Jurnal Ilmiah Mahasiswa Kedokteran Universitas Airlangga

JUXTA: Jurnal Ilmiah Mahasiswa Kedokteran Universitas Airlangga
2023 January, XIV (01)

ORIGINAL ARTICLE

Clinical Profile of Children with Pyelonephritis and Cystitis in Dr. Soetomo General Academic Hospital, Surabaya

Lutifta Hilwana [1], Ninik Asmaningsih Soemyarso [2*], Atika Atika [3]

[1]Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.
[2]Department of Pediatrics, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.
[3]Department of Public Health and Preventive Medicine, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.

A B S T R A C T

Introduction: Urinary tract infection (UTI) is a common infection in children. Prompt diagnosis and treatment of this infection are important to prevent further damage to the kidney. This study aimed to examine the clinical profile of children with pyelonephritis and cystitis in Dr. Soetomo General Academic Hospital, Surabaya.

Methods: This was a descriptive study conducted in Dr. Soetomo General Academic Hospital, Surabaya, from June 2013 until December 2015, using secondary data and presented by percentage. Samples included in this study were children aged two months to five years old with UTI as a primary or secondary diagnosis of diarrhea and had urine culture results ≥ 10^5 CFU/ml.

Results: There were 30 patients with pyelonephritis and 27 patients with cystitis. The prevalence of pyelonephritis was 0.285% and of cystitis was 0.247%. In pyelonephritis patients younger than one-year-old, boys and girls were equal. However, boys (60%) were more frequent in cystitis patients. In both pyelonephritis and cystitis patients aged 1-5, girls were more frequent (56.3%; 64.7%). In pyelonephritis patients, all patients were found with fever, followed by diarrhea (60%) and lethargy (56.7%) as the two most common symptoms. The two most common symptoms in cystitis patients were lethargy (44.4%) and irritability (33.3%). Urinary symptoms, such as dysuria and hematuria, were more frequent in cystitis (11.1%; 7.4%) patients than in pyelonephritis patients.

Conclusion: Boys were more frequent to suffer urinary tract infections. Systemic symptoms were frequently found in pyelonephritis patients, while urinary symptoms were more frequent in cystitis patients.

A R T I C L E I N F O

Article history:

Received 25-10-2022

Received in revised form 17-11-2022

Accepted 29-11-2022

Available online 10-01-2023

Keywords:
Children,
Cystitis,
Human & disease,
Profile,
Pyelonephritis.

Cite this as:
Hilwana L, Soemyarso NA, Atika A. Clinical Profile of Children with Pyelonephritis and Cystitis in Dr. Soetomo General Academic Hospital, Surabaya. *JUXTA J Ilm Mhs Kedokt Univ Airlangga* 2023; 14: 1–5.

* Correspondence: ninik.soemiarso@fk.unair.ac.id

JUXTA: Jurnal Ilmiah Mahasiswa Kedokteran Universitas Airlangga
p-ISSN: 1907-3623; e-ISSN: 2684-9453
DOI: 10.20473/juxta.V14I12023.1-5

Introduction

Urinary tract infection (UTI) is due to significant bacteria/pathogens in the urinary tract structure.[1–3] UTI is a common infection in children.[1,4] This infection can attack the urinary tract, starting from the urethra, the bladder, until the renal parenchyma. All ages, including infants and children, can suffer from UTI. Mostly, UTI in children is caused by *E. coli*. UTI is a common disease in children after upper respiratory tract infection and gastrointestinal infection.[5]

About 20% of all consultation with pediatricians is about UTI and chronic pyelonephritis.[5] UTI is more frequent in girls than in boys.[6–8] The UTI data in Surabaya is still being determined. Common UTIs suffered by infants and children are infections of the bladder (cystitis) and renal (pyelonephritis).[9]

Clinical symptoms of UTI in children are non-specific. Symptoms shown by the patient are based on age, location of the infection, and intensity of inflammation.[7] Variety of clinical symptoms makes UTI sometimes left undiagnosed.[7] Moreover, pyelonephritis cannot be diagnosed correctly because dimercaptosuccinic acid (DMSA) scan as a definite examination of pyelonephritis is not available in all cities. Underdiagnosed and over-diagnosed UTIs can occur.[5] Based on that condition, it is necessary to understand the clinical symptoms of pyelonephritis and cystitis.

