

Sensitivity rates of bacteria causing urinary tract infections to commonly used antibiotics

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ABSTRACT

Ning Rintiswati – *Sensitivity rates of bacteria causing urinary tract infections to commonly used antibiotics*

Background: The choice of antibiotics in the treatment of infections, including urinary tract infection has been mainly based on previous clinical and empirical experiences. No antibiotic guideline is available for use in daily practice so that failure in the treatment of infections will inevitably happen. Since it is quite complicated work to prepare the guideline we start with a simple preliminary study on antibiotic susceptibility of bacteria causing urinary tract infections.

Objectives: The aim of this study is to know the recent status of various antibiotics agent in relation to their efficacy in the treatment of urinary tractus infection, especially in Yogyakarta.

Methods: Isolation, identification and antibiotic susceptibility test of bacteria from urine specimens were performed by available standard methods. Subject: Urine specimens sent to Microbiology Department for isolation, identification, and antibiotics susceptibility test.

Results: The results showed that 184 isolates were obtained during the period of July 1997 to June 1998.

Susceptibility rate of the isolates to ampicillin was very low, whereas the rates were much higher for ciprofloxacin, norfloxacin, gentamicin, and amikacin.

Conclusions: It is concluded that ciprofloxacin could be the first choice and norfloxacin, gentamicin or amikacin serve as alternatives in the treatment of urinary tract infections.

Key words: bacteria – urinary tract infection – antibiotics susceptibility – sensitivity rates

ABSTRAK

Ning Rintiswati – *Angka sensitivitas bakteri penyebab infeksi saluran kemih terhadap antibiotika yang sering digunakan*

Latar belakang: Selama ini pilihan antibiotik untuk pengobatan infeksi, termasuk infeksi saluran kemih, terutama didasarkan atas pengalaman klinik dan empirik sebelumnya. Tidak tersedia *antibiotic guidelines* untuk praktek sehari-hari sehingga kegagalan dalam pengobatan infeksi akan terjadi. Berhubung pembuatan guideline merupakan pekerjaan yang cukup rumit maka dilakukan penelitian pendahuluan mengenai kepekaan bakteri penyebab infeksi saluran kemih terhadap pelbagai antibiotik.

Tujuan penelitian: Mengetahui potensi beberapa antibiotik dalam kaitannya dengan infeksi saluran kemih khususnya di Yogyakarta

Bahan dan cara penelitian : Isolasi, identifikasi bakteri dari spesimen urin dan dilakukan uji kepekaan bakteri dengan metode Kirby-Bauer. Subyek: Spesimen urine yang dikirim ke Laboratorium Mikrobiologi Fakultas Kedokteran Universitas Gadjah Mada untuk pemeriksaan identifikasi, isolasi dan uji kepekaan bakteri terhadap antibiotik.

Hasil penelitian: Hasil menunjukkan bahwa selama kurun waktu antara Juli 1997 sampai Juni 1998 didapatkan 184 isolat bakteri. Tingkat kepekaan isolat tersebut terhadap ampisilin sangat rendah, sedangkan kepekaan terhadap siprofloksasin, norfloksasin, gentamisin dan amikasin menunjukkan tingkat yang jauh lebih tinggi.

Simpulan: Disimpulkan bahwa siprofloksasin dapat menjadi pilihan pertama dan norfloksasin, gentamisin atau amikasin merupakan alternatif untuk pengobatan infeksi saluran kemih.

INTRODUCTION

Urinary tract infections are commonly found in daily practice, affecting men and women of all age groups. It was estimated that 10-15% women had an episode of urinary tract infection during their life.¹ Treatment of the infections with antibiotics usually results in a complete recovery. So far, however, choice of antibiotics used in the treatment has been mainly based on previous clinical and empirical experiences. This practice, sooner or later, may lead to failures of the treatment which in turn increase the risk of complications and other consequences.

To anticipate the problem it is very important to provide the clinicians with an antibiotic guideline which can be used as a reference in daily clinical practice. Ideally, the guideline should include all available antibacterial agents and all infections of organs systems. Many countries have their own guidelines such as the one published periodically in Australia.² There is no such guideline in Indonesia and it takes long time to prepare, for we have to compile the data on antibiotic susceptibility test performed periodically in as many laboratory of microbiology as possible in Indonesia. In this study we evaluate the susceptibility of bacteria causing urinary tract infections to various antibiotics. The aim of the study is to provide information about recent status of these antibacterial agents in relation to urinary tract infections, especially in Yogyakarta. Hopefully, the information will be useful for the clinicians.

MATERIALS AND METHODS

Bacteria were obtained from urine specimens sent to the Laboratory of Microbiology for isolation, identification, and antibiotics susceptibility test. Blood agar and Mc Conkey agar were used for primary isolation and further identification of the bacteria was carried out with a series of media for biochemical tests.³ In addition, identification was also based on colonial morphology appeared in primary isolation media as well as Gram stain.

Susceptibility test was performed by disk diffusion method of Kirby-Bauer using eleven different antibiotic disks (ampicillin, amoxicillin + clavulanic acid, tetracycline, cotrimoxazole, chloramphenicol, gentamicin, amikacin, ciproflo-

xacin, norfloxacin, cefotaxim, and nitrofurantoin). Briefly, bacterial suspension with the density of 10^8 forming unit/ml is evenly streaked on to Mueller Hinton agar plates and antibiotic disks were then applied on the surface of the agar. After overnight incubation at 37° C zones of growth inhibition around the disks were measured and interpretation was based on an available standard from NCCLS⁴.

