Innovare Academic Sciences

International Journal of Pharmacy and Pharmaceutical Sciences

ISSN- 0975-1491 Vol 7, Issue 2, 2015

Original Article

PROFILE OF ANTIBIOTIC RESISTANCE AND USAGE PATTERN IN ICU OF PRIVATE HOSPITAL IN BANDUNG, INDONESIA

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Received: 14 Oct 2014 Revised and Accepted: 06 Nov 2014

ABSTRACT

Objective: To evaluate the resistance and usage patterns of antibiotics in the ICU of the private hospital in Bandung Indonesia.

Methods: A cross sectional retrospective study in the period from July to December 2012 at a private hospital in Bandung Indonesia which conducted microbial identification and antibiotic sensitivity testing using Kirby Bauer method.

Results: There were 132 patients were cultured positive which sputum was the most common specimen (86.36%, n=114). Pneumonia was the most frequent diagnosis (34.3%). Thirteen bacteria obtained were *Escherichia coli* (31.58%) as the highest isolates, followed by *Pseudomonas Spp.* (20.18%) and *Acinetobacter baumanii* (10.53%). Beta lactam group was found as the most frequent antibiotic use especially meropenem. The highest rate of microbial resistance was to Ampicillin including *E. coli*, *K. pneumoniae*, *Stenotrophomonas Sp.*, *Enterobacter Spp.*, *Serratia Sp.* Those isolates were 100% resistant to ampicillinand*A. baumannii* isolate were 83.3% resistant to Ampicillin.

Conclusion: The resistance rate and the usage of high beta-lactam antibiotics in the ICU required good management in making programs for infection control, surveillance of resistant bacteria, monitoring the use of antibiotics in hospitals, making a sustainable new guidelines for the usage of antibiotics and prophylaxis, and monitoring the usage of antibiotics in hospitals.

Keywords: Resistance pattern, Antibiotic, Microorganism, Isolate, ICU, *Escherichia coli*, Ampicillin, Meropenem.

INTRODUCTION

The Intensive Care Unit is one of potential sources of nosocomial infections even extensive infection control is routinely implemented [1]. The incidence rate is 23.7 infections per 1000 patients days which the rates of nosocomial infection in ICU range from 5% - 30%. The factors affect the risk of nosocomial infection including underlying disease, severity of illness, length of ICU stay, use of invasive devices and procedures and prolonged or inappropriate use of antibiotics in the ICU[2]. Along with the problem of nosocomial infection, the ICU also is deemed the epicenter of resistance development. The ICU has even been defined as a factory for creating, disseminating, and amplifying antimicrobial resistance [3]. The main impact on those was rising in morbidity, mortality, and healthcare costs [4]. The incidence of antimicrobial resistance has increased over the years resulting in limitation of therapeutic options. An antimicrobial resistance pattern in the ICU can help in determining antibiotics prescribing policy[5]. The antimicrobial resistance pattern should be conducted twice or three times per year routinely in order to inform the most infected bacteria, both sensitive and resistant antibiotic so the chosen antibiotic based on the pattern will be correct and meet the outcome goal. The aimed study was to observe the profile of antimicrobial resistance pattern of bacterial isolates and the pattern of antibiotic usage obtained from ICU patients at one private hospital in Bandung Indonesia.

MATERIALS AND METHODS

A cross-sectional retrospective study was conducted based on the antibiogram at the period of July to December 2012 in one private hospital in Bandung. During the period, gained 132 ICU patients conducted in microbial identification and antibiotic sensitivity testing. The antibiogram consist ofthe name of microorganisms in the positive culture and the list of the antibiotic which were resistant and sensitive to the founding microorganism. The antibiogram was made by the microbial identification of patients specimen which based on standard microbiological methods and microbial antibiotic sensitivity test performed using Kirby Bauer method. The results were interpreted in accordance with the guidelines on Clinical and Laboratory Standards Institute [6]. The pattern of antibiotic use was conducted from medical records of each patient. The ethical permission was not needed in this present study because of not to use patient directly.

RESULTS AND DISCUSSION

A total of 132 patients were admitted to the ICU during the period July to December 2012, had cultured positive bacteria, 76 patients (57.58%) were male, while women were 56 patients (42.42%). Most isolate were obtained from sputum specimens in the amount of 114 (86.36%). There were 13 bacteria identified from 114 sputum isolate which *Escherichia coli* was the most frequent in 36 specimens (31.58%), followed by *Pseudomonas Spp.* as many as 23 specimens (20.18%) and *Acinetobacter baumanii* in 10 specimens (10.53%). Pneumonia was the most frequent as many as 24 cases (34.3%) followed by stroke17 cases (24.3%) and sepsis in 8 cases (11.4%). Data on antibiotic resistance pattern were shown in table 2. Ampicillin was the highest antibiotic which has almost 100% resistant against several bacterial pathogens in ICU of a private hospital in Bandung. Beta lactam was the highest class of antibiotics which prescribed in the ICU (36.4%) especially meropenem (Fig.6).