Underdiagnosed and overdiagnosed pyelonephritis and cystitis can have a long-term impact on the patient's renal function due to late treatment. The long-term impacts are impairment of renal function, end-stage renal disease, renal scarring, and increased risk of progressive renal disease at a later age. Furthermore, UTI in children can be fatal, and it can cause death.[1,10]

Due to the importance of clinical symptoms in children to diagnose pyelonephritis and cystitis, this study aimed to examine the clinical profile of pyelonephritis and cystitis in two months to five years old children from June 2013 until December 2015. By understanding the symptoms better, the correct diagnosis can be made, and later give the correct treatment in time.

Methods

This was a descriptive study conducted in Dr. Soetomo General Academic Hospital, Surabaya, from June 2013 until December 2015 using secondary data (medical records) and presented by percentage. Samples were taken using total sampling. The samples were children aged two months to five years old with UTI as the primary or secondary diagnosis, and had urine culture results ≥ 10^5 CFU/ml. Variables of this study were clinical symptoms and urinary culture results. This study had received ethical clearance from Ethical Committee for Health Research Dr. Soetomo General Academic Hospital, Surabaya.

Results

From June 2013 until December 2015, there were 57 samples. 30 were pyelonephritis, and 27 were cystitis. There were 10,517 children aged 0 months to 4 years old recorded in Dr. Soetomo General Academic Hospital, Surabaya, from June 2013 until December 2015. The prevalence counting samples were adjusted until four years old. Children older than 48 months old were excluded. As a result, there were 30 cases of pyelonephritis and 26 cases of cystitis. The prevalence of pyelonephritis was 0.285% (30/10,517), and cystitis was 0.247% (26/10,517).

The number of boys and girls in pyelonephritis patients younger than one year old was equal. However, in cystitis patients, boys were more frequent (Table 1). In Table 1, it can be seen that girls older than one year old were more frequent in pyelonephritis and cystitis. All cases of pyelonephritis were fever with a mean temperature of 38.62˚C (SD ± 0.56). Most cases of cystitis (15 out of 27) had no fever.

Table 2 shows the two most frequent symptoms experienced by pyelonephritis patients after fever, which were diarrhea (60%) and lethargy (56.7%). The same table shows that in cystitis patients, the two most frequent symptoms were lethargy (44.4%) and irritability (33.3%). Urinary symptoms such as dysuria and hematuria were more frequent in cystitis patients (11.1%; 22.2%) than in pyelonephritis patients (3.3%; 0%). 14 boys were diagnosed with pyelonephritis, and 12 boys were diagnosed with cystitis. Five out of 14 boys with pyelonephritis had phimosis, and one out of 14 had a micropenis. Meanwhile, in cystitis patients, 25% (3 out of 12) had phimosis.

Table 3 shows that most cases of pyelonephritis were caused by *E. coli* (40%) and then by *E. coli* ESBL (+) (20%). Along with pyelonephritis, in cystitis patients, *E. coli* (40,7%) was mostly found in urine culture, followed by *Klebsiella pneumonia* ESBL (+) (18,5%).

Table 1. Sex distribution of pyelonephritis and cystitis patients based on age

	Age	Boys n (%)	Girls n (%)	Total n (%)
Pyelonephritis	2-12 months old	7 (50)	7 (50)	14 (100)
	13 months-5 years old	7 (43.8)	9 (56.2)	16 (100)
Cystitis	2-12 months old	6 (60)	4 (40)	10 (100)
	13months-5 years old	6 (35.3)	11 (64.7)	17 (100)

Source: Research data, processed

Table 2. Clinical symptoms of pyelonephritis and cystitis (n pyelonephritis = 30; n cystitis = 27)