The sensitivity rates of bacteria to antibiotics was counted by the formula:

$$\frac{\text{number of resistance isolates}}{\text{number of isolated tested}} \times 100\%$$

RESULTS

A total of 184 isolates were obtained during the period of July 1997 to June 1998. The most frequent bacteria isolated were *Escherichia coli* (33.1%), followed by *Klebsiella pneumoniae* (19.5%), *Staphylococcus aureus* (13.1%), and *Pseudomonas sp.* (10.3%)

Susceptibility rates of individual bacteria to various antibiotics is presented on TABLE 1.

To determine the best antibiotic to choose regardless of the causative bacteria for the treatment of urinary tract infections, we propose the formula, Score of antibiotics:

$$\frac{\text{Total (Sensitivity rate X percent of individual bacteria)}}{\text{Number of species isolated}}$$

Higher scores indicate better antibiotics in term of their effectiveness for urinary tract infections.

DISCUSSION

Our study showed that most isolates were Gram negative bacteria with *E. coli* being the predominant species, followed by *K.pneumonia*, *S.aureus*, *Pseudomonas sp*, respectively. Previous studies also showed similar results.^{5,6,7,8} Sensitivity rates of the isolates to ampicillin were very low, ranging from 0% to 25% . Supardi reported that sensitivity rate of *E. coli* to ampicillin was 3%, whereas Marwoto showed the rate of 5.26%^{6,7}.

TABLE 1. – Sensitivity rates of bacteria causing urinary tract infection to most commonly used antibiotics.

Bacteria	No. of isolates (%)	Sensitivity rates (%) to										
		AMP	TE	SXT	C	CN	AK	CIP	NOR	CTX	F	AMC
<i>E. coli</i>	61 (33.1)	15	26	38	49	84	84	82	64	84	52	16
<i>K.pneumonia</i>	36 (19.5)	0	47	39	47	89	92	86	72	83	53	39
<i>S.aureus</i>	24 (13.1)	25	29	29	54	67	63	75	75	58	67	46
<i>E.cloacae</i>	10 (5.5)	0	20	20	10	50	30	70	70	40	20	20
<i>Pseudomonas sp</i>	19 (10.3)	5	5	5	11	47	74	63	53	32	0	16
<i>S.epidermidis</i>	10 (5.5)	0	10	40	30	10	60	40	50	0	50	50
<i>Bacillus sp</i>	8 (4.3)	25	25	25	25	38	38	25	25	25	38	38
Streptococci	3 (1.7)	33	33	0	67	0	33	33	0	0	33	0
<i>E.aerogenes</i>	13 (7.1)	31	31	15	38	92	92	85	85	46	31	23
Number of species isolated: 9												
Total isolates : 184												

AMP: ampicillin, TE: Tetracycline, SXT: Cotrimoxazole; C: Chloramphenicol, CN: Gentamicin, AK: amikacin
CIP: Ciprofloxacin, NOR: norfloxacin, CTX: cefotaxim, F: Nitrofurantoin, AMC: Amoxicillin + Clavulanic acid.

TABLE 2. – Score of antibiotics according to the formula

Antibiotic	Score
Ampicillin	115.53
Tetracyclin	305.99
Cotrimoxazole	368.73
Chloramphenicol	452.03
Gentamicin	794.06
Amikacin	738.22
Ciprofloxacin	821.27
Norfloxacin	713.53
Cefotaxim	682.49
Nitrofurantoin	494.86
Amoxicillin + Clavulanic acid	307.69

Despite this finding, however, ampicillin is still widely used for bacterial infections, including urinary tract infections. It is very likely that most clinicians do not aware of the rapid development of ampicillin resistant bacteria because of the lack of published data concerning antibiotic monitoring.

An addition of clavulanic acid to amoxicillin increased susceptibility rates of the isolates, especially *S. aureus*, *K. pneumoniae*, and *E. cloacae*. Since in vitro activity of ampicillin is practically the same as amoxycillin it is strongly suggested that these isolates produce beta-lactamase. Nevertheless, combination of amoxycillin and clavulanic acid did not increase the sensitivity of the isolates so much. Sensitivity rates of the isolates to tetracycline, cotrimoxazole, nitrofurantoin, and chloramphenicol also showed relatively low.

Most isolates showed much higher sensitivity to ciprofloxacin and the rates of 82% and 75% were observed for *E. coli* and *S. aureus*, respectively. Previous report in 1989 showed that isolates of these two bacteria were all susceptible to

ciprofloxacin⁸. Sensitivity rates of the isolates to norfloxacin, gentamicin, and amikacin showed a little bit lower than that of ciprofloxacin.

For practical point of view, we propose the formula for scoring an individual antibiotic in order to determine the choice of the agents in the treatment of urinary tract infections. This scoring system will be very useful in making an antibiotic guideline. According to our formula we suggested that ciprofloxacin should be the first choice for urinary tract infections, whereas norfloxacin, gentamicin, and amikacin could be the alternatives (TABLE 2.). Needless to say that other factors such as route of administration of the drug and possible allergic reaction have to be considered in establishing the choice.

Continuous monitoring of antibiotics concerning their in vitro activity against clinical isolates from infections of various anatomical sites or organ systems is very important. Periodical publication reporting data on this study will be an invaluable source of information about current status of certain antibiotics.

CONCLUSION

Based on this study we concluded that most urinary tract infections are caused by Gram negative bacteria, especially *E. coli*. Susceptibility rate of the bacteria to ampicillin is very low. According to our scoring system ciprofloxacin is the best choice of antibacterial agent for urinary tract infections, whereas norfloxacin, amikacin or gentamicin can be used as an alternative agent.

