Bacterial and Antibiotic Susceptibility Patterns in Patient with Pediatric Urinary Tract Infection at Dr. Hasan Sadikin General Hospital

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Abstract

Background: Pediatric urinary tract infection (UTI) should become attention due to high prevalence, severe complication, and high cost treatment. Bacterial pattern and its susceptibility are different in every region.The objective of this study was to discover pattern of bacteria causing UTI and their susceptibility to antibiotics.

Methods: This study was an observational descriptive study. The data was obtained from medical records and susceptibility testing results of pediatric UTI in Department of Child Health at Dr. Hasan Sadikin General Hospital in period of 2014. Data taken was presented in table.

Results: There were 26 cultures which had microbiological findings among 79 cultures taken from 106 patients with UTI. The majority of findings were *Escherichia coli* (10 cases), *Pseudomonas aeruginosa* (4 cases), and *Klebsiella pneumoniae* (4 cases). Antibiotic classes with high susceptibility level were aminoglycoside, sulfonamide, and fluoroquinolone. Resistance level were higher in cephalosporin class than others.

Conclusions: Most common bacterial found are *Escherichia coli, Pseudomonas aeruginosa*, and *Klebsiellapneumoniae*. The result of susceptibility testing for cultures shows variance of susceptibility pattern to antibiotics in pediatric patients with UTI at Department of Child Health Dr. HasanSadikin General Hospital. **[AMJ.2017;4(1):52–7]**

Keywords: Antibiotic susceptibility, bacteria, pediatric urinary tract infection

Introduction

Attention should be focused on pediatric urinary tract infection (UTI) due to high prevalence, severe complication, and high cost treatment. Urinary tract infection is one of the most bacterial infection in children. Urinary tract infection prevalence is higher in boys than in girls, 2.7% and 0.7%, respectively.[1] Besides of high prevalence, UTI causes several complications, such as renal scars, hypertension, and end-stage renal disease.[2] Expense on UTI treatment creates another burden. UTI treatment costs are more than total ≥180$ million per year in United States.[3]

Urinary tract infection in pediatric patients should be treated with antibiotics as soon as possible. Most cases need antibiotic therapy before the culture and susceptibility testing are done. Antibiotic therapy is started with empirical therapy, then matched with susceptibility testing result. The selection of antibiotics depends on the most frequent pathogen causing UTI in previous cases.[4] Since the bacteria and antibiotic susceptibility patterns are different in each region, knowledge of these pattern in each region is essential to provide clinically appropriate therapy.[5] Incorrect antibiotic empirical therapy, such as overuse, misuse, or underuse, may increase bacterial resistance to antibiotic.[6,7]

The objective of this study was to investigate bacterial pattern and antibiotics susceptibility in pediatric patients with UTI.

Methods

The descriptive observational design was used in this study. This study was performed at Department of Child Health at Dr. Hasan

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Sadikin General Hospital Bandung from September to November 2015. The population in this study was all taken from medical records and laboratory exam results of pediatric patients which diagnosed as UTI and admitted to hospital in 2014. This study was approved by the ethical standard approval from Faculty of Medicine of Universitas Padjadjaran and Health Research Ethics Committee Dr. Hasan Sadikin General Hospital Bandung, no. LB.04.01/A05/EC/307/VII/2015.

The inclusion criterion of this study was all the medical records and laboratory exam results of pediatric patients who were admitted to Dr. Hasan Sadikin Hospital Bandung and diagnosed as UTI, either as primary diagnosis or additional diagnosis. The exclusion criteria were UTI pediatric patients without complete or available antimicrobial susceptibility test results. Samples were collected through total sampling. Urine samples were collected from midstream urine or catheter. This study required access to obtain database of Clinical Pathology Laboratory of Dr. Hasan Sadikin General Hospital to observe microbiological cultures and antibiotics susceptibility testing results. Susceptibility testing results were interpreted with Clinical & Laboratory Standard Institute.

Results

There were 106 pediatric patients with UTI in Dr. Hasan Sadikin General Hospital in period of 2014. There were 79 urine cultures to be examined taken from patients with diagnosis of UTI. There were 26 urine cultures from which were found microorganisms tested for its susceptibility to antibiotics later on. The results showed that three most frequent bacteria causing UTI in pediatric patient were *Escherichia coli, Klebsiellapneumoniae*, and *Pseudomonasaeruginosa* (Table 1).

