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BACTERIAL PATTERNS AND ANTIBIOTIC SUSCEPTIBILITY IN TABANAN GENERAL HOSPITAL

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Abstract

Background: *Bacterial resistance will affect the results of therapy, costs, spread of disease, and duration of illness. To minimize the losses incurred, it is necessary to monitor bacterial resistance and the use of antibiotics.* ***Aims****: To identify, monitor, map, and overcome antibiotic resistance and restrict bacterial transmission in hospitals, especially at the Tabanan General Hospital.* ***Method:*** *This research was conducted using a cross-sectional method using samples of inpatients and outpatients sent by clinicians to the Clinical Pathology Laboratory, Microbiology Sub Lab, from January to December 2022.* ***The Results****: Of the 590 positive culture samples in 2022, the majority were caused by Escherichia coli (15.25%), and 62.22% were ESBL. Apart from that, 8.31% were found to be Staphylococcus aureus, and 53.06% were MRSA.* ***Conclusion****: The percentage of Escherichia coli bacteria that produce the ESBL enzyme is still high (62.22%). The rate of Staphylococcus aureus bacteria that produce the MRSA enzyme is still high (53.06%). The antibiotics Meropenem, Amikacin, and Tigecycline have the highest sensitivity to ESBL. The antibiotics Nitrofurantoin, Linezolid, and Quinupristin/Dalfopristin have the highest sensitivity to MRSA.*

Keywords*: bacterial patterns, antibiotic susceptibility, Tabanan General Hospital*

1. Introduction

Antibiotic resistance is currently a health problem throughout the world. Antibiotic resistance is the resistance of microorganisms to antibiotic drugs to which they were previously sensitive. Resistant organisms (bacteria, viruses, and some parasites) are said to withstand the attack of antibiotic drugs so that standard treatment becomes ineffective, the infection persists and can spread. Antibiotic resistance is a consequence of incorrect use of antibiotics and the development of the microorganism itself (mutations or acquired resistance genes) (1). Data reports on bacterial pattern and its sensitivity in several hospitals in Indonesia have found methicillin-resistance of S. aureus (MRSA) was 13-26%, ESBL-producing E. coli and K. pneumonia were 25-5% and 32-56%, respectively (2).

The leading cause of antibiotic resistance is the widespread and irrational use of antibiotics. More than half of

patients in hospital care receive antibiotics as treatment or prophylaxis. In 2015, 30% of antibiotics prescribed to outpatients were unnecessary, and acute respiratory infections accounted for the highest use of unnecessary antibiotics at 50%. When an infection becomes resistant to first-line antibiotic treatment, second- or third-line antibiotics, which are more expensive and sometimes more toxic, must be used. Another consequence is from an economic perspective for clinicians, patients, healthcare administrators, pharmaceutical companies, and society. Health costs will increase along with the need for new, stronger, and of course more expensive antibiotics. Inappropriate use of antibiotics in one patient can give rise to resistant strains that then spread to other patients who do not use antibiotics, making this an urgent public health problem (3,4).

In accordance with the Regulation of the Minister of Health of the Republic of Indonesia Number 8 of 2015 concerning Antimicrobial Resistance Control Programs in Hospitals, this research was designed to identify, monitor, map, and overcome antibiotic resistance as well as restrict the transmission of bacterial in hospitals, especially in Tabanan General Hospital (5).

2. Research Methods

This research was conducted using a cross-sectional method using samples of inpatients and outpatients sent by clinicians to the Clinical Pathology Laboratory, Microbiology Sub Lab. All positive culture results (590 samples) in the period of January to December 2022 were used as research samples. Bacterial identification and antibiotic sensitivity test using the Vitek 2 Compact System.

3. Result and Discussion

In the period January to December 2022, there were 953 culture samples at the Tabanan General Hospital with 590 samples being positive (details can be seen in table 1). These bacterials include Escherichia coli, Staphylococcus aureus, Acinetobacter baumannii, Pseudomonas aeruginosa, Staphylococcus haemolyticus, Klebsiella pneumoniae ssp pneumoniae, Staphylococcus epidermidis. Not all of the culture samples can grow and give the expected results. There are many factors that cause the culture not to grow, including: giving antibiotics before taking the culture sample, the bacteria in the patient's sample are anaerobic or fastidious bacteria, and there is in vitro-in vivo growth selectivity (6).

Table 1. Positive Samples Based on Sample Type

No.	Sample Types	Frequency
1.	Blood	173
2.	Urine	183
3.	Sputum	24
4.	Wound swab	173
5.	Body tissue	21
6.	LCS	11
7.	Dialysate fluid	1
8.	CAPD fluid	1
9.	WSD fluid	1
10.	Rectal swab	1
11.	Ear secret	1

Table 2. Percentage Incidence of ESBL (*Extended Spectrum β-lactamase*), *Carbapenemase*, MRSA (*Methicillin-Resistant Staphylococcus Aureus*), MRSE (*Methicillin-Resistant Staphylococcus Epidermidis*), and VISA (*Vancomycin-Resistant Staphylococcus Aureus*) in Tabanan General Hospital in 2022

No	Organism	Frequency	%
1	*Escherichia coli*	90	
	Escherichia coli (ESBL (+))	56	62.22
2	*Klebsiella pneumoniae ssp pneumoniae*	37	
	Klebsiella pneumoniae ssp pneumoniae (ESBL (+))	26	70,27
3	*Staphylococus aureus*	49	
	Staphylococus aureus (MRSA (+))	26	53,06