Symptoms	Pyelonephritis n (%)	Symptoms	Cystitis n (%)
Diarrhea	18 (60)	Lethargy	12 (44.4)
Lethargy	17 (56.7)	Irritability	9 (33.3)
Irritability	15 (50)	Decreased appetite	7 (25.9)
Vomit	11 (36.7)	Vomit	6 (22.2)
Decreased appetite	10 (33.3)	Diarrhea	6 (22.2)
Distended abdomen	4 (13.3)	Distended abdomen	4 (14.8)
Frequency	1 (3.3)	Dysuria	3 (11.1)
Dysuria	1 (3.3)	Hematuria	2 (7.4)
Urgency	0 (0)	Frequency	1 (3.7)
Incontinence	0 (0)	Urgency	0 (0)
Hematuria	0 (0)	Incontinence	0 (0)
Flank pain	0 (0)	Flank pain	0 (0)
Nutrition:		Nutrition:	
• Severely underweight	6 (20)	• Severely underweight	3 (11.1)
• Underweight		• Underweight	
• Normal	5 (16.7)	• Normal	4 (14.8)
• Overweight/Obese	18 (60)	• Overweight/Obese	19 (70.4)
	1 (3.3)		1 (3.7)

Source: Research data, processed

Table 3. The distribution of bacteria in pyelonephritis and cystitis patients based on urine culture (n pyelonephritis = 30; n cystitis = 27)

Bacteria	Pyelonephritis n (%)	Bacteria	Cystitis n (%)
E. coli	12 (40)	*E. coli*	11 (40.7)
E. coli ESBL	6 (20)	*Klebsiella pneumonia ESBL*	5 (18.5)
Klebsiella pneumonia ESBL	4 (13.3)	*E. coli ESBL*	2 (7.4)
Enterobacter cloaceae	3 (10)	*Morgagnella morgagnii*	2 (7.4)
Enteroccous faecalis	1 (3.3)	*Enteroccous faecalis*	1 (3.7)
Streptococcus haemolyticus	1 (3.3)	*Streptococcus haemolyticus*	1 (3.7)
Cryptococcus laurentil	1 (3.3)	*Pseudomonas aeroginosa*	1 (3.7)
Klebsiella oxytoca	1 (3.3)	*Proteus mirabilis*	1 (3.7)
Cedecea lapagei	1 (3.3)	*Enterococcus caseliflaun*	1 (3.7)
Pseudomonas aeroginosa	1 (3.3)	*Enterobacter hominis*	1 (3.7)
Enterobacter aerogenes	1 (3.3)	*Acinetobacter spp.*	1 (3.7)
Cedecea davisae	1 (3.3)	*Cryptococcus laurentil*	0 (0)
Proteus mirabilis	0 (0)	*Klebsiella oxytoca*	0 (0)
Enterococcus caseliflaun	0 (0)	*Enterobacter cloaceae*	0 (0)
Morgagnella morgagnii	0 (0)	*Cedecea lapagei*	0 (0)
Enterobacter hominis	0 (0)	*Enterobacter aerogenes*	0 (0)
Acinetobacter spp.	0 (0)	*Cedecea davisae*	0 (0)

Source: Research data, processed

Discussion

In Indonesia, the incidence of new pediatric UTI cases is 0.1% - 0.9%, obtained from a study conducted in 7 teaching hospitals from 1984 through 1989.[5] The specific prevalence of pyelonephritis and cystitis is unknown. In this study, the prevalence of pyelonephritis in children two months to four years old from June 2013 until December 2015 in Dr. Soetomo General Academic Hospital, Surabaya, was 0.285%, and of cystitis was 0.25% of the total pediatric patients admitted to the same period.

UTIs can attack all ages and gender. In pyelonephritis patients younger than one-year-old, the number of boys and girls was equal, but in cystitis patients, boys were more frequent. In both pyelonephritis and cystitis patients older than one year old, girls were more frequent. These results are in accordance with a study by Ramlakhan (2014), UTIs in children younger than one year old are frequently suffered by boys, and in children older than one year old are frequently suffered by girls.[11] It is assumed that in children younger than one year old, in particular, in six months old children, pathogen bacteria are colonized in the prepuce that is still attached to the glands. Nevertheless, after six months old, the prepuce is easily retracted. Therefore, colonization decreases. In addition, because there is higher colonization under the foreskin, therefore, uncircumcised boys have a higher risk of UTI rather than circumcised boys.[12] UTIs are more frequent in girls older than one year old because it is predicted that the shorter urinary tract makes the distance of bacteria to colonize the bladder shorter.[13]