Urine cultures with positive bacterial colonization were tested for their susceptibility to antibiotics and classified according to criteria from CLSI. Susceptibility testing results showed variance of susceptibility level (Table 2). Aminoglycoside and fluoroquinolone had high susceptibility to bacteria causing UTI, while the findings of cephalosporin showed high level of resistance to bacteria causing UTI (Table 2).

The data which became the most common pathogen (*Escherichia coli, Klebsiellapneumoniae*, and *Pseudomonas aeruginosa*) were presented in detail result (Table 3).

Table 1 Bacterial Pattern from Urine Cultures of Pediatric Patients with Diagnosis of UTI

Bacteria	Number of Findings (n=26)
Acinetobacterbaumanii	1
Acinetobacteriwoffii	1
Escherichia coli	10
Klebsiellapneumoniae	4
Pseudomonas aeruginosa	4
Enterococcus faecalis	3
Micrococcus spp.	1
Staphylococcus haemolyticus	2

Escherichia coli fndings was known to be susceptible more than 50% to Amikacin, PiperacillinTazobactam, Ertapenem, Meropenem, Levofloxacin, Cotrimoxazole, and Tigecycli, while the cephalosporin class have low susceptibility, such as Cefadroxil, Cefmetazon, Cefotaxime, Cefazolin, Ceftriaxone, and Cefepime.

Klebsiellapneumoniae was fully resistant to cephalosporinclassantibiotic,suchasCefazolin, Cefmetazon, Ceftazidime, Ceftriaxone, andCefepime. While *Klebsiellapneumoniae* was susceptible to Amikacin, Meropenem, Ciprofloxacin, Levofloxacin, Cotrimoxazole, and Tigecyclin. *Pseudomonas aeruginosa* were susceptible to Amikacin, Piperacillin-Tazobactam, Ciprofloxacin, and Levofloxacin. While *Pseudomonas aeruginosa* was fully resistant to Ampicillin Sulbactam, Cefazolin, Ceftriaxone, Cotrimoxazole, and Tigecyclin.

Discussion

This study discovers the most common bacteria causing UTI in pediatric patient at Department of Child Health was *Escherichia coli*, followed by *Klebsiellapneumoniae* and *Pseudomonas aeruginosa*. This result was similar to the recent study by Edlin et al.[8] and Garout et al.[9] which showed that the most common uropathogen was *Escherichia coli*. These findings were different from the study conducted by Rezaeet al.[5] and Waadallah et al.[10] which showed that *Klebsiellapneumoniae* and *Enterococcus spp* were the second and third most common uropathogen, respectively. It might be due to *Pseudomonas*

Table 2 Susceptibility Patterns of Bacteria to Antibiotics from Urine Culture of Patients with Diagnosis of UTI

	Acineto-bacter Baumanii (n=1)	Acineto-Bacter Iwoffii (n=1)	Eschericia Coli (n=10)	Klebsiella Pneumoniae (n=4)	Pseudo-Monas aeruginos (n=4)	Entero-Coccus faecalis (n=3)	Strepto-Coccus haemolyticus (n=2)	Micro-Coccus (n=1)
				Total Susceptible (Persentase)				
Aminoglycoside								
Amikacin	1 (100)	1 (100)	7 (70)	2 (50)	4 (100)			
Gentamycin	1 (100)	0 (0)	5 (50)	0 (0)	2 (50)	2 (100)	1 (50)	0 (0)
Netilmycin		1 (100)	0 (0)					0 (0)
β-lactam/ with adjuvant								
Ampicillin Sulbactam	0 (0)	1 (100)	3 (33,3)	0 (0)	0 (0)	3(100)		
PiperacillinTazobactam	1 (100)	1 (100)	6 (60)	0 (0)	2 (5)			
Amoxycillin-Clav		0 (0)	0 (0)			3(100)		
Carbapenems								
Ertapenem			1 (100)	0 (0)				
Imipenem						2 (100)	0 (0)	
Meropenem	1 (100)	1 (100)	7 (77,7)	3 (75)	2 (50)		0 (0)	
Cephalosporins								
Cephadroxil		0 (0)	0 (0)				0 (0)	0 (0)
Cefoxitin							0 (0)	
Cefazolin	0 (0)	0 (0)	3 (30)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Cefmetazon	0 (0)		0 (0)	0 (0)				
Cefuroxime							0 (0)	0 (0)
Ceftazidime	1 (100)	0 (0)	4 (40)	0 (0)	1 (25)	0 (0)	0 (0)	0 (0)
Cefixime							0 (0)	0 (0)
Cefotaxime		0 (0)	0 (0)				0 (0)	0 (0)
Cefoperazone							0 (0)	0 (0)
Ceftriaxone	0 (0)		4 (40)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Cefepime	1 (100)	1 (100)	4 (40)	0 (0)	1 (25)		0 (0)	0 (0)
Fluoroquinolones								
Ciprofloxacin	1 (100)	0 (0)	5 (55,5)	1 (25)	3 (75)		1 (50)	0 (0)
Levofloxacin	1 (100)		5 (83,3)	1 (50)	3 (75)	3 (100)	1 (50)	0 (0)
Moxifloxacin						2 (100)		
Macrolides								
Erythromycin						1(33,3)	0 (0)	0 (0)
Monobactams								
Aztreonam	1 (100)		4 (44,4)	0 (0)	2 (67)			
Penicillins								
Ampicillin	0 (0)		0 (0)	0 (0)				
Sulfonamide								
Cotrimoxazole	1 (100)	0 (0)	6 (60)	2 (50)	0 (0)		1 (50)	1(100)
Tetracycline								
Tigecyclin	1 (100)		9 (100)	3 (75)	0 (0)	3 (100)	2(100)	
Chloramphenicol		0 (0)	0 (0)					1(100)
Linezolid						3 (100)	1 (100)	
Vancomycin						3 (100)	2 (100)	

