

Description of Methicillin-resistant *Staphylococcus aureus* Infection at Arifin Achmad General Hospital, Riau Province from 2015-2019

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Abstract: Methicillin-Resistant *Staphylococcus aureus* (MRSA) is one of the most important pathogen causing hospital-associated infections worldwide. This study aimed to determine the prevalence of MRSA infections at Arifin Achmad General Hospital, Riau Province, Indonesia. This study was a retrospective study using MRSA infected patients' medical record data in Arifin Achmad General Hospital during 2015-2019. There were 600 isolates of *Staphylococcus aureus* enrolled in this study. Of this, the prevalence of MRSA ranged between 23.8% and 42.7%. The highest prevalence of MRSA infections was found in the surgical ward (44.8%). The MRSA isolates were mostly found among pus specimens (66.5%) and obtained from patients with skin, and soft tissue infections. vancomycin, tigecycline, and linezolid were highly susceptible to the MRSA isolates. The MRSA infections were frequently found among male patients (51.2%), 46-55 years old (27.9%), length of stay 7-13 days (26.7%), onset more than two days (54.7%), no history of surgery (51.2%), and not referred patients (81.4%). In conclusion, the prevalence of MRSA at Arifin Achmad General Hospital was relatively high. A further hospital surveillance system should be set up to monitor this.


1 INTRODUCTION


Staphylococcus aureus (*S. aureus*) is a skin flora in humans. However, it is an important pathogen, particularly among susceptible hosts (Erikawati *et al.*, 2016). These bacteria are the most common cause of pyogenic infections of the skin and soft tissues (Kliegman *et al.*, 2016). Methicillin-resistant *Staphylococcus aureus* (MRSA) is a specific strain of *S. aureus* with resistance to almost all β -lactam antibiotics such as penicillin, methicillin, and cephalosporin (Gayatri *et al.*, 2015). MRSA is resistant to β -lactam due to a change of penicillin-binding protein (PBP2) to PBP2a, which has a low


affinity for β -lactam (Conly, 2018). The emergence of MRSA has become a significant problem because of the limited antibiotic therapy of MRSA infections.


Since MRSA was first discovered in the 1960s (Wong *et al.*, 2018), the prevalence of MRSA infections has increased (Negara, 2016). Little is known regarding the epidemiology of MRSA infections in Indonesia, especially in Riau. MRSA infection features must be investigated continuously because of changes in the prevalence and patterns of antibiotic resistance. This study aimed to determine the epidemiology of MRSA infections at Arifin Achmad General Hospital, Riau Province, during 2015-2019.

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2 MATERIALS AND METHODS

A retrospective study was conducted at Arifin Achmad General Hospital, Riau Province, Indonesia, during April-June 2020. The MRSA isolates were obtained by clinically indicated culture in the Microbiology Laboratory of Arifin Achmad General Hospital from 2015-2019. The Vitek 2 system carried out confirmation of identification and antibiotic susceptibility test. Antibiotics tested included clindamycin, erythromycin, tigecycline, vancomycin, linezolid, amoxicillin, amoxicillin/clavulanic acid, piperacillin/tazobactam, ampicillin/sulbactam, cefazolin, ceftriaxone, ceftazidime, cefepime, cefoxitin, ertapenem, meropenem, gentamicin, ciprofloxacin, trimethoprim/sulfamethoxazole, and rifampicin.

The patient's clinical data were collected from the medical record data and analyzed using the SPSS statistical software version 23.

3 RESULTS

3.1 Prevalence of MRSA Infections

Overall, 600 samples of *S. aureus* were collected, 197 of MRSA (32.8%). The highest MRSA prevalence was found in 2019 (42.7%), while the lowest was 2016 (23.8%). The highest prevalence was in the surgical ward (43.8%).

Table 1: MRSA prevalence at Arifin Achmad General Hospital, Riau Province 2015-2019.

Variable		MRSA (n=197)	<i>S. aureus</i> (n=600)
Period	2015	16 (30,2%)	53
	2016	24 (23,8%)	101
	2017	45 (32,8%)	137
	2018	48 (30,2%)	159
	2019	64 (42,7%)	150
	Total	197 (32,8%)	600
Ward	Intensive Care Unit	21 (30,0%)	70
	Neonatal Care Unit	2 (11,1%)	18
	Surgical Ward	57 (43,8%)	130
	Medical Ward	62 (32,3%)	192
	Mix Ward	18 (24,3%)	74
	Fetomaternal Ward	3 (30,0%)	10
	Outpatient clinic	31 (33,3%)	93
	Emergency Unit	3 (23,1%)	13

3.2 Distribution of MRSA based on Source of Specimen

MRSA was mostly found in pus and sputum (66.6% and 19.3%, respectively). Only three MRSA isolates were found in tissue and urine each (1.5%).

Table 2: Distribution of MRSA isolates based on the type of specimens at Arifin Achmad General Hospital, Riau Province 2015-2019.

