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Clinical Profile of Multidrug-Resistant Organisms at Burn Center Dr. Soetomo General Hospital Surabaya from June 2020 to June 2021

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ABSTRACT

Background: Burns are an ideal environment for primary wound infection to occur. Burn infection can lead to the acquisition of Multidrug-Resistant Organisms (MDRO) with certain risk factors, such as the cause, degree and total body surface area (TBSA) of burns, length of stay, and invasive procedures performed. This study aims to determine the clinical profile of burn patients who experience MDRO. ***Method:*** Data was taken using medical records at the Burn Center Dr. Soetomo General Hospital Surabaya during June 2020 - June 2021 with a descriptive study and a cross sectional approach. ***Result:*** A total of 67 burn patients were included in this study. Sixteen patients were found to have burns with MDRO, and 51 other patients only had burns without MDRO which was excluded in this study. Patient in this study were dominated by men with a total of 11 patients (68.8%), most patient were in the 19–45-year age group of 8 patients (50%) with an average of 35 ± 20.58 years, and length of stay >14 days in 11 patients (68.8%) with an average 32,75 ± 38.31 days. All patients had invasive procedures performed. Fire was the most common cause of burns, namely in 9 patients (56.3%). Severe burns occurred in 16 patients (100%) of the MDRO burns studied. Eleven patients (68.8%) had TBSA > 30% with an average of 37.06% ± 18.59%. Acinetobacter baumannii was the most MDR bacteria cultured in this study with 15 cultures (32.6%). It is followed by Pseudomonas aeruginosa with 9 cultures (19.6%) and Klebsiella pneumoniae with 4 cultures (8.7%). A. baumannii is most commonly found in blood cultures, followed by cultures of phlegm and wounds. This is in contrast to P. aeruginosa with the most findings in wound cultures, followed by cultures of sputum and blood. ***Conclusion:*** Our study shows that MDRO infection is still a matter of concern in burns. Even so, the number of samples should be increased to see the significance and the relationship between variables in future burn studies.

Keywords: burn; MDRO; infection

INTRODUCTION

Burns are traumatic lesions caused by several agents such as thermal, chemical, mechanical, or electrical in the skin layer to a certain degree [1]. The World Health Organization (2) estimates that more than 300,000 people die each year from fire-related burns worldwide. Burns are becoming an ideal environment for primary wound infections to occur, and existing interventions have increasingly allowed burn victims to survive early physiological disorders that contribute to the risk of pneumonia, urinary tract infections (UTIs), and bloodstream infections [3, 4].

Burn patients have lost the main protection of the body against infection, namely the skin. In addition, large burns can cause immunosuppression that reduces the cellular and humoral defenses of infection [5]. MDRO can occur in burns due to improper handling of the infection. Multidrug-resistant (MDR) is a condition in which bacteria are resistant to at least one type of antibiotic from ≥3 antibiotic groups [6]. This can be caused by biological processes as well as social stresses, such as improper use of antibiotics, inadequate diagnosis, as well as the use of high doses of antibiotics in sick patients. In 2009, Indonesia was ranked 8th out of 27 countries with the highest multidrug resistant predicate in the world [7]. Infections caused by MDRO will provide worse clinical outcomes, such as treatment failure, economic impacts such as increased cost of care, to death, when compared to other infections.

Research on MDRO risk factors in burns shows that burn duration is the main factor of MDRO infection in addition to the size of the burn and the presence of inhalation injuries. Wanis et al. [8] found an increase in MDRO species isolated from 125 patients in the first 7 days by 6% to 44% after 28 days of hospitalization. Burns caused by fire and a total body surface area (TBSA) of more than 35% are significant risk factors in developing nosocomial infections caused by MDRO [9].

Research on the profile of multidrug-resistant organisms in burn patients at the Burn Center of Dr. Soetomo General Hospital during June 2020 – June 2021 has not been available and analyzed. With the increase in MDRO cases in high burns, this study is expected to help health workers to become reference data so as to prevent the incidence of MDRO in burns according to data recorded in medical records in the future. Based on this, it is necessary to conduct research to describe the profile of the spread of MDRO in burns aimed at management and research on burns and MDRO in the future.

METHOD

This study uses a descriptive study with a cross-sectional approach, namely a study that studies the dynamics of the correlation between several risk factors by means of approach, observation, effects, and data collection at the same time in a certain time span [11] using medical record data of burn patients who have MDRO at the Burn Center of Dr. Soetomo Hospital Surabaya for the period June 2020 – June 2021.

Sixty-seven burn patients were obtained during this study. According to the inclusion criteria, the research sample is required to be a burn patient with a positive MDRO culture at Dr. Soetomo General Hospital Surabaya from June 2020 – June 2021 who has a complete medical record. This excluded 51 burn patients without MDRO culture. Sixteen of burn patients with MDRO were recorded and analyzed with the Microsoft Excel program. The medical record data to be extracted is in the form of several variables, such as demographic profile (gender, age, length of stay, mortality rate), burn profile (cause, degree, and TBSA), and MDR bacterial profile.