Table 3 Result of Antibiotic Susceptibility Testing in 3 Most Common Bacteria Causing UTI in Pediatric Patient

	Escherichia coli (n=10)			Total Susceptible (%)	Klebsiella pneumoniae (n=4)			Total Susceptible (%)	Pseudomonas aeruginosa (n=8)			Total Susceptible (%)
	R	I	S		R	I	S		R	I	S	
Aminoglycoside												
Amikacin	2	1	7	7 (70)	2	0	2	2 (50)	0	1	4	4 (100)
Gentamycin	5	0	5	5 (50)	4	0	0	0 (0)	1	1	2	2 (50)
Netilmicin	1	0	0	0 (0)								
β-lactam/ with adjuvant												
Ampicillin Sulbactam	5	1	3	3 (33,3)	4	0	0	0 (0)	1	0	0	0 (0)
PiperacillinTazobactam	4	0	6	6 (60)	2	2	0	0 (0)	2	0	2	2 (50)
Amoxycillin-Clav	1	0	0	0 (0)								
Carbapenem												
Meropenem	2	0	7	7 (77,7)	1	0	3	3 (75)	1	1	2	2 (50)
Ertapenem	0	0	1	1 (100)	1	0	0	0 (0)				
Cephalosporins												
Cefadroxil	1	0	0	0 (0)								
Cefazolin	6	1	3	3 (30)	4	0	0	0 (0)	4	0	0	0 (0)
Cefmetazon	0	1	0	0 (0)	1	0	0	0 (0)				
Ceftazidime	6	0	4	4 (40)	4	0	0	0 (0)	3	0	1	1 (25)
Cefotaxime	1	0	0	0 (0)								
Ceftriaxone	6	0	4	4 (40)	4	0	0	0 (0)	4	0	0	0 (0)
Cefepime	6	0	4	4 (40)	4	0	0	0 (0)	3	0	1	1 (25)
Fluoroquinolones												
Ciprofloxacin	4	0	5	5 (55,5)	1	2	1	1 (25)	1	0	3	3 (75)
Levofloxacin	1	0	5	5 (83,3)	1	0	1	1 (50)	1	0	3	3 (75)
Monobactams												
Aztreonam	5	0	4	4 (44,4)	4	0	0	0 (0)	1	0	2	2 (67)
Penicillins												
Ampicillin	1	0	0	0 (0)	1	0	0	0 (0)				
Sulfonamide												
Cotrimoxazole	4	0	6	6 (60)	2	0	2	2 (50)	4	0	0	0 (0)
Tetracycline												
Tigecyclin	0	0	9	9 (100)	0	1	3	3 (75)	4	0	0	0 (0)
Chloramphenicol	1	0	0	0 (0)								

Note: R: Resistant; I: Intermediate; S: Susceptible

aeruginosa which had been colonizing at the hospital which causing nosocomial infection or previous antibiotic therapy in pediatric patients.[11]

