

Association of pyuria and positive urine culture in children with urinary tract infection

Adrian Umboh, MD; Andy Sugoro, MD

ABSTRACT

Background Infections affecting the urinary tract are commonly found in children and responsible as the second cause of morbidity after respiratory tract infections.

Objective To determine the association between pyuria and positive urine culture in children with suspected urinary tract infection (UTI).

Methods We reviewed all patients who suffered from suspected UTI with pyuria, aged 1 month to 13 years at the Department of Child Health, Manado Central General Hospital from January 1999 until December 2001.

Results Of the 45 patients who suffered from suspected UTI with pyuria, 33 (73%) were proved to have UTI (12 males and 21 females). There was significant association between pyuria of more than 20 white cells per high power field visualized and the incidence of UTI ($p < 0.05$), but no association was found between sex and the incidence of UTI. In patients aged 1 year and older, the rate of UTI was higher in female than male, namely 61% of females and 30% of males had UTI. The main cause of UTI was *Escherichia coli* (67%). The most common symptoms were fever (94%), vomiting (76%), and upper abdominal pain (55%).

Conclusion There was a significant association between patients whom suspected UTI with pyuria and incidence of UTI [Paediatr Indones 2002;42:197-200].

Keywords: pyuria, urinary tract infection, urine culture

Urinary tract infection (UTI) is a condition where the microbes grow and breed in the urinary tract in significant number.¹ It is the most common serious bacterial illness among febrile infants and young children and can contribute to permanent renal damage.^{2,3} The importance of identifying children at risk from renal damage due to UTI in childhood has

been emphasized repeatedly.⁴ UTI is the second main cause of morbidity of infectious diseases in children after respiratory tract infection.^{5,6} The probability of having UTI also increases as body temperature increases, one might speculate that children with febrile seizures are at increased risk for this infection, especially in infants.⁷ Symptoms of UTI vary significantly with the patient's age and the location of the infection within the urinary tract. In infant, the commonest symptom is febrile with unknown cause.^{8,9} The normal urinary tract is sterile. Contamination by bowel flora may result in urinary infection if a virulent organism is involved, if the child is immunosuppressed, or both.¹⁰ In neonates, infection may originate from other sources, through blood flow and then comes to the urinary tract.^{10,11}

Rapid and accurate diagnosis of UTI in childhood is important, and pyuria is often considered critical in diagnosis in addition to the presence of large numbers of bacteria.¹² Clinically, important pyuria has been defined as more than 10 white cells per high power field visualized by light microscopy in a centrifuged urinary sediment.^{8,13} The objective of this study was to find out the association of pyuria and positive urine culture in patients who suffered from suspected UTI.

From the Department of Child Health, Medical School, University of Sam Ratulangi—Manado Hospital, North Sulawesi, Indonesia

Reprint requests to: Adrian Umboh, MD, Department of Child Health, Medical School, Sam Ratulangi University/Manado Hospital, Manado, Indonesia. Tel./Fax.: 62-431-859091

Methods

This retrospective study was conducted on children aged 1 month to 13 years old suspected to have UTI. The patients were treated at the Department of Child Health, Manado Hospital from January 1999 to December 2001. They did not have any renal dysfunction or other renal disorder.

We defined UTI as the existence of growth and breed of any microbes in the urinary tract in significant number, while significant bacteriuria refers to the condition when the urine culture shows more than 100,000 bacterial colonies per milliliter urine from a clean-catch urine specimen. Urine specimen was obtained by bladder catheterization or midstream urine. Quantitative urine culture was grown in the Microbiology Laboratory of Manado Central General Hospital. Inoculate plates used contained sheep blood agar and MacConkey agar. All plates were incubated at 37°C and were examined at 24-48 hours. Data analysis was performed by chi square test, *p* value of <0.5 was considered significant.

Results

The study comprised 45 patients with suspected UTI and pyuria (17 males and 28 females). Only 33 patients (73%) were proved to have UTI, comprising 12 males and 21 females (mean age 5.4 years, median 4.9 years). **Table 1** shows that girls outnumbered boys, but there was no significant association between sex and patient's age group.