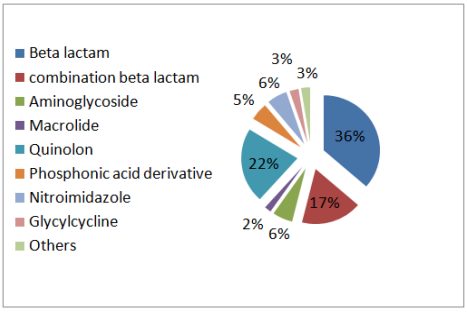

Fig. 1: It shows the frequency of Antibiotic class used in ICU during July-December 2014.

Table 1: It shows the frequency of microorganism isolated from sputum specimen during July-December 2012

No	Microorganism	Isolates frequency
1	*Escherichia coli*	36 (31.58)
2	*Pseudomonas Spp.*	23 (20.18)
3	*A. Baumanii*	12 (10.53)
4	*Staphylococcus aureus*	11 (9.65)
5	*Klebsiella pneumoniae*	10 (8.77)
6	*Streptococcus beta*	5 (4.39)
7	*Streptococcus gamma*	4 (3.51)
8	*S. epidermidis*	3 (2.63)
9	*Stenotrophomonas sp*	3 (2.63)
10	*Streptococcus alfa*	2 (1.75)
11	*Enterobacter spp*	2 (1.75)
12	*Bulchorderia*	2 (1.75)
13	*Serratia Sp*	1 (0.88)
	Total	**114 (100,00)**

Table 2: It shows the antibiotic resistance pattern in ICU during July-December 2012

Antibiotic	Microorganism											
	Escherichia coli	***Pseudomonas***	***A. Baumanii***	***Staphylococcus aureus***	***Klebsiella pneumoniae***	***Streptococcus beta***	***Streptococcus gamma***	***Staphylococcus epidermidis***	***Stenotrophomonas sp***	***Streptococcus alfa***	***Enterobacter spp***	***Bulchorderia***
amc	22,2%	66,7%	75,0%	9,1%	10,0%	0,0%	50,0%	0,0%	0,0%	0,0%	100,0%	50,0%
scf	11,4%	93,8%	54,5%	9,1%	0,0%	20,0%	0,0%	33,3%	100,0%	50,0%	50,0%	0,0%
cro	88,5%	100,0%	72,7%	9,1%	10,0%	0,0%	0,0%	33,3%	33,3%	50,0%	0,0%	50,0%
c	64,0%	86,4%	90,9%	25,0%	33,3%	0,0%	0,0%	0,0%	33,3%	0,0%	0,0%	100,0%
cip	66,7%		75,0%	18,2%	30,0%			0,0%			0,0%	50,0%
da				18,2%		40,0%	75,0%	33,3%		100,0%		
e		27,3%		27,3%		40,0%	75,0%	33,3%	0,0%	100,0%		
fos	0,0%		20,0%	10,0%	0,0%	0,0%	50,0%	33,3%		50,0%	0,0%	50,0%
lzd		73,7%		0,0%		20,0%	25,0%	0,0%	100,0%	50,0%		
mem	12,1%		80,0%	0,0%	0,0%	0,0%	50,0%	0,0%		0,0%	0,0%	0,0%
fox		85,0%		9,1%				0,0%				
mxf				18,2%		20,0%	75,0%	33,3%		50,0%		50,0%
f		4,3%							0,0%			
tzp	11,1%		75,0%	9,1%	0,0%	0,0%	25,0%	0,0%		0,0%	50,0%	0,0%
teic				0,0%				0,0%				
te	56,3%	91,3%	66,7%	9,1%	20,0%			33,3%	0,0%		0,0%	
tg	0,0%	85,7%	8,3%	0,0%	0,0%	0,0%	0,0%	0,0%	33,3%	0,0%	0,0%	0,0%
tob	41,4%	100,0%	70,0%	11,1%	0,0%			33,3%	0,0%		0,0%	50,0%
sxt	72,2%	100,0%	58,3%	9,1%	30,0%	20,0%	50,0%	0,0%	100,0%	0,0%	50,0%	50,0%
amp	100,0%	17,4%	83,3%		100,0%				100,0%		100,0%	
atm	61,1%	60,9%	91,7%		10,0%				33,3%		50,0%	50,0%
fep	33,3%		75,0%		10,0%						0,0%	50,0%
cfm	83,3%		100,0 %		10,0%						50,0%	
caz	58,3%	68,2%	75,0%		10,0%				100,0%		50,0%	
dor	11,4%		75,0%		0,0%						0,0%	50,0%
na	72,2%		75,0%		30,0%						0,0%	
ofx		21,7%							33,3%			
ak	11,1%		66,7%		0,0%						0,0%	50,0%