Escherichia coliis is susceptible to Amikacin (70%), PiperacillinTazobactam (60%), Levofloxacin (83.3%), and Cotrimoxazole (60%). *E. coli* is susceptibility to Amikacinin. This study is similar to the rates observed by Reeza et al.[5] (70.3%) Comparable figures of *Escherichia coli* susceptibility to PiperacillinTazobactam, Levofloxacin, Cotrimoxazolewere found by Magliano et al.[12] (95.4%; 77.1%; 72.9%, respectively). Amikacin, Piperacillin Tazobactam, and Cotrimoxazole usage should be considered in pediatric patient with UTI management.[13] *Escherichia coli* had low level of susceptibility to cephalosporin class, such as Cefadroxil (0%), Cefazolin (30%), Ceftazidime (40%), Ceftriaxone (40%),

and Cefepime (40%). Mirsoleymani et al.[14] reported higher susceptibility percentage of Escherichia coli to Ceftriaxone (52.2%). High resistance to Ceftazidime and Ceftriaxone was supported by the study by Haris et al.[15]

High level susceptibility to Amikacin (50%), Levofloxacin (50%), and Cotrimoxazole (50%) was found on *Klebsiellapneumoniae* isolates. In comparison, the study by Waadallah et al.[10] showed *Klebsiellapneumoniae* was susceptible to Amikacin (100%) and Cotrimoxazole (80%). Other studies conducted by Magliano et al.[12] discovered 93.0% of *Klebsiellapneumoniae* was susceptible to Levofloxacin. *Klebsiellapneumoniae* was fully resistant to cephalosporin antibiotic class, such as Cefazolin, Cefmetazon, Ceftazidime, Ceftriaxone, and Cefepime.On the other hand, study by Gracia et al.[16] showed that 0% was resistant to Cefepime and 26% was resistant to Ceftazidime on *Klebsiellapneumoniae* isolates. The study by Waadallah et al.[10] showed that 93% of *Klebsiellapneumoniae* was susceptible to Ceftriaxone. There were 2 isolates which were classified as ESBL-producing *Klebsiellapneumoniae*. The study by Maslikowska et al.[17] showed that there were ESBL-producing *K. pneumonia* causing UTI. Pediatric patients with diagnosed of UTI which caused by ESBL-producing *KlebsiellaPneumoniae* had high risk mortality and severe clinical outcomes with high cost of treatment for UTI.[17]

Pseudomonas aeruginosais considered to be fully resistant to Ampicillin Sulbactam, Cefazolin, Ceftriaxone, Cotrimoxazole, and Tigecyclin. *Pseudomonas aeruginosa* were found naturally resistant to Cotrimoxazoleand Cephalosporin antibiotic, including Ceftazidime.[11,18] Antibiotics susceptible to *Pseudomonas aeruginosa* isolates are Ciprofloxacin (75%)and Levofloxacin (75%). These findings are supported by the study conducted by Pobiega et al.[19] showed that most of *Pseudomonasaeruginosa* are susceptible to fluoroquinolone, such as Ciprofloxacin (80.8%) and Levofloxacin (77%).This study discovered Amikacin (100%) and PiperacillinTazobactam (50%) are susceptible on *Pseudomonas aeruginosa* cultures. This study is similar with a study by Rezaee et al.[5] which found *Pseudomonas aeruginosais* susceptible to Amikacin (100%). The study by Maglianoet al.[12] found similar result that *Pseudomonas aeruginosa* was susceptible to Piperacillin Tazobactam (88%).

The limitations of this study are the small range of population involved and short research period. Other important things to notice are the physician should neatly write the medical record and the hospital should collect the data completely. This study recommends the next study to obtain larger scale of population and to spend longer research period in order to reach more accurate and reliable result to represent present circumstances.

The possibility colonization of bacteria causing UTI should increase health care worker awareness to prevent nosocomial infection (now it is known as health care related infection). Aseptic and antiseptic procedures should be done according tostandard procedures. High susceptibility level on Amikacin, Cotrimoxazole, Ciprofloxacin, and Levofloxacin become evidence that these antibiotics should be considered as antibiotic empirical therapy for UTI in pediatric patients. This study recommends the antibiotic empirical therapy to be given after the sample is taken for culture test, and matched with the culture and susceptibility result.

In conclusion, microorganisms causing urinary tract infection are mostly *Escherichia coli, Pseudomonas aeruginosa*, and *Klebsiellapneumoniae* at Department of Child Health, Dr. Hasan Sadikin General Hospital, Bandung. The susceptibility level of aminoglycoside, sulfonamide, and fluoroquinolone are high on most microorganisms. Meanwhile, the resistance level of microorganisms is high on cephalosporin class. These susceptibility and resistance level should be considered in pediatric patient with UTI therapy. The findings showed diverse susceptibility to antibiotics in pediatric patients with diagnosis of UTI. The culture and susceptibility test are important to do in pediatric patients with UTI management to prevent antibiotic resistant development.

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