Bacteriological Pattern and Antibiotic Resistance in Children with Urinary Tract Infection in Ulin General Hospital Banjarmasin, Indonesia

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ABSTRACT

Introduction: Changes in pathogenic bacterial patterns of urinary tract infection (UTI) in children and their resistance pattern to antibiotics are a serious problem. The presence of a pattern of bacterial features and sensitivity to antibiotics has an important role for clinicians as reference and empirical therapy guideline in an area. The purpose of this study was to look at patterns of pathogenic bacteria and antibiotics resistance in children with UTI in Ulin General Hospital Banjarmasin.

Material and methods: This was an observational descriptive study using cross sectional approach. Data were obtained from the medical records of children aged 3 months - 17 years who were diagnosed with UTI during the period January 2016 to July 2017.

Results: There were 82 children diagnosed as suspected UTI, 46 of whom met inclusion and exclusion criteria. In this study, obtained *Klebsiella pneumoniae* as the most bacteria causing UTI in children, followed by *Escherichia coli*. The highest antibiotic resistance was ampicillin (92.3%), and still have high sensitivity to tigecycline (93.3%).

Conclusion: Most antibiotic which is resistant to the bacteria that cause UTI in children is ampicillin while antibiotics with the highest sensitivity are tigesiklin, meropenem and amikasin.

Keywords: Antibiotic Resistance, Antibiotic Sensitivity, Bacterial Patterns, Children, Urinary Tract Infection.

INTRODUCTION

Urinary tract infection (UTI) is one of the most common infection in children.[1] Urinary tract infection is defined as the presence of bacteria in the urine in significant amounts.[2] Urinary tract infection is an important risk factor for renal insufficiency or end-stage renal disease.[3]

The incidence of UTI varies with the age and sex of the children. Approximately 5% of all children under 2 years of age with fever experience UTI. In the first year of life, UTI was mostly found in boys, which is about 3.7% compared to girls of about 2%.[4] However, this incidence changes mainly in school-age children, decreased in boys and increased in girls.[5]

Approximately 80% of UTI in children is caused by *Escherichia coli*.[6] Other bacteria that cause UTI in children are *Klebsiella*, *Proteus mirabilis*, *Pseudomonas aeruginosa* and *Enterobacter* while another 10% are caused by Gram-positive bacteria including *Staphylococci*, *Enterococci* and *Sterptococci*.[7]

Nowadys the pattern of bacteria causing UTI in children varies greatly based on each regional geographic of a region that may be a reference for empirical antibiotic selection guidelines.[8] The change in pathogenic bacterial patterns causing UTI in children and their resistance pattern to antibiotics in communities and hospitals is a serious problem. This makes it difficult in the treatment of UTI in children and is associated with increased morbidity rates of patients, more costs for evaluation and management, increased hospital admission and greater use of broad-spectrum antibiotics.[9,10]

Management of UTI in children is the most important eradication of the bacteria that cause UTI with antibiotic therapy. Each country or region has epidemiological data on the bacteria that cause UTIs and different antibiotic sensitivity patterns. This is important for guidance in UTI therapy.[1,3] The administration of antibiotic therapy may be adapted to empirical therapy in the area prior to culture results and antibiotic resistance tests obtained. Initial treatment of antibiotics begins with broad-spectrum antibiotics.[11]

The presence of bacteriological pattern and antibiotic sensitivity pattern are important to identify and manage the children with UTI.[12] Never have been reported about the bacteriological pattern and the antibiotic resistance to the UTI in children at Ulin General Hospital Banjarmasin. Based on the above description it is necessary research on the pattern of bacterials and antibiotic sensitivity that should always be new, as a reference and guidance of empirical antibiotic therapy for clinicians at Ulin General Hospital and surrounding hospitals in the treatment of UTI in children.