Specimen	Frequency (N=197)	Percentage (%)
Pus	131	66,5
Tissue	3	1,5
Blood	13	6,6
Sputum	38	19,3
Urine	3	1,5
Other	9	4,6

3.3 Diagnosis and Characteristics based on MRSA Patients

Based on 197 culture results identified as MRSA, there were 86 medical records that could be accessed in this study. MRSA cases were mostly found in patients with skin and soft tissue disorders (59%), followed by lung disorders (16%). The frequency of MRSA was higher in men (51.2%) than in women (48.8%). MRSA was mostly found in patients with 46-55 years (27.9%), and the least was 12-16 years old (1.2%). MRSA infections were common in patients with a treatment duration of 7-13 days (26.7%) with an onset of more than 2 days (54.7%). MRSA patients mostly did not have a history of surgery (51.2%) and were not transferred from other healthcare facilities (81.4%).

3.4 Antimicrobial Sensitivity Pattern

The antibiotics that have the highest sensitivity were tigecycline, vancomycin, and linezolid (100%). All isolates were resistant to amoxicillin, amoxicillin/clavulanic acid, piperacillin/tazobactam, ampicillin/sulbactam, cefazolin, ceftriaxone, ceftazidime, cefepime, cefoxitin, ertapenem, and meropenem.

Table 3: Diagnosis and Characteristics of MRSA patients at Arifin Achmad General Hospital, Riau province in the period 2015-2019.

Variable		Frequency (N= 86)	Percentage (%)
Diagnosis	Skin and Soft-Tissue	51	59,3
	Heart and bloodstream	3	3,5
	Lungs	14	16,3
	Bone and joint	11	12,8
	Nervous system	3	3,5
	Other	4	4,7
Gender	Male	44	51,2
	Female	42	48,8
Age	0 – 5	8	9,3
	6 – 11	3	3,5
	12 – 16	1	1,2
	17 – 25	8	9,3
	26 – 35	9	10,5
	36 – 45	17	19,8
	46 – 55	24	27,9
	56 – 65	12	14
	> 65	4	4,7
	Mean ± SD	39,7 ± 19	
Length of Stay	<1 day	17	19,8
	1 – 6 days	15	17,4
	7 – 13 days	23	26,7
	14 -20 days	7	8,1
	21 – 27 days	8	9,3
	28 – 34 days	5	5,8
	35 – 41 days	1	1,2
	42 – 48 days	2	2,3
	49 – 55 days	2	2,3
	56 – 62 days	1	1,2
	>62 days	5	5,8
	Mean ± SD	17,7 ± 26,7	
Onset	0 – 2 days	39	45,3
	>2 days	47	54,7
	Mean± SD	7,8 ± 14,9	
History of Surgery		42	48,8
Transferred from another hospital		16	18,6

4 DISCUSSION

The mean prevalence of MRSA at Arifin Achmad General Hospital from 2015-2019 was 32.8%. Research conducted at Dr. Saiful General Hospital Anwar obtained an MRSA prevalence of 38.2% (Erikawati *et al.*, 2016). The study conducted at 427 centers in 45 countries found an MRSA prevalence of 40.3% (Diekema *et al.*, 2019). Arifin Achmad General Hospital has made efforts to reduce MRSA infections, including handwashing education, isolating patients, using personal protective equipment, disinfection of equipment and rooms, and using antibiotics according to culture results. The variation in prevalence found at Arifin Achmad General Hospital is probably due to the absence of screening in the patient, so it is difficult to identify whether the infection source came from the Arifin

Achmad General Hospital or from outside the hospital.

The highest MRSA prevalence in this study was found in the surgical ward (44.8%). A study conducted at the Port-of-Spain General Hospital showed that MRSA's prevalence in the surgical ward was 39.4% (Ramdass *et al.*, 2018). Research conducted at Dr. Soetomo Hospital, Surabaya, in 2018 found that the highest prevalence of MRSA carriers was found in surgical wards (Kuntaman *et al.*, 2016). MRSA contamination in surgical wards is more significant than in medical wards (Nkuwi *et al.*, 2018), which results in a greater risk of infection.

MRSA infections are common in skin and soft tissue disorders. *S. aureus* is a typical skin flora that can cause a skin infection when the skin barrier is damaged, which can produce pus (Erikawati *et al.*, 2016). This also causes pus to be the most common specimens of isolated MRSA, as the results of