TABLE 1. DISTRIBUTION OF UTI BASED ON SEX AND AGE

Sex	Age		Total
	1-12 months	1-13 years	
Male	2	10	12
Female	1	20	21
Total	3	30	33

$\chi^2 = 1.310$ $p=0.29$

Fever was the most common symptom found, namely in 31 (94%) patients, followed by vomiting and upper abdominal pain found in 25 (76%) patients and in 18 (55%) patients, respectively (**Table 2**).

TABLE 2. SYMPTOMS OF UTI (N=33)

Symptoms	Patient number
Febrile	31
Vomiting	25
Abdominal pain	22
-upper	18
-lower	4
Abdominal distention	13
Anorexia	11
Diarrhea	10
Dysuria	6
Increased frequency	5
Urgency	4
Irritability	3
Macroscopic hematuria	2
Costovertebral angle pain	1

Twenty-eight out of 33 proved UTI patients had pyuria with >20 white cells per high power field visualized by light microscope. There was a significant association between pyuria of more than 20 white cells per high power field visualized and the occurrence of UTI (**Table 3**). *Escherichia coli* was found to be the leading cause of UTI (22 out of 33 patients). See **Table 4**.

TABLE 3. CORRELATION BETWEEN PYURIA AND THE OCCURRENCE OF UTI

Urine white cells	Urinary tract infection		Total
	Yes	No	
£20 / HPF	5	7	12
>20 / HPF	28	5	33
Total	33	12	45

$\chi^2 = 6.328$ $p=0.01$. HPF = high power field

TABLE 4. BACTERIAL SPECIES RECOVERED FROM UTI (N=33)

Species	Total
<i>Escherichia coli</i>	22
<i>Staphylococcus</i>	4
<i>Proteus</i>	3
<i>Diplococcus</i>	1
<i>Pseudomonas</i>	1
Others	2

Discussion

In general, UTI affects females more often than males among children as well as adults. However, in the neonatal period and early infancy, UTI is seen more commonly in males (75-80%) than in females (20-25%).^{11,13,14} Although the precise reason for increased predilection of male infants to UTI in this age group is

unclear, it may be related to an increased susceptibility to sepsis and other bacterial infections that has been well described in males during early infancy.¹³ By the first year of life, symptomatic UTI affects females about three times more often than males.^{13,14} It is estimated that the risk of symptomatic UTI in children aged 2 to 14 years is 1.6/1000/year in males and 3.8/1000/year in females.¹³ Our study showed that females were more often than males in suffering from UTI, particularly in the age group of one year-old or older.

Symptoms of UTI vary significantly with the patient's age and location of the infection within the urinary tract. In the neonatal period, UTI may present with nonspecific symptoms, such as slow weight gain, temperature instability, feeding difficulties, irritability, vomiting, or abdominal distention. Sepsis is a common accompaniment in neonates.^{8,13} Symptoms of UTI in infant less than 1 year of age but beyond the neonatal period are also somewhat nonspecific, they may consist of febrile, irritability, sickly appearance, refusal of food, vomiting, and diarrhea.^{13,14} Preschool and school aged children with symptomatic UTI generally have symptoms localized to the urinary tract. Dysuria, urgency, and increased frequency are the common manifestations of cystitis or lower UTI.¹⁴ Symptoms as aforementioned may illustrate the location of infection. The localization of infection includes upper urinary tract infection and lower urinary tract infection. The upper urinary tract infection are among others ureteritis, pyelitis, and pyelonephritis with symptoms may be febrile or hypothermia, irritability, anorexia, vomiting, diarrhea, upper abdominal pain, weight-body loss, abdominal distention; whereas the lower urinary tract infection are among others ureteritis and cystitis with symptoms may be dysuria, increased frequency, and urgency.^{8,14} In children with fever of unknown cause, urine culture must be done to set aside the urinary tract infection.¹¹ In this study, the common symptoms found were fever, vomiting, upper abdominal pain, abdominal distention, anorexia and diarrhea. By looking to the symptoms mentioned above, it was clear that the localization of infection in this study was upper urinary tract infection in majority.