amc: Amoxicillin-clavulanic acid, scf: Sulbaktam – cefoperazon, cro: Ceftriaxone, c: Chloramphenicol, cip: Ciprofloxacin, da: Clindamycin, e: Erythromycin, f: Phosphomycin, lzd: Linezolid, mem: Meropenem, fox: Cefoxitin, mxf: Moxifloxacin, f: Nitrofurantoin, tzp: Piperasilin-tazobaktam, teic: Teicoplanin, te: Tetracycline, tg: Tygycycline, tb: Tobramycin, sxt: Trimethoprim-sulfamethoxazole, amp: Ampicillin, atm: Aztreonam, fep: Cefepim, cfm: cefixime, caz: Ceftazidim, dor: Doripenem, na: Nalidixic acid, ofx: Ofloxacin, ak: Amikacin, *: only one isolate

Antibiotic resistance was a serious worldwide health problem both in developed and in developing countries, in the community and in hospitals, especially in intensive care units. Sputum was the most frequent specimen which performed the highest rates of positive bacteria culture (86.36%), this was due to the use of a ventilator which was very significant factors of microbial exposure [7]. There arose out of *Esherichia coli* isolate which found the most in sputum. *Escherichia coli* was the most common because of *E. coli* infection in the ICU were often responsible for infection in the community and nosocomial infection which affects sepsis in the ICU [8]. During the study was discovered pneumonia as the most disease. Pneumonia is a type of acute respiratory infection that affects the lungs. The lungs are made up of tiny sacs called alveoli, which fills with air when a healthy person breathes. When an individual has pneumonia, the alveoli is filled with pus and fluid, which make breathing painful and limits oxygen intake. It can cause by viruses, bacteria and fungi [9]. The mortality rate of pneumonia in one study ranged was 20-50%. These clinically significant infection prolong duration of mechanical ventilation and ICU length of stay, underscoring the financial burden these infection impose on the health care system [10]. Ampicillin was 100% highest antibiotic which resistant to some bacteria such as *E. coli*, *K. pneumoniae*, *Stenotrophomonas Sp.,Enterobacter Spp*., *Serratia Sp.* and 83.3% was resistant to *A. baumannii*. The ampicillin resistant may be due to the AMPR (blaTEM1) gene as the resistant

gene to ampicillin was obtained from *Salmonella paratyphoid* and used as a marker gene and plant transformation microorganism. The gene responsible for the synthesis of beta-lactamase enzymes that neutralize the penicillin group of ampicillin [11]. In addition to ampicillin, other antibiotic resistance rate average was cefixime (60.8%) and ceftazidime (60.3%). Selection of optimal antibiotic for the treatment of infection required clinical judgment and knowledge related to detailed pharmacological and microbiological factors. Antibiotics were widely used for human therapy, as well as for animal and even for fish farming which can cause selection of pathogens resistant to multiple drugs. During the period from July to December 2012, there are 154 items of antibiotics used in ICU which beta lactam as the highest group that was equal to 36.4% which meropenem was the most frequent antibiotic.

Beta lactam group was the broad spectrum antibiotic for pneumonia guideline therapy. Meropenem is a carbapenem antibiotic approved by the US Food and Drug Administration for the treatment of complicated skin and skin-structure infections, complicated intra-abdominal infections, and pediatric bacterial meningitis (in patients ⩾3 months of age).

In clinical trials, it also has shown efficacy as initial empirical therapy for the treatment of nosocomial pneumonia. Unlike other β-lactam antibiotics, including third-generation cephalosporins, carbapenems have shown activity against extended-spectrum β-lactamase-producing and AmpC chromosomal β-lactamase-producing bacteria [12].

From this research found that beta lactam group was discovered as the most frequent antibiotic used in ICU during July to December 2012 while ampicillin which belong to beta lactam group was the most antibiotic which resistant to some bacteria. Health facility as the largest contributor of antibiotic usage should be required to make a good management program for infection control, surveillance of resistant bacteria, overseeing the use of antibiotics in hospitals, making a sustainable new guidelines for the use of antibiotics and prophylaxis, and monitoring the use of antibiotics in the hospital due to improve the rational use of antibiotics.

ACKNOWLEDGEMENT

We would like to acknowledge The Immanuel Hospital Bandung, for research collaboration with Pharmacology and Clinical Pharmacy Research Group, School Of Pharmacy, Bandung Institute Technology.

CONFLICT OF INTERESTS

Declared None

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