

DISTRIBUTION OF PATHOGENIC BACTERIA AND SENSITIVITY PATTERNS IN INTENSIVE CARE UNIT PATIENTS AT HOSPITAL X JAKARTA

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ABSTRACT

Nosocomial infection is a serious health problem. Nosocomial infections are infections that occur >48 hours during treatment at a health facility. One of the factors for the occurrence of nosocomial infections is treatment in the intensive care unit. This study used a cross-sectional retrospective design, using secondary data from bacterial pattern data. The most common bacteria found in infected patients in the intensive care unit were *K. pneumoniae* 22.4%, *E. coli*, and *Acinetobacter sp.* each of 6.6%. From the antibiotic sensitivity pattern, Amikacin was still quite good against *K. pneumoniae* (70%), *P. aeruginosa* (77%) and *E. coli* (94%), Tigecycline against *E. coli* (94%) and *Acinetobacter sp.* (90%).

Keywords: Bacterial Pattern; Nosocomial Infection; Sensitivity

INTRODUCTION

Nosocomial infections, also known as healthcare-associated infections (HAIs) are serious health problems experienced by hundreds or even millions of people every year around the world. Nosocomial infection is defined as an infection that occurs while a patient is hospitalized in a health care facility for more than 48 hours without evidence of infection or in the incubation period at the time of admission. Nosocomial infections increase morbidity, mortality, and burden cost of care.¹⁻⁵

Treatment in the Intensive Care Unit is one of the major risks factor for nosocomial infections, which is caused by various factors such as invasive procedures, prolonged treatment, excessive use of antibiotics, cross-transmission between patients and staff, and inadequate infection prevention procedures. Various nosocomial infections that occur in the intensive care unit are urinary tract infections (UTIs), ventilator-associated pneumonia (VAP), surgical site infections (SSIs), and bloodstream infections. Bacteria that cause nosocomial infections, which are found in almost 70% of cases in ICU patients, are Gram-negative bacteria such as *Pseudomonas aeruginosa*, *Acinetobacter spp.*, *Enterobacteriaceae*, and Gram-positive bacteria, namely *Staphylococci*.^{6,7} The *Enterobacteriaceae* family that often becomes a problem in nosocomial infection cases are mainly ESBL-producing bacteria (Extended Spectrum Beta-Lactamase), including *K. pneumoniae*, *E.coli*, *Enterobacter spp.*, *Citrobacter spp.*, *Proteus spp.*, and *Morganella morganii*.^{8,9}

A study in India conducted for 10 months by Chidambaram *et al.*, in 2018, found that the most common bacteria in the intensive care unit was *Klebsiella spp.* (47.87%), *Pseudomonas aeruginosa* (11.7%), *Acinetobacter spp.* (11.17%), and *Escherichia coli* (10.64%) for Gram-negative bacteria, while for Gram-positive are *Enterococcus spp.* (4.79%).¹⁰ Another study conducted by Fahim in Egypt, obtained from 1280 pathogenic bacteria for 1 year, most of which came from blood cultures (44.84%), urine (41.41%), and wound swabs (13.75%). The most pathogenic bacteria were *Klebsiella spp.* (22.5%), *Escherichia coli* (13.4%) and coagulase-negative *Staphylococci* (12.5%).¹¹ A study from Fatmawati Hospital showed similar results, 64.7% positive culture results were obtained with the most common bacteria that caused infection in the intensive care unit included *P. aeruginosa* (26.5%), *K. pneumoniae* (15.3%), and *S. epidermidis* (14.9%).¹² Another study conducted at Sanglah Hospital Bali also showed that bacteria causing infection in intensive care unit patients were dominated by Gram-negative bacteria, *A. baumannii*, *P. aeruginosa*, and *K. pneumoniae*.¹³ This study aims to determine the pattern of infection-causing bacteria and their sensitivity patterns in the intensive care unit of RS X in Jakarta.

METHODS

This study was a cross-sectional study, with a retrospective design, using secondary data from the intensive care unit bacterial pattern data from January to December 2019. All taken samples met the standard operational sampling procedures applicable at Hospital X in Jakarta. Bacterial identification and sensitivity tests were performed using Vitex2.

