 (56.9)	22/51 (43.1)
Effective treatment (symptoms subsided)	57.8/78 (74.10)	18/78 (25.9)
Treatment of complications	25/78 (32.1)	53/78 (67.9)
Instructions for follow-up and prevention of recurrence	66/78 (84.6)	12/78 (15.4)
Treatment of UTI in special cases	22/78 (28.2)	6/78 (7.7)
Prophylaxis treatment	22/78 (28.2)	6/78 (7.7)

According to age: 2-18 years. UTI, urinary tract infection.

Treatment consideration was classified according to age 1 month to 2 years:

(1) Indication for hospitalization was properly done in 88.8%. This is in agreement with Spoorenberg *et al.* [8].
(2) Treatment chosen according to type of UTI:

In case of lower UTI, treatment was properly chosen in 100%, and this is in agreement with Nice 2018 [15].

In case of upper UTI, treatment was properly chosen in 92, and this is in agreement with Nice 2018 [15].

However, it was improperly chosen in 16% by usage of trimethoprim sulfamethoxazole in age less than 2 months, and this is not in agreement with Braga *et al.* [16]. Medical team should be advised not to use trimethoprim sulfamethoxazole in children less than 2 months of age.

Regarding the duration of usage antibiotic in that age, in case of cystitis, duration of treatment was proper in 100% of cases, and this is in agreement with Spoorenberg *et al.* [8], whereas in case of acute pyelonephritis, duration of treatment was proper in 80% (7–14 days).

Indications in age from 2 to 18 years:

(1) Indication of hospitalization was properly done in 87.8%, and this is in agreement with Spoorenberg *et al.* [8].
(2) Treatment choice according to type of UTI:

In case of lower UTI, treatment was properly chosen in 100%, and this is in agreement with National Institute for Health and Clinical Excellence [15].

In case of upper UTI, treatment was properly chosen in 58.7%. So, management planes should be revised and adjusted to correlate with international management guidelines in upper UTI in such age group.

Conclusion

Reasonable evidence on the causative organisms, route and duration of treatment, and the role of prophylaxis exist should allow decisions on appropriate treatment to be made in conjugation with clinical and practical considerations. Traditional empiric antibiotic preferences should be re-examined in light of the high-resistance patterns observed, and local formularies should be developed to maximize therapeutic effect while minimizing development of resistant strains.

Recommendations

We recommend the following: improve the outcome of management of UTI; proper history taking from the patient parents or relatives with proper documentation in the patients files; following

the examination sheet, with stress on general and supportive measures including self-care measures; follow-up visits, especially for patients with special situations; improve the facilities for investigations for all patients; and strictly follow the guidelines in the diagnosis of UTI.

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Conflicts of interest
There are no conflicts of interest.

References

1 Montini G, Tullus K, Hewitt I. Febrile urinary tract infections in children. N Engl J Med 2011; 365:239–250.

2 Roberts KB. Revised AAP Guideline on UTI in febrile infants and young children. Am Fam Physician 2012; 86:940–946.

3 Chakupurakal R, Ahmed M, Sobithadevi DN, Chinnappan S, Reynolds T. Urinary tract pathogens and resistance pattern. J Clin Pathol 2010; 63:652–654.

4 Barber AE, Norton JP, Spivak AM. Urinary tract infections: current and emerging management strategies. Clin Infect Dis 2013; 57:719–724.

5 National Institute for Health and Clinical Excellence. Urinary tract infection in under 16s: diagnosis and management (2007 updated 2017) NICE guideline CG54

6 Ristola MT, Hurme T. NICE guidelines for imaging studies in children with UTI adequate only in boys under the age of 6months. Pediatr Surg Int 2013; 29:215–222.

7 Coulthard MG, Lambert HJ, Vernon SJ. Does prompt treatment of urinary tract infection in preschool children prevent renal scarring mixed retrospective and prospective audits. Arch Dis Child 2014; 99:342–347.

8 Spoorenberg V. Appropriate antibiotic use for patients with urinary tract infections reduces length of hospital stay. Clin Infect Dis 2014; 58:164.

9 American Academy of Pediatrics. Practice parameter: the diagnosis, treatment, and evaluation of the initial urinary tract infection in febrile infants and young children. American Academy of Pediatrics. Committee on quality improvement. Subcommittee on urinary tract infection. Pediatrics 1999; 103:843–852.

10 Bell LE, Mattoo TK. Update on childhood urinary tract infection and vesicoureteral reflux. Semin Nephrol 2009; 29:349–359.

11 National Institute for Health and Clinical Excellence : Fever in under 5s: assessment and initial management,Clinical guideline.Published: 22 May 2013.nice.org.uk/guidance/cg160© NICE.

12 Shaikh N, Morone NE, Lopez J. Does this child have a urinary tract infection?. JAMA 2007; 298:2895–2904.

13 Tse NK, Yuen SL, Chiu MC, Lai WM, Tong PC. Imaging studies for first urinary tract infection in infants less than 6 months old: can they be more selective?. Pediatr Nephrol 2009; 24:1699–17033.

14 Bush NC, Keays M, Adams C, Mizener K, Pritzker K, Smith W, *et al.* Renal damage detected by DMSA, despite normal renal ultrasound, in children with febrile UTI. J Pediatr Urol 2015; 11:e121–e127.

15 National Institute for Health and Clinical Excellence. Urinary tractinfection (lower): antimicrobial prescribing NICE guideline. 2018 October 31, 2018.

16 Braga LH, Mijovic H, Farrokhyar F. Antibiotic prophylaxis for urinary tract infections. Pediatrics 2013; 131:e251–e261.