RESULTS

The data in this study used medical record data of burn patients who had multidrug-resistant organisms (MDRO) at Dr. Soetomo Hospital Surabaya during June 2020 to June 2021. Data in the form of the patient's age, gender, cause of burn, degree of burn, extent of burn, hospitalization, invasive procedures performed, and the type of bacteria cultured in the patient. Total of medical record data obtained was 67 patients.

TABLE 1: Demographical profile of burn patient with MDRO.

Variables	Frequencies n = 16 (%)
Age	
0-18 years	4(25)
19-45 years	8 (50)
46-60 years	3 (18.8)
>60 years	1 (6.3)
Average (Mean ± SD)	35 ± 20,58
Sex	
Male	11 (68.8)
Female	5 (31.3)
Length of Stay	
0-7 days	2 (12.5)
8-14 days	3 (18.8)
>14 days	11 (68.8)
Average (Mean ± SD)	32,75 ± 38,31
Invasive Procedure	
yes	16 (100)
no	0
Mortality	
recovered	13 (81.25)
death	3 (18.75)

Demographic Profile

The results of the medical record study showed that there were 11 men (68.8%) and 5 women (31.3%) who suffered burns with MDRO. The age of patients consists of the toddler to elderly group, ranging from 1 to 62 years with an average patient age of 35 ± 20.58 years. From this study, it was found that the length of stay of patients ranged from 4 days to 161 days. This length of time is categorized into, 0-7 days, 8-14 days, and more than 14 days. It was found that 2 patients (12.5%) had a stay in the 0–7-days group, 3 patients (18.8%) in the 8–14-days group, and 11 patients (68.8%) in the >14-days group.

In the 16 patients who were the data of the study, it was found that all patients experienced invasive procedures, such as the installation of a urinary catheter, endotracheal tube, wound surgery, debridement and wound dressing, and the installation of a central venous catheter. The mortality rate of this study showed that as many as 13 patients (81.25%) recovered and 3 patients (18.75%) died.

The degree of severe burns, TBSA >30%, and the implementation of invasive procedures are obtained in all patients who died.

TABLE 2: Burn profile.

Variables	Frequencies n = 16 (%)
Etiology	
Scald	4 (25)
Flame	9 (56.3)
Direct	1 (6.3)
Electrical	2 (12.5)
Burn Degree	
Mild	0 (0)
Moderate	0 (0)
Severe	16 (100)
TBSA	
0-10%	3 (18.8)
11-20%	1 (6.3)
21-30%	1 (6.3)
>30 %	11 (68.8)
Average (Mean ± SD)	37,06 ± 18,59

Burn Profile

Burn is caused by several things such as hot water, contact, fire, and electricity. The most common cause found in patients was fire in 9 patients (56.3%). Hot water was the second most common cause of 4 patients (25%). Electricity was the next cause with 2 patients (12.5%) followed by contact with 1 patient (6.3%). In all patients (100%) severe burns were obtained. The area of burns has a variation from 0% to more than 30%. 11 patients (68.8%) suffered burns with an area of >30%. A total of 3 patients (18.8%) suffered burns with an area of 0-10% and a burn area of 11-20% and 21-30% each of 1 patient (6.3%).

Bacterial Profile

MDRO is cultured from several locations in patients, such as wounds, sputum, to urine. There were 46 bacterial cultures that tested positive for MDRO. MDRO culture is derived from blood cultures, namely 21 blood cultures, 15 wound isolates, 7 sputum cultures, and 3 urine cultures. In this study, *Acinetobacter baumannii* bacteria became the most culture, namely 15 isolates (32.6%). Other MDR bacteria were followed by *Pseudomonas aeruginosa* as many as 9 isolates (19.6%), *Klebsiella pneumoniae* as many as 4 isolates (8.7%), *Staphylococcus haemolyticus* and *Enterococcus faecalis* as many as 3 isolates each (6.5%), and *Staphylococcus epidermidis* as many as 2 isolates (4.3%). Each of the other MDR bacteria such as *Demacoccus nishinomiyaensis, Staphylococcus lentus*, *Staphylococcus hominis, Stenotrophomonas maltophilia, Corynebacterium striatum, Corynebacterium mycolatum, Corynebacterium jeikeium, Enterobacter cloacae, Providencia stuartii*, and *Providencia rettaeri* had as many as one isolate (2.2%) at the time of culture.

DISCUSSION

The total sample in this study was 67 patients. After examining the data, 16 patients were found to be included in the inclusion criteria, namely burn patients with MDRO. Fifty-one patients were excluded in this study.

This exclusion sample was a burn patient without MDRO. The absence of microbiological swab results in burn patients is a factor in the exclusion of medical record data that has been studied. In the study of burn patients with MDRO at the Burn Center of Dr. Soetomo General Hospital during June 2020 – June 2021, there were 11 men (68.8%) and 5 women (31.3%).