All patients with pyelonephritis in this study had a fever with a mean temperature of 38.62˚C (SD ± 0.56). American Academy of Pediatrics stated that the minimum temperature of fever which defines pyelonephritis is 38˚C,[14] sometimes the temperature reaches 39˚C.[15] Cystitis patients had no fever. Another study said that cystitis tends to show urinary symptoms rather than systemic symptoms such as fever.[1] In this study, other symptoms found in pyelonephritis patients were diarrhea and lethargy. Meanwhile, in cystitis patients, lethargy and irritability were the two most frequent symptoms. These results are supported by other studies that stated the symptoms of pyelonephritis and cystitis could be overlapped; both have non-specific symptoms, including frequency, a decrease of appetite, urgency, irritability, dysuria, lethargy, hematuria, vomiting, incomplete emptying bladder, diarrhea, incontinence, and distended abdomen.[16]

Compared to pyelonephritis patients, urinary symptoms such as hematuria and dysuria were more frequent in cystitis patients. Urinary symptoms happen because of inflammation in the bladder or urethra, part of the lower urinary tract.[17] Flank pain is the systemic symptom frequently shown in pyelonephritis patients based on other studies,[1] however, in this study, flank pain was not found. The possibility of no flank pain in young children is because children, especially in the preverbal stage, cannot express the pain or any symptoms they experienced.[1,18] Phimosis was found in this study. Phimosis is one of the risk factors for pyelonephritis and cystitis.[19] Bacteria from the colon can colonize the prepuce, surface of the gland, and distal urethra uroepithelial.[9] In this study, one patient with pyelonephritis had a micropenis. There is no evidence that micropenis is a predisposing factor or risk factor for UTI.[19,20] Thus, micropenis in this study was considered a co-incidence.

The most common bacteria found from urine culture in both pyelonephritis and cystitis patients was *E. coli*. It is similar to other studies stating that the most frequent bacteria in pyelonephritis is *E. coli*.[21,22] UTI is an ascending infection that needs two factors, bacteria colonization in the urinary tract and then up to the renal.[21] It also involves bacteria adhesion, virulence factor, and bacteria motility related to host anatomy, humoral defence, and genetic factors.

Strength and Limitations

The strength of this study was the list of symptoms of both pyelonephritis and cystitis patients which was showed in details that can help doctors making prompt diagnosis of it. The limitation of this study was that some medical records had incomplete data. Therefore, further studies are needed to learn more about the clinical symptoms of pyelonephritis and cystitis in children.

Conclusion

Most symptoms shown in pyelonephritis patients were fever followed by diarrhea, and in cystitis patients was lethargy. Urinary symptoms were more common in cystitis patients than in pyelonephritis patients.

Acknowledgments

Special thanks to the mentors who gave guidance during the research process. Thanks to the medical records staff at Dr. Soetomo General Academic Hospital, Surabaya.

Conflict of Interest

The authors declared there is no conflict of interest.

Funding

This study did not receive any funding.

Ethical Clearance

This study had received ethical clearance from Ethical Committee for Health Research Dr. Soetomo General Academic Hospital, Surabaya (no. 580/Panke.KKE/XI/2015) on 24 November 2015.