RESULTS

During January – December 2019, there were 241 culture specimens from intensive care patients with the distribution as followed: 117 sputum samples, 28 cerebrospinal fluid (CSF) samples, 35 blood samples, 31 bronchial rinses, 16 pus, 10 tissue samples, and 4 urine samples. From 241 specimens, 161 isolates of microorganisms grew (66.8%) and 80 specimens did not grow (33.2%), details as shown in table 1.

Table 1. Distribution of Microorganisms of Intensive Care Patients at Hospital X in January – December 2019.

Microorganisms	Sputum	Bronchial wash	CSF	Blood	Pus	Tissue	Urine	Total micro-organisms
<i>K.pneumoniae</i>	42	6	0	1	4	1	0	54 (22,4%)
<i>P.aeruginosa</i>	11	0	1	0	0	1	1	14 (5,8%)
<i>E.coli</i>	11	2	0	1	0	2	0	16 (6,6%)
<i>Acinetobacter sp.</i>	9	4	3	0	0	0	0	16 (6,6%)
<i>S. epidermidis</i>	6	0	0	0	1	1	0	8 (3,3%)
<i>S. aureus</i>	5	1	1	1	2	2	0	12 (5%)
<i>A.baumannii</i>	4	7	1	0	1	0	0	13 (5,4%)
<i>Enterobactersp</i>	4	0	0	0	0	0	0	4 (1,6%)
<i>E.cloacae</i>	3	0	0	0	1	0	0	4 (1,6%)
<i>S. saprophyticus</i>	3	0	1	0	1	0	0	5 (2,1%)
<i>S.maltophilia</i>	2	1	1	0	0	0	0	4 (1,6%)
<i>K. oxytoca</i>	2	0	0	0	0	0	0	2 (0,8%)
<i>E. faecalis</i>	2	0	0	0	1	1	1	5 (2,1%)
<i>S. paucimobilis</i>	0	0	1	0	0	0	0	1 (0,4%)
<i>S. viridans</i>	0	0	1	0	2	0	0	3 (1,2%)
No growth	13	10	18	32	3	2	2	80 (33,2%)
Total	117	31	28	35	16	10	4	241

Table 2. Gram-Negative Antibiotic Sensitivity Pattern (%) of Intensive Care Patients at Hospital X in January – December 2019.

Antibiotics	Microorganisms									
	<i>K.pneumoniae</i>	<i>P.aeruginosa</i>	<i>E.coli</i>	<i>Acinetobacter sp.</i>	<i>A.baumannii</i>	<i>Enterobacter sp.</i>	<i>E.cloacae</i>	<i>S.maltophilia</i>	<i>K.oxytoca</i>	<i>S.paucimobilis</i>
Chloramphenicol	52	8	56	20	8	50	75	25	100	0
Cotrimoxazole	31	8	25	30	8	50	50	75	50	0
Gentamycin	40	54	50	40	16	75	75	25	100	100
Kanamycin	21	8	19	20	8	25	50	0	0	0
Tetracycline	29	8	6	20	0	25	25	0	50	100
Amikacin	70	77	94	40	38	50	100	25	100	100
Aztreonam	33	38	6	0	0	50	75	0	100	0
Ampicillin-Sulbactam	26	0	38	10	8	25	25	0	100	100
Cefotaxime	19	0	56	0	0	25	50	0	50	100
Amoxicillin-Clavulanate	38	0	44	0	0	25	25	0	50	100
Ceftriaxone	19	8	63	0	0	25	25	0	100	100
Ceftazidime	29	62	63	10	8	25	25	75	100	100
Ciprofloxacin	29	62	19	30	8	25	50	50	100	100
Cefoperazone-Sulbactam	14	-	25	30	8	25	25	0	50	100
Piperacillin-Tazobactam	33	77	69	30	8	25	50	25	50	100
Doxycycline	62	38	75	30	8	50	50	-	100	100
Cefepime	17	31	75	40	8	50	25	0	50	100
Tigecycline	33	0	94	90	31	50	50	75	50	100
Meropenem	81	54	100	30	8	50	75	0	100	100
Imipenem	50	38	75	20	8	50	25	0	50	100
Levofloxacin	48	62	25	30	8	75	75	75	100	100

Moxifloxacin	31	38	19	20	8	25	50	75	100	100
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Table 3. Gram-Positive Antibiotic Sensitivity Pattern (%) of Intensive Care Patients at Hospital X in January – December 2019.