MATERIAL AND METHODS

An observational cross sectional retrospective study was conducted in the Division of Nephrology, Department of Child Health Faculty of Medicine/Ulin General Hospital, Universitas Lambung Mangkurat Banjarmasin, Indonesia

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from January 2016 until July 2017. The data of all samples were collected from medical record. Inclusion criteria was age 3 months – 17 years old with diagnosis suspected urinary tract infection. Exclusion criteria, if the data was not completed in medical record. All samples of urine culture and antibiotic sensitivity were done with Vitek 2 system (Biomerieux, France) in Microbiology Laboratory Ulin General Hospital.

RESULTS

Of the 82 children diagnosed as suspected UTI, 46 children met the inclusion and exclusion criteria. The complete

distribution of sample characteristics can be seen in Table 1. Of 46 samples with suspected UTI, 29 cases were examined for urine culture and antibiotic sensitivity. There are 18 (62.1%) samples showing significant bacterial growth ($\geq 10^5$ cfu), 2 (6.9%) non significant bacterial growth and 9 (31.0%)
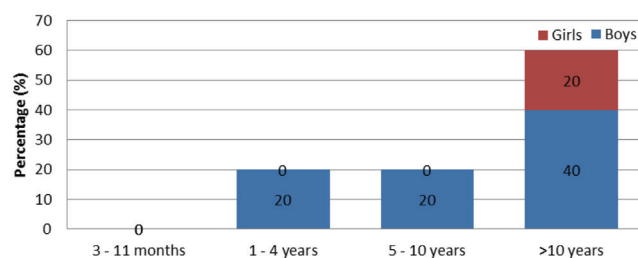

Figure-1: Distribution of Klebsiella pneumoniae by age and gender

Sample	n (%)
Gender	
Boys	19 (41.3)
Girls	27 (58.7)
Age	
3 – 11 months	4 (8.7)
1 - 4 years	16 (34.8)
5 - 10 years	11 (23.9)
>10 years	15 (32.6)
Table-1: Sample Characteristics	

Microorganisms	n (%)
Klebsiella pneumoniae	5 (28)
Escherichia coli	3 (16.8)
Enterobacter spp.	2 (11.1)
Acinetobacter spp.	2 (11.1)
Enterococcus spp.	1 (5.5)
Pseudomonas aeruginosa	1 (5.5)
Achromobacter xylosoxidane	1 (5.5)
Shigella disentriae	1 (5.5)
Staphylococcus haemolyticus	1 (5.5)
Fungal	1 (5.5)
Total	18 (100)
Table-2: Microorganisms isolated from urine culture	

Antibiotics	Number of isolates tested	Sensitive n (%)	Resistant n (%)
Amoxicillin	4	1 (25)	3 (75)
Ampicillin	13	1 (7.7)	12 (92.3)
Ampicillin-Sulbactam	16	7 (43.7)	9 (56.3)
Piperacillin-Tazobactam	13	8 (61.5)	5 (38.5)
Gentamycin	17	9 (52.9)	8 (47.1)
Ciprofloxacin	18	9 (50)	9 (50)
Cotrimoxazole	16	9 (56.2)	7 (43.8)
Tigecycline	15	14 (93.3)	1 (6.7)
Amikacin	15	12 (80)	3 (20)
Aztreonam	13	5 (39)	8 (61)
Ceftriaxone	13	5 (39)	8 (61)
Ceftazidime	15	8 (53.4)	7 (56.6)
Cefepime	16	9 (56.2)	7 (43.8)
Cefazolin	12	3 (25)	9 (75)
Cefixime	2	0	2 (100)
Meropenem	15	13 (86.7)	2 (13.3)
Ertapenem	11	9 (81.8)	2 (18.2)
Table-3: Sensitivity test of bacteria that cause childhood UTI susceptible to selected antibiotics			