References

1. Becknell B, Schober M, Korbel L, *et al*. The Diagnosis, Evaluation and Treatment of Acute and Recurrent Pediatric Urinary Tract Infections. *Expert Rev Anti Infect Ther* 2015; 13: 81–90. [PubMed]
2. Wuwuti I, Kuntaman, Wasito E. Risk Factors of Urinary Tract Infection Caused by Extended-Spectrum-β-Lactamase-Producing Escherichia coli in Inpatients at a Tertiary Hospital in Surabaya, Indonesia. *Folia Medica Indonesiana* 2022; 58: 208–214. [Google Scholar]
3. Felicia A, Debora K, Ramadhani R. In Vitro Antimicrobial Activity Evaluation of Ginger (Zingiber officinale) Absolute Ethanol Extract against Uropathogenic Escherichia coli (UPEC). *JUXTA Jurnal Ilmiah Mahasiswa Kedokteran Universitas Airlangga* 2022; 13: 51–56. [Google Scholar]
4. Karmazyn BK, Alazraki AL, Anupindi SA, *et al*. ACR Appropriateness Criteria ® Urinary Tract Infection—Child. *J Am Coll Radiol* 2017; 14: S362–S371. [PubMed]
5. Pardede SO, Tambunan T, Alatas H, *et al*. *Konsensus Infeksi Saluran Kemih pada Anak*. Jakarta: Ikatan Dokter Anak Indonesia, http://pustaka.unpad.ac.id/wp-content/uploads/2013/12/Pustaka_Unpad_Konsensus_-Infeksi_-Saluran.pdf.pdf (2011).
6. Shaikh N, Morone NE, Bost JE, *et al*. Prevalence of Urinary Tract Infection in Childhood. *Pediatr Infect Dis J* 2008; 27: 302–308. [PubMed]
7. Subandiyah K. Pola dan Sensitivitas terhadap Antibiotik Bakteri Penyebab Infeksi Saluran Kemih Anak di RSU Dr Saiful Anwar, Malang. *J Kedokt Brawijaya* 2004; 20: 57–61. [Journal]
8. Tusino A, Widyaningsih N. Karakteristik Infeksi Saluran Kemih pada Anak Usia 0-12 Tahun di RS X Kebumen Jawa Tengah. *Biomedika*; 9. Epub ahead of print 8 March 2018. [Journal]
9. Giorgi A. Urinary Tract Infection in Children. *Healthline*, https://www.healthline.com/health/urinary-tract-infection-children#Overview1 (2018).
10. Leung AKC, Wong AHC, Leung AAM, *et al*. Urinary Tract Infection in Children. *Recent Pat Inflamm Allergy Drug Discov* 2019; 13: 2–18. [PubMed]
11. Ramlakhan S, Singh V, Stone J, *et al*. Clinical Options for the Treatment of Urinary Tract Infections in

Children. *Clin Med Insights Pediatr* 2014; 8: CMPed.S8100. [PubMed]
12. Dubrovsky AS, Foster BJ, Jednak R, *et al*. Visibility of the Urethral Meatus and Risk of Urinary Tract Infections in Uncircumcised Boys. *Can Med Assoc J* 2012; 184: E796–E803. [PubMed]
13. Mayo Foundation for Medical Education and Research. Urinary Tract Infection (UTI). *Mayo Clinic*, https:// www.mayoclinic.org/ diseases-conditions/ urinary-tract-infection/ symptoms-causes/syc-20353447 (2022). [WebPage]
14. Shapiro E. American Academy of Pediatrics Policy Statements on Circumcision and Urinary Tract Infection. *Rev Urol* 1999; 1: 154–6. [NCBI]
15. Hinfey PB. Pediatric Pyelonephritis. *Medscape*, https://emedicine.medscape.com/article/968028-overview (2022).
16. American Urological Assosiciation. Medical Student Curriculum: Pediatric Urinary Tract Infections. *AUA Website*, https://www.auanet.org/meetings-and-education/for-medical-students/medical-students-curriculum/pediatric-uti (2020).
17. Wagenlehner F, Naber K. Urinary Tract Infections In Children. *Antimicrobe*, http://www.antimicrobe.org/e4b.asp (2014).
18. Espinosa C, Bryant K, Pharm KB. Therapeutics of Pediatric Urinary Tract Infections. *iMedPub Journals* 2015; 7: 4. [WebPage]
19. Soemyarso N, Saharso D, Arief S. *Infeksi Saluran Kemih. Modul Pembelajaran Ilmu Kesehatan Anak*. Surabaya: Airlangga University Press, 2014.
20. Shaikh N, Hoberman A. Patient Education: Urinary Tract Infections in Children (Beyond the Basics). *UpToDate*, https://www.uptodate.com/contents/urinary-tract-infections-in-children-beyond-the-basics (2016).
21. Chishti AS, Maul EC, Nazario RJ, *et al*. A Guideline for the Inpatient Care of Children with Pyelonephritis. *Ann Saudi Med* 2010; 30: 341–349. [PubMed]
22. Morello W, La Scola C, Alberici I, *et al*. Acute Pyelonephritis in Children. *Pediatr Nephrol* 2016; 31: 1253–1265. [PubMed]