Table 3. Sensitivity of Staphylococcus aureus (MRSA) Bacteria to Antibiotics

Organism	Amount	CIP %	CLI %	ERY %	GEN %	LVX %	LNZ %	MFX %	NIT %	OXA %	PEN %	QDA %	RIF %	TCY %	TGC %	SXT %	VAN %
Staphylococcus aureus ss. aureus	26	19.2	69.2	23.1	34.6	23.1	96.2	23.1	96.2	0	0	96.2	85	84.6	100	27	88.5

CIP=ciprofloxacin; CLI=Clindamycin; ERY=Erythromycin; GEN=Gentamicin; LVX=Levofloxacin; LNZ=Linezolid; MFX= Moxifloxacin; NIT=Nitrofurantoin; OXA=Oxacylline; PEN= Penicillin; QDA= Quinupristin-dalfopristin; RIF= Rifampicin; TCY= Tetracycline; TGC= Tigecycline; SXT= Trimethoprim/Sulfamethoxazole; VAN= Vancomycin

Table 4. Sensitivity of Escherichia coli and Klebsiella Pneumoniae bacteria (ESBL : +)

Organism	Amount	AMK %	AMP %	SAM %	ATM %	CZO %	FEP %	CAZ %	CRO %	CIP %	ET P %	GEN %	MEM %	NIT %	TZ P %	TGC %	SXT %
Escherichia coli	56	98.2	0	19.6	8.9	0	58.9	17.9	0	3.6	87.5	44.6	98	91.1	80.4	95	41.1
Klebsiella pneumonia ss. pneumoniae	26	100	0	7.7	3.8	0	42.3	3.8	0	11.5	100	53.8	100	26.9	38.5	62	34.6

AMK= Amikacin; AMP= Ampicillin; SAM= Ampicillin/sulbactam; ATM= Aztreonam; CZO= Cephazolin; FEP= Cefepime; CAZ= Ceftazidime; CRO= Ceftriaxone; CIP= Ciprofloxacin; ET= Ertapenem; GEN= Gentamicin; MEM= Meropenem; NIT= Nitrofurantoin; TZ= Pipercillin/Tazobactam; TGC= Tigecycline; SXT= Trimethoprim/Sulfamethoxazole

From Table 2, data is obtained that 70.27% of Klebsiella pneumoniae ssp pneumonia bacteria are ESBL bacteria and 62.22% of Escherichia coli bacteria are ESBL bacteria. Meanwhile, 53.06% of S. aureus bacteria are MRSA. Patients with MRSA or ESBL should be given more attention if this bacteria is found in a ward. The tendency for the enzyme to spread to other organisms that are still sensitive to antibiotics is very high. These hospital bacteria can colonize the hands of doctors, paramedics, patient waiters, medical equipment, patients' beds, and the environment around the patients. There should be good hand washing using soap or hand rub.

From Tables 3 and 4 it can also be seen that the antibiotics Meropenem, Amikacin, and Tigecycline are the antibiotics with the highest sensitivity to ESBL. The antibiotics Nitrofurantoin, Linezolid, and Quinupristin/Dalfopristin are the antibiotics with the highest sensitivity to MRSA. In this study, it appears that Escherichia coli has become a high percentage of Gram-negative bacterial from year to year, followed by Klebsiella pneumoniae ssp pneumonia. For gram-positive bacteria, Staphylococcus aureus appears as a bacteria that is often recorded as having a high percentage. This is not much different from research conducted by Marhamah in 2023, where data was obtained that the bacteria that were most often found in patients with surgical wound infections at RSUP Dr. M. Djamil Padang for the 2019-2020 period were Escherichia coli 23.1%, Pseudomonas aeruginosa 17.9%, Klebsiella pneumoniae 15.4%, Acinetobacter baumannii 12.8%, and Staphylococcus aureus 12.8%.(7) These results are in line with research conducted by Isik O, et al. in Turkey in 2015 which found Escherichia coli as the most common bacterial found from

surgical wound culture isolation, namely 22.8% (8).

In 2022, the percentage of Escherichia coli bacteria that produce the ESBL enzyme will still be high, namely 62.22%. The percentage of Staphylococcus aureus bacteria that produce the MRSA enzyme is still high, namely 53.06%. The antibiotics Meropenem, Amikacin, and Tigecycline are the antibiotics with the highest sensitivity to ESBL. The antibiotics Nitrofurantoin, Linezolid, and Quinupristin/Dalfopristin are the antibiotics with the highest sensitivity to MRSA. In Marhamah in 2023 it was also found that the antibiotics that Escherichia coli bacteria are sensitive to are the antibiotics amikacin, ertapenem, meropenem, piperacillin-tazobactam, cefoxitin, nitrofurantoin, and tigecycline (7). Staphylococcus aureus is sensitive to the antibiotics aztreonam, linezolid, nitrofurantoin, quinupristin-dalfopristin cefotaxime, and tigecycline (7). Research by Wiguna in 2016, stated that Escherichia coli was sensitive to meropenem. Staphylococcus aureus is sensitive to amikacin, erythromycin, and ampicillinsulbactam. Klebsiella pneumoniae is sensitive to amikacin, ampicillin - sulbactam, amoxicillin - clavulanate, levofloxacin, tetracycline, and ciprofloxacin. (9) According to research conducted by Altamimi et al amikacin, ertapenem, and meropenem are the most effective intravenous antibiotics for empiric therapy against pathogens that cause UTI, including ESBL-producing bacteria (10).

4. Conclusion

The percentage of Escherichia coli bacteria that produce the ESBL enzyme is still high, namely 62.22%. The percentage of Staphylococcus aureus bacteria that produce the MRSA enzyme is still high, namely 53.06%. The antibiotics Meropenem, Amikacin, and Tigecycline are the antibiotics with the highest sensitivity to ESBL. The antibiotics Nitrofurantoin, Linezolid, and Quinupristin/Dalfopristin are the antibiotics with the highest sensitivity to MRSA.

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