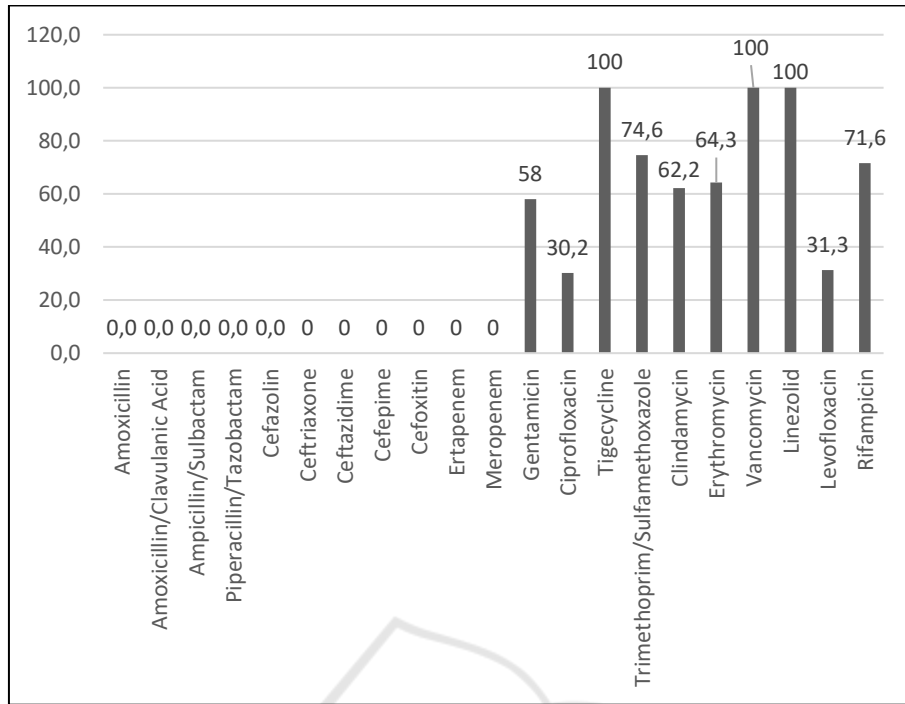


Figure 1: MRSA antimicrobial sensitivity patterns in the Arifin Achmad General Hospital, Riau province in the period of 2015-2019.

previous studies (Erikawati *et al.*, 2016; Garoy *et al.*, 2019).

This study found that MRSA infections at Arifin Achmad General Hospital were more common in men. This study's results are the same as in previous studies (Garoy *et al.*, 2019; Nuryah *et al.*, 2019; Sit *et al.*, 2017). Gender is not associated with MRSA infection (Garoy *et al.*, 2019), but men are more susceptible due to less adherence to hygiene behavior than women (Humphrey *et al.*, 2015).

The 46-55 year age group is the most common group infected by MRSA. This result is because this age group is at a productive age, where they do much physical activity. There is a greater risk of injury, making it easier for bacteria to enter the body (Nuryah *et al.*, 2019).

Most patients are hospitalized from 7-13 days. Patients with a treatment duration of 7-13 days had a 2.7 times greater risk of becoming infected with MRSA than those with 1-6 days of stay, and this risk will increase along with the increasing length of stay (Loke *et al.*, 2015).

Most MRSA infections were found with the onset of more than 2 days. This result is consistent with Diekema's research in 2019 in which MRSA infections were more common in nosocomial isolates (Diekema *et al.*, 2019).

In this study, it was found that more patients with MRSA infection at Arifin Achmad General Hospital were found without a history of surgery. Previous studies have found MRSA is common in patients with a history of surgery (Abidin *et al.*, 2020; Alrabiah *et al.*, 2016) and concluded that a history of surgery is a risk factor for MRSA infection (Graffunder and Venezia, 2002). MRSA infection occurring soon after surgery is usually rare. MRSA infection after surgery can usually be surgical site infection (SSI) or bacteremia. Emergency surgery, contaminated surgery, decreased immunity, and the presence of comorbid in a patient can increase the risk of MRSA infection (Gurusamy *et al.*, 2013).

In this study, MRSA infections at Arifin Achmad General Hospital were less common in referral patients. An increase in MRSA infections in one hospital can accelerate the transmission among hospitals. In other words, it increases infection in other hospitals, depending on the relationship among the hospitals (Lee *et al.*, 2011).

The antibiotics with the best sensitivity for MRSA at Arifin Achmad General Hospital are tigecycline, vancomycin, and linezolid. These antibiotics are an option in empiric therapy for MRSA (VanEperen and Segreti, 2016).

5 CONCLUSION

The prevalence of MRSA at Arifin Achmad General Hospital from 2015-2019 was quite high and varied due to the difficulty of detecting the source of infection. The highest prevalence of MRSA was found in the surgical ward, with the most specimen source was pus. MRSA infection was mostly found in male patients aged 46-55 years, with an onset of more than 2 days, have no history of surgery, and were not referred from other hospitals. The antibiotics with the best sensitivity for MRSA at Arifin Achmad General Hospital are tigecycline, vancomycin, and linezolid, which are recommendations for MRSA empirical therapy.

6 ETHICAL STATEMENT

Ethical approval was obtained from the Ethics Unit for Medical and Health Research Ethics, Faculty of Medicine, University of Riau Number: B/021/UN.19.5.1.1.8/UEPKK/2020.

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