Antibiotics	Klebsiella pneumoniae			Escherichia coli		
	Resistant n (%)	Sensitive n (%)	Total	Resistant n (%)	Sensitive n (%)	Total
Amoxicillin	0	0	0	1 (100)	0	1
Ampicillin	5 (100)	0	5	2 (100)	0	2
Ampicillin-Sulbactam	3 (60)	2 (40)	5	2 (100)	0	2
Gentamicin	3 (60)	2 (40)	5	2 (100)	0	2
Ciprofloxacin	2 (40)	3 (60)	5	2 (66.7)	1 (33.3)	3
Cotrimoxazole	2 (40)	3 (60)	5	2 (66.7)	1 (33.3)	3
Ceftazidime	3 (60)	2 (40)	5	2 (66.7)	1 (33.3)	3
Meropenem	0	5 (100)	5	1 (33.3)	2 (66.7)	3
Piperacillin/Tazobactam	1 (20)	4 (80)	5	2 (66.7)	1 (33.3)	3
Tigecycline	0	5 (100)	5	0	2 (100)	2
Cefazolin	3 (75)	1 (25)	4	2 (66.7)	1 (33.3)	3
Cefepime	3 (60)	2 (40)	5	2 (66.7)	1 (33.3)	3
Aztreonam	3 (60)	2 (40)	5	2 (66.7)	1 (33.3)	3
Ertapenem	0	5 (100)	5	1 (33.3)	2 (66.7)	3
Amikacin	0	5 (100)	5	0	3 (100)	3
Ceftriaxone	3 (60)	2 (40)	5	2 (66.7)	1 (33.3)	3
Table-4: Klebsiella pneumoniae and E. coli sensitivity test against selected antibiotics						

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samples with no bacterial growth. Table. 2 shows that *Klebsiella pneumoniae* is the most common cause of UTI in children (28%) followed by *Escherichia coli* (16.8%). Urinary tract infection by *Klebsiella pneumoniae* obtain most in the age group >10 years (Figure 1), and most of them (60%) with complex UTI. All UTIs caused by *Escherichia coli* are simplex UTI.

Of all the bacteria that cause childhood UTIs show that it still has a high sensitivity to tigecycline then followed by meropenem, and amikacin. The highest resistance rate of antibiotics is ampicillin followed by cefazolin, and cefixime. (Table 3).

Meropenem, amikacin, tigecycline and ertapenem were the antibiotics with the highest sensitivity to *Klebsiella pneumoniae* (Table 4). Antibiotics with the highest sensitivity to *E. coli* were tigecycline and amikacin (Table 4). Ampicillin is an antibiotic that is resistant to all UTI cases in children caused by *E. coli* and *Klebsiella pneumoniae*.

DISCUSSION

In this study found more UTI cases in girls (58.7%) than boys (41.3%). This is in accordance with the research of Sharma et al[3] and Saeed et al[13]. Girls tend to suffer from UTI because anatomically, the female urethra is shorter and closer to the anus making it easier to get infections in the urinary tract.[1]

According to Rai et al[7], the epidemiology of UTI varies by age and sex. Urinary tract infections tend to occur in smaller children, that is in the age group 1-5 years[4], in accordance with the results of this study is obtained most UTI in the age group 1- 4 years. This is because in smaller children are still not trained properly to urinate and have not been able to maintain the genital area hygiene so that tends to experience UTI.[7,13]

The two most common causes of UTI in children obtained in this study were *Klebsiella pneumoniae* (28%) and *Escherichia coli* (16.8%), these results differed from those obtained in several studies conducted in different countries such as Kayas et al[6] in Turkey and Aryal et al[14] in Nepal, indicating that *Escherichia coli* is the most common cause of UTI. Ashoka et al[10] received *Escherichia coli* followed by *Klebsiella pneumoniae* as the commonest bacteria found in childhood UTI. Research conducted in Banda Aceh, Indonesia by Haris et al[12] showed the results of *Pseudomonas aeroginosa* as the most cause, followed by *Escherichia coli* and *Klebsiela*.

