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Profile of Bacterial Types and Length of Stay in Burn Patients at Dr. Soetomo General Hospital in The Period of January – December 2015

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Abstract— Background: Burns are a global public health problem. Problems that are often found in burn patients are wound problems, infections, sepsis, and others. Infections can be caused by bacteria, virus and fungi. Infection in burn patients may trigger an increase in morbidity rates that lead to longer hospitalization and require greater costs. **Objective**: The aim of this study was to explore the correlation of the types of bacteria that infect burn patients and the length of stay of bacteria-infected burn patients. **Methods**: This study was a descriptive study by collecting data retrospectively of burn patients in period between January – December 2015 from patient medical record in burn center of RSUD Dr. Soetomo Surabaya.The data was analyzed using excel**. Results:** The number of patients collected was 61 patients, of whom 41 patients were infected with bacteria. Gram-negative bacteria is the most common infectant in burn patients among them are *Pseudomonas aeruginosa, Klebsiella pneumoniae, Acinetobacter baumanni, Enterobacter spp., Proteus spp.* and *Escherichia coli.* The length of stay of burn patients who infected with bacteria was twice longer that of uninfected burn patients. the average duration of treatment for uninfected burn patients was 0-10 days whereas the length of treatment period for infected burn patients averaged 11-20 days.

Keywords— Burn patient, length of stay, bacterial infection

1. Introduction

Burns are a global public health problem, each year deaths can be up to 265,000 people. This mostly occurs in low- and middle-income countries and almost half of the mentioned occurs in the South - East Asia Region. [1] According to the results of the Basic Health Research (Riskesdas) of the Republic of Indonesia in 2013 conducted by the Ministry of Health, the total prevalence of national injuries suffered by Indonesians is 8.2%, the cause of injury due to burns is 0.7% of the total national injury prevalence in Indonesia. [2]

Problems that are often found in burn patients are problems with wounds, infections, sepsis, and others. Sepsis and systemic inflammatory response syndrome (SIRS) are the most common causes associated with increased patient mortality. [3] Burn patients have a high risk of developing nosocomial infections, one of the causes is the effect of a decreased immune system in the body of burn patients and a long period of hospitalization. [4]

There are various types of burn infections, e.g wound colonization, wound infections, invasive infections, cellulitis and necrosis/fasciitis. [5] Typical pathogenic bacteria in burn patients are basically no different from normal flora in the surrounding environment. However, the microorganisms that causes infection can change during the treatment of burns, with gram-positive bacteria in the initial period replaced by gram-negative bacteria and fungi in the next period. [6]

The types of pathogenic bacteria that cause burn infections have changed from time to time. For example, at Shriners Hospitals for Children - Galveston, 42% of children died from sepsis due to infection with the Pseudomonas bacteria in 1989-1999. [7] From 1999 to 2009, 86% of patients also died of sepsis which was caused by Pseudomonas and other microorganisms, like *Acinetobacter* and *Klebsiella*. [8] Due to frequent changes in the pattern of germs that cause infection in burn patients, it is necessary to periodically evaluate the types of germs that infect burn patients so that they can determine the appropriate treatment strategy. [9] Patients with infection are expected to increase the length of stay in addition to increasing hospitalization costs, thereby increasing the risk of death. [10]

In the period from January to December 2015, the relationship between the types of bacteria infecting burn patients and the length of stay at Dr. Soetomo Surabaya has not been researched and analyzed so it is necessary to conduct research to be used as a strategy for burn care management in the future. The purpose of this study was to determine the correlation between the types of bacteria infecting burn patients and the length of stay in Dr. Soetomo Surabaya. Through this research, it is hoped that it can add information about what types of bacteria often infect burn patients and their length of stay at Dr. Soetomo General Hospital Surabaya.

2. Method

This type of research is a descriptive study by collecting data on the types of bacteria that infect burn patients and the length of stay in Dr. Soetomo General Hospital Surabaya retrospectively through patient medical records during the period from January to December 2015.

The population taken was patients with burns who were treated at the Burn Center Dr. Soetomo General Hospital Surabaya. The sample used was burn patients who were treated at the Burn Center Dr. Soetomo Surabaya in the period of January 2015 - December 2015 using the consecutive technique. The data collected included: patient's age, sex, patient's medical history, severity of burns, types of bacteria infecting burn patients, length of stay period. The data obtained will be presented in tables and diagrams.

3. Result

In this study, there were 61 patients. 41 patients were infected with bacteria and the remaining 20 patients were not infected with bacteria. The number of patients were 41 males and 20 females.