Antibiotics	Microorganisms			
	<i>S.aureus</i>	<i>S.epidermidis</i>	<i>S.saprophyticus</i>	<i>E.faecalis</i>
Penicillin G	0	0	0	50
Ampicillin	0	0	0	75
Cefoxitin	90	38	50	50
Chloramphenicol	60	50	75	50
Cotrimoxazole	70	13	75	25
Gentamycin	70	38	50	25
Erythromycin	90	38	50	75
Tetracycline	70	50	50	50
Ampicillin-Sulbactam	70	38	50	100
Clindamycin	80	50	25	50
Amoxicillin-Clavulanate	80	38	25	75
Ciprofloxacin	80	38	50	75
Piperacillin-Tazobactam	70	38	50	25
Vancomycin	90	100	100	100
Tigecycline	80	75	100	75
Teicoplanin	90	100	75	75
Linezolid	100	100	100	100
Levofloxacin	80	75	50	75
Moxifloxacin	80	75	50	50

DISCUSSION

From the results of this study, it was found that the 5 dominant bacteria in infectious patients in the intensive care unit were *K. pneumoniae* 22.4%, *E. coli* 6.6%, *Acinetobacter* sp 6.6%, *P. aeruginosa* 5.8%, and *A. baumannii* 5.4% for Gram-negative bacteria, while for Gram-positive bacteria the most common were *S. aureus* 5% and *S. epidermidis* 3.3%. These results were comparable with the study conducted in Bali by Budayanti *et al.*, which found the bacteria that dominated the cause of infections were Gram-negative bacteria, respectively, *E. coli*, *A. baumannii*, *P. aeruginosa*, and *K. pneumoniae*.¹³ However, the study by Budayanti *et al.* was performed in all hospital wards, unlike the one in this study, which was limited to the intensive care unit.

The results were similar to the research conducted by Akter *et al.*, in Bangladesh and Maksum Radji *et al.*, in Jakarta, with the same research sample, namely the sample collected in the intensive care room. The results showed that the most infectious bacteria in intensive care patients were *E. coli* 28%, *Klebsiella sp.* 27%, *Acinetobacter sp.* 17.3%, *Pseudomonas sp.* 9.6%, and *Staphylococcus aureus* 5.3% in Bangladesh, not much different from the study conducted at Fatmawati Hospital Jakarta, that discovered the most pathogens found in intensive care unit infections were *P. aeruginosa* 26.5%, *K. pneumoniae* 15.3%, and *E. aerogenes* 13.3% for Gram-negative bacteria, while similar results in Gram-positive bacteria were found as the cause of infection in intensive care patients, namely *S. epidermidis* 14.9% and *S. aureus* 3.2%.^{12,14}

The bacterial sensitivity pattern in intensive care unit patients at RS X showed that Gram-negative bacteria were more resistant to various antibiotics, especially when compared to the results of the susceptibility test of Gram-positive bacteria. Antibiotics with relatively good sensitivity include Meropenem (81%) and Amikacin (70%) for *K. pneumoniae* bacteria, Amikacin and Piperacillin-Tazobactam respectively 77% for *P. aeruginosa*, and Amikacin (94%), Tigecycline (94%), and Meropenem (100%) against *E. coli* bacteria, while the antibiotic that still had good sensitivity to *Acinetobacter sp.* was tigecycline (90%), but none of the antibiotics had good enough sensitivity for *A. baumannii*. Meanwhile, for Gram-positive bacteria, the sensitivity pattern was quite good, there were still many sensitive antibiotics. The sensitivity pattern of pathogens that cause nosocomial infections in the intensive care room from various studies shows that the pattern of bacteria in the intensive care room is multidrug-resistant microorganisms, this can be caused by the use of antibiotics during treatment.¹⁵⁻¹⁷ The intensive care unit is often considered the epicenter of the development and spread of resistant microorganisms. Critically ill patients are susceptible to infection due to exposure to various invasive measures, which disrupt the body's defense barrier, such as suppression of the cough reflex due to sedation or

suppression of gastric acid by stress ulcers prophylactic medication. Extensive and inappropriate use of broad-spectrum antibiotics are factors associated with the development and spread of multidrug-resistant microorganisms.¹⁸⁻²⁰

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