The first and one of the simplest tests to perform in a child with suspected UTI is urinalysis, including examination of the urinary sediment. Pyuria or excretion of an increased number of white blood cells is considered to be a presumptive evidence of

UTI.¹³ Pyuria is defined as the presence of more than 10 white cells per high power field visualized by light microscope in a centrifuged urinary sediment.^{8,13} Pyuria may consider as an indicator of UTI.¹⁵ It is suggested that 40% of patients with pyuria of more than 10 white cells per high power field visualized also contained significant bacteriuria.⁸ Centrifuged urine sediment that shows the existence of pyuria does not absolutely indicate UTI, but it can be used for suspecting diagnosis of UTI.¹⁴ Conversely, UTI does not absolutely show pyuria.⁸ In this study, we found significant association between pyuria of more than 20 white cells per high power field visualized and the occurrence of UTI.

Urinary tract infections are caused mainly by colonic bacteria;¹¹ as much as 60–90% of patients with UTI are caused by *E. coli*.^{8,10,11,16} Our study showed that *E. coli* was also the leading cause of UTI.

In conclusion, UTI in females were more often than males, particularly in children aged ≥ 1 year old. The elevation of white cells in urine, particularly of more than 20 cells per high power field, is associated with the incidence of UTI. *Escherichia coli* was found as the main etiology of UTI.

References

1. Umboh A. Infeksi saluran kemih. In: Mantik MFJ, Runtunuwu A, Wantania JM, editors. Buku pedoman diagnosis dan terapi. 2nd ed. Manado: Bagian Ilmu Kesehatan Anak/SMF Anak FK Unsrat/RSUP Manado; 2001. p.154–6.
2. Hoberman A, Wald ER. Urinary tract infection in young febrile children. *Pediatr Infect Dis J* 1997;16:11–7.
3. Honkinen O, Jahnukainen T, Mertsola J, Eskola J, Ruuskanen O. Bacteremic urinary tract infection in children. *Pediatr Infect Dis J* 2000;19:630–4.
4. Pead L, Maskell R. Study of urinary tract infection in children in one health district. *Br Med J* 1994;309:631–4.
5. Kraus SJ. Genitourinary imaging in children. In: Sheldon CA, Churchill BM, editors. *The Pediatric Clinic of North America. Pediatric urology*. Philadelphia: WB Saunders Company; 2001. p. 1381–424.
6. Tambunan T. Infeksi saluran kemih kronik. Presented at the 10th National Congress of Pediatric; 1996 June 16-20; Bukittinggi, Indonesia.

7. Teach SJ, Geil PA. Incidence of bacteremia, urinary tract infections, and unsuspected bacterial meningitis in children with febrile seizures. *Pediatr Emerg Care* 1999;15:9-12.
8. Umboh A. Infeksi saluran kemih pada anak. Manado: Laboratorium Ilmu Kesehatan Anak Fakultas Kedokteran Unsrat Manado; 1994.
9. Karyomanggolo WT, Tambunan T. Infeksi saluran kemih. In: Parmuljo HS, Nurhamzah W, Zacharia J, editors. Pencitraan traktus urinarius pada anak. Proceedings of the 26th Pediatric Continuing Medical Education, Medical School, University of Indonesia; 1992 September 11-12; Jakarta, Indonesia. Jakarta: Balai Penerbit FKUI; 1992.
10. Larcombe J. Urinary tract infection in children. *Br Med J* 1999;319:1173-5.
11. Elder JS. Urinary tract infections. In: Behrman RE, Kliegman RM, Jenson HB, editors. *Nelson textbook of pediatrics*. 16th ed. Philadelphia: WB Saunders Company; 2000. p. 1621-5.
12. Turner GM, Coulthard MG. Fever can cause pyuria in children. *BMJ* [serial online] 1995;311:924 [cited 2002 May 2]. Available from: URL: <http://bmj.com>
13. Kher KK, Leichter HE. Urinary tract infection, In: Kher KK, Makker SP, editors. *Clinical pediatric nephrology*. New York: Mc Graw - Hill; 1992. p. 277-321.
14. Rusdidjas, Ramayati R. Infeksi saluran kemih. In: Alatas H, Tambunan T, Trihono PP, editors. *Nefrologi anak jilid 1*. Jakarta: Balai Penerbit FKUI; 1993. p.109-31.
15. Hoberman A, Wald ER, Reynolds EA, Panchansky L, Charron M. Pyuria and bacteriuria in urine specimens obtained by catheter from young children with fever. *J Pediatr* 1994;124:513-9.
16. Tambunan T. Infeksi saluran kemih. Presented at Pertemuan Ilmiah Tahunan IDAI; 2001 June 25-27; Palembang, Indonesia.