Table 1. Distribution of sex in burn patients

No	Sex	Total	%
1	Male	41	67
2	Female	20	33
	Total	61	100

Distribution of Age in Burn Patients

Table 2. Distribution of age in burn patients

No	Age Groups (years)	Total	%
1	Toddler (0-5)	7	11
2	Children (5-11)	7	11
3	Early adolescence (12-16)	2	3
4	Late adolescence (17-25)	5	8
5	Early adulthood (26-35)	15	25
6	Late adulthood (36-45)	12	20
7	Early senior (46-55)	6	10
8	Late senior (56-65)	5	8
9	Elderly (>65)	2	3
	Total	61	100

Table 3. Distribution of burn injury cause

No	Cause	Total	%
1	Fire	32	52
2	Scald	10	17
3	EIHV	10	17
4	Gas explotion	9	15
5	Chemical material	0	0
	Total	61	100

Table 4. Degree of burn injury

No	Degree of burn injury	Total	%
1	I	0	0
2	IIA	56	92
3	IIB	54	89
4	IIAB	2	3
5	III	15	25

From the table above, in 2015, the highest number of burn patients was IIA-degree burns with 56 patients or 92% and the least was found in IIAB-degree burns, which was only 2 patients or 3%. Patients with first degree burns were not found in Dr. Soetomo Surabaya.

Classification of Body Surface Area in Burn Injury

Table 5. Classification of Body Surface Area in Burn Injury (Percentage)

No	Body Surface Area	Total	%
1	0%-10%	10	16
2	10%-20%	10	16
3	20%-30%	9	15
4	30%-40%	14	23
5	40%-50%	2	3

6	50%-60%	6	10
7	60%-70%	4	7
8	70%-80%	1	2
9	80%-90%	4	7
10	90%-100%	1	2
	Total	61	100

From the table above, in 2015, the most number of burn patients with a burn area of 30% - 40% were 14 patients or 23% and the least were patients with a burn area of 70% - 80% and 90% - 100% which was 1 patient or 2% respectively.

Table 6. Distribution of history of illness in burn patients at Dr. Soetomo General Hospital Surabaya January – December 2015

No	Illness	Total	%
1	Hypertension stage I JNC VII	4	7
2	Hypertension stage II JNC VII	8	13
3	Cerebral infarction	1	2
4	Diabetes Mellitus type II	3	5
5	Hepatitis B	1	2
6	Hepatitis C	1	2
7	Epilepsy	3	5
8	Schizophrenia	1	2
9	Acute Kidney Injury	7	11
10	Myelitis Tuberculosis	1	2
11	Lung Tuberculosis	1	2

Table 7. Total distribution of burn patients with bacterial infection at Dr. Soetomo General Hospital Surabaya January – December 2015

No	Type of Infection	Total	%
1	Bacteria	41	67
2	Uninfected	20	33
	Total	61	100

From the table above, in 2015 there were 41 burns patients infected with bacteria alone or 67%, and 20 patients or 33% of burn patients were not infected with bacteria.

Distribution of Dominant Types of Bacterial Infection in Burn Patients

Table 8. Distribution of dominant types of bacteria infecting burn patients at Dr. Soetomo General Hospital period of January – December 2015

No	Type of Bacteria	Total	%
1	*Staphylococcus aureus*	3	5
2	*Pseudomonas aeruginosa*	15	25

3	*Acinetobacter baumannii*	21	34
4	*Klebsiella pneumoniae*	14	23
5	*Escherichia coli*	2	3
6	*Proteus mirabilis*	2	3

On the table above it is shown that in 2015, the most often bacteria infection in burn patients is caused by *Acinetobacter baumannii* with 21 patients or 34%, followed by *Pseudomonas aeruginosa* with 15 patients or 25%, then *Klebsiella pneumoniae* as with 14 patients or 23%. Staphylococcus aureus bacteria was found in 3 patients or 5%, as for *Escherichia coli* and *Proteus mirabilis* bacteria were found in 2 patients or 3%, respectively.

Table 9. Distribution of length of stay in uninfected burn patients at Dr. Soetomo General Hospital Surabaya January – December 2015

No	Length of Stay (days)	Total	%
1	0-10	10	16
2	11-20	6	10
3	21-30	2	3
4	31-40	1	2
5	41-50	0	0
6	51-60	0	0
7	>60	1	2

Table 10. Distribution of length of stay in burn patients with bacterial infection at Dr. Soetomo General Hospital Surabaya January – December 2015

No	Length of Stay (days)	Total	%
1	0-10	5	8
2	11-20	10	16
3	21-30	11	18
4	31-40	6	10
5	41-50	2	3
6	51-60	3	5
7	>60	3	5

On the table above, the length of stay period between uninfected burn patients and burns patients with bacterial infection can be compared, the least number of patients was treated within a period of 31-40 days and within > 60 days, given 1 patient each (2%).
Burn patients with bacterial infection mostly was treated in a span of 21-30 days, with 11 patients (18%) and the shortest period was within a period of 41-50 days, with 2 patients (3%).