By the distribution of *Klebsiella pneumoniae* based on age and gender in this study, it was found to be the most common in the age group > 10 years and the boys. This is appropriate with the results of the Mashouf et al[15] study that *E. coli* is the most common cause of UTI in children <12 years of age (preteens), whereas *Klebsiella pneumoniae* as the second most common cause of UTI especially among adolescents. Ghedira et al[16] mentions that *E. coli* predominantly occurs in UTI in girls while *Proteus mirabilis* and *Klebsiella pneumoniae* are likely encountered in boys. Oscarson[17] in his study mentioned that *Klebsiella pneumonia*-induced UTI is usually a complex UTI with anatomical and functional

predisposing factors in the urinary tract, in accordance with the results of this study that most (60%) are complex UTIs. Of all the bacteria causing UTI in children showed that still have high sensitivity to tigecycline (93.3%) then followed by meropenem (86.7%), and amikacin (80%). These results are in accordance with the Oscarson study[17] which tigecycline shows the highest sensitivity to the bacteria that cause UTI. In the study conducted by Afridi et al[18], Aryal et al[14], Gupta et al15[5], Saeed et al[13] and Khatoon et al[1] obtained that meropenem, amikacin and ertapenem were the high sensitivity antibiotics to pathogenic bacteria causing UTI in children.

The highest resistance antibiotics from the number of isolates tested in this study was ampicillin (92.3%). These results are consistent with the results of studies conducted by Sharma et al[3], Kayas et al[6], Ashoka et al[10] and Saeed et al[13] which show that the rates of resistance to ampicillin are very high in almost all regions.

In this study, meropenem, amikacin and tigecycline were the antibiotics with the highest sensitivity to *Klebsiella pneumoniae*. This is in accordance with research conducted by Gupta et al[19] which mentions *Klebsiella pneumoniae* is still sensitive to antibiotics meropenem and amikacin. Research conducted by Oscarson[17] also showed that amikacin and tigecycline are the most sensitive antibiotics to *Klebsiella pneumoniae*.

Antibiotics with the highest sensitivity to *E. coli* in this study were tigecycline and amikacin. This is like the study conducted by Rai et al[7] and Saeed et al[13] that amikacin is the most sensitive antibiotic to *E. coli*. In addition, the Oscarson[17] study also mentions that tigecycline and amikacin are the most sensitive antibiotics to *E.coli*.

Each country or region has epidemiological data on the bacteria that cause UTIs and different antibiotic sensitivity patterns. This is important for guidance in UTI therapy.[1,3] Knowledge of hospital sensitivity patterns is indispensable for use as a reference in the use of antibiotics.[12] The pattern of bacterial sensitivity to antibiotics is rapidly changing over time, especially in developing countries, so proper selection of antibiotics is essential in UTI therapy.[6,13]

The presence of different pattern of bacteria causing UTI in children in each region as well as the increasing number of antibiotic resistance to pathogenic bacteria causing UTI so it needs to be updated data periodically.[14] Due to the number of samples obtained in this study are limited with the lack of predisposing factor data, it is hoped that in the future we can know the pattern of pathogenic bacteria and bacterial sensitivity to antibiotics with more samples and prospective predisposing factor, since it is very useful to establish the policy of antibiotic usage as an effort to minimize the occurrence of resistance.

CONCLUSION

The most common pathogenic bacteria that causes UTI in children in Ulin General Hospital Banjarmasin is *Klebsiella pneumonia* followed by *Escherichia coli*. Tigecycline is the highest sensitivity antibiotic to UTI-causing bacteria followed

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by meropenem and amikacin. Ampicillin is an antibiotic with the highest resistance to almost all bacteria causing UTI in children in Ulin General Hospital. Meropenem is an antibiotic with highest sensitity to *Klebsiella pneumoniae* followed by amikacin, tigecycline and ertapenem, while against *E. coli* are tigecycline and amikacin.

Further research on the bacteriological pattern and antibiotic resistance of UTI in children at Ulin General Hospital Banjarmasin periodically with more samples and other antibiotics is needed.

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