4. Discussion

In this study, there were 61 burn patients, 41 men (67%) for men, while 20 (33%) women. This result is in

accordance with the study of Blom et al. In 2016 in South Africa, which found that the number of burn patients had more male than female. This is thought to be because men are more active in types of work that are at risk of getting burns. [11]

Based on age, it was found that the most burn patients were in early adults with an age range of 26-35 years, as many as 15 patients (25%). This result is in accordance with the results of research by Blom et al. In 2016 in South Africa, which stated that burns occurred in men> 20 years old.

The most common cause of burns was fire, with 52% or 32 cases. The results of this study are different from the results of research by Li et al. In 2017 in China which stated that hot water (scald) was the most common cause of burns. The two most common causes of burns are scald and fire. These differences in results indicate that the etiology of burns varies widely which can be influenced by other factors, for example the location of the incident and the population of a country. [12]

Based on the results of the study, the degree of burns was mostly found in Dr. Soetomo General Hospital Surabaya is IIA-degree burn with 56 cases or 92%, and IIB-degree burn with the percentage of 89% or 54 cases. The results of this study differed from the results of research by Li et al. In 2017 in China which stated that third degree burns were the most common. This difference can be caused by several factors, one of which is the type of burns. The results of research at Dr. Soetomo General Hospital Surabaya shows that the total area of burns in patients is 30-40%, which the the percentage of 23% or 13 patients. The results of this study are different from the results of research by Li et al in 2017 in China which stated that the most number of patients were patients with burn area of ≤ 10. Factors that can cause differences in the results of this study occur because of other factors that trigger burns, one of which is the cause of burns.

There are several types of bacteria, especially gram-negative bacteria that often infect burn patients, especially in hospitals, that is *Pseudomonas aeruginosa, Klebsiella pneumoniae, Acinetobacter baumanni, Enterobacter spp., Proteus spp.* and *Escherichia coli.* [13] Infection from these bacteria predominates, especially during burn surgery or during the wound cleaning to remove necrosis or debris in the patient's body (debridement). [14]

In this study, the type of bacteria that often infects burn patients is gram-negative bacteria, namely *Acinetobacter baumanni* with the percentage of 34% or 21 patients, *Pseudomonas aeruginosa* with the percentage of 25% or 15 patients. *Klebsiella pneumoniae* has 23% or 13 patients. There are also types of gram-positive bacteria that can infect burn patients, which is *Staphylococcus aureus* with the percentage of 5% or 3 infected patients, then *Escherichia coli* and *Proteus spp.* which infected 2 patients or as much as 3%, respectively. Azzopardi et al's study in 2014 in England also found that the types of gram-negative bacteria that often infect burn patients, especially those treated in hospital are *P. aeruginosa, K. pneumoniae, E. coli, Enterobacter spp.* and *Proteus spp.* [15]

The length of stay period for uninfected burn patients is 0-10 days, which is 16% or 10 people. The percentage of patients infected with bacteria for 21-30 days is 13% or 11 people.
Based on the results of research by Li et al in 2017 in China, the percentage of length of stay for burn patients in the hospital is 17 days and this result is obtained from various factors, for example from gender, age, TBSA, degree of burns, number of operations. and various other etiologies. Based on research by Erol et al. these criteria can be a risk factor for burn patients to undergo longer treatment in the hospital or affect the length of

stay (LOS) of these burn patients.

One of the reasons for burn patients being treated longer in the hospital is that the patient is infected with microorganisms in the hospital, for example bacteria and fungi. [16] Burn patients with colonization of pathogenic microorganisms especially those resistant to several types of drugs are a major risk factor and will underlie other emerging diseases and these patients will experience immunosuppression and cause the patient to stay in the hospital longer. [17]
Other factors that cause the patient to stay longer in the hospital are the extent of burns, the degree of burns severity, the patient's medical history. [18]

5. Conclusion

1. The type of bacteria that often infects burn patients is the gram negative type, namely *Pseudomonas aeruginosa, Klebsiella pneumoniae, Acinetobacter baumanni, Enterobacter spp., Proteus spp.* and *Escherichia coli.*
2. The average length of stay period for uninfected burn patients at Dr. Soetomo General Hospital Surabaya is 0-10 days.
3. The average length of stay period for burn patients with bacterial infection at Dr. Soetomo General Hospital Surabaya is 21-30 days.
4. Burn patients with bacterial infection at Dr. Soetomo General Hospital Surabaya hospitalized 2-3x longer than uninfected burn patients.

6. References

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