This suggests that more incidence occurs in males. This discovery is consistent with previous research on burn-related infections in Saudi Arabia [11]. The incidence of burns in adult males generally occurs in open spaces or workplaces, while in women it generally occurs at home.

TABLE 3: Bacterial profile of burn patient with MDRO.

Pathogens	Wound n = 15	Sputum n = 7	Blood n = 21	Urine n = 3	Frequencies n = 46 (%)
Acinetobacter baumannii	3	4	7	1	15 (32.6)
Pseudomonas aeruginosa	7	1	1	0	9 (19.6)
Klebsiella pneumoniae	0	0	2	2	4 (8.7)
Staphylococcus haemolyticus	0	0	3	0	3 6.5)
Enterococcus faecalis	0	0	3	0	3 (6.5)
Staphylococcus epidermidis	0	0	2	0	2 (4.3)
Dermacoccus nishinomiyaensis	1	0	0	0	1 (2.2)
Staphylococcus lentus	0	0	1	0	1 (2.2)
Stenotrophomonas maltophilia	0	1	0	0	1 (2.2)
Corynebacterium striatum	0	1	0	0	1 (2.2)
Enterobacter cloacae	1	0	0	0	1 (2.2)
Providencia stuartii	1	0	0	0	1 (2.2)
Corynebacterium jeikeium	0	0	1	0	1 (2.2)
Providencia rettgeri	1	0	0	0	1 (2.2)
Corynebacterium mycolatum	1	0	0	0	1 (2.2)
Staphylococcus hominis	0	0	1	0	1 (2.2)

This can be due to several things, such as men wearing looser clothing and causing skin exposure, a generally greater number for driver and outdoor workers who are generally men than women [12].

The age of patients consists of the toddler to elderly group, ranging from 1 to 62 years with an average patient age of 35 ± 20.58 years. The age group of burn incidence with MDRO was highest in the group of 19-45 years (50%). Research conducted by Gupta, Naik and Singh [13] states that the most group is in the age group of 16-30 years (35.67%) followed by the age group of 31-45 years (22.7%). Another study showed the highest age of patients in the 15–39-year group (52.8%) and followed by the 40–59-year group (27.8%) [14].

Invasive procedures have been performed on all patients studied. This can be a risk of infection in burn patients due to repeated surgical procedures, catheter use, as well as prolonged hospitalization [15]. The longest length of stay was in the >14-day range in 11 patients (68.8%) having an average of 32.75 ± 38.31%. Another study had a median length of stay (LOS) in 47 MDRO burn patients was 39 days with a range of 19-74 days [16]. The length of stay in another study was found to have an average of 16.1 days with a range of 3-55 days [17].

There are several causes of burns obtained in this study. The most common causes in this study were fire in 9 patients (56.3%), hot water in 4 patients (25.0%), electricity in 2 patients (12.5%) and contact in a patient (6.3%). Research by Putra et al. [18] also stated similar findings, namely that the most common causes of burns were fire at 57.0%, scald at 29.0%, and electrical injury high voltage (EIHV) at 14.0%. In a different study, Putra et al. [17] found fire as the cause of the most burns at 70% followed by EIHV at 21% and hot water at 9%.

All patients in this study suffered severe burns. The Burn Surface Area (TBSA) >30% was the most common finding in this study, namely in 11 patients (68.8%) with an average of 37.06 ± 18.59%. Research by Chen et al. [19] states that the average burn area or total body surface area (TBSA) is 46.1% ± 29.1% with the highest TBSA range at 50-59%. In another study, it was found that the broad range of burns was 20-73% with an average of 24.5 ± 19.73% [18]. Güldoğan et al. [14] found the TBSA range of >30% to be in the range of 30-94% with an average of 57.72 ±16.2%.

The number of patients who died in this study was 3 patients (18.75%) out of a total of 16 patients studied. All burn patients who died in this study had severe burns, TBSA >30%, and positive invasive procedures. Ellithy et al. [20] found six patients (18.2%) burn died in the MDRO infection group and four patients (16%) burned died in the non-MDRO infection group. Another study showed the mortality rate in burn patients infected with TBSA >30% was 11 patients (30.56%) [14]. A cohort study conducted over 3 years showed that the mortality rate of burn patients with MDRO had a total of 15 patients (21.4%) out of a total of 70 patients [21].

In this study, 46 bacteria were cultured from 16 burn patients with MDRO. All patients had at least one MDRO bacterium ever cultured. All bacteria found in this study are the result of microbiological discoveries in patient medical record data. Acinetobacter baumannii became the most bacteria isolated with 15 isolates (32.6%). Pseudomonas aeruginosa became the second most culture with 9 isolates (19.6%) followed by Klebsiella pneumoniae with the third most with 4 isolates (8.7%).

A study showed that Acinetobacter baumannii and Pseudomonas aeruginosa became the most common bacteria found in intensive care unit (ICU) burns [22][19][11]. The high prevalence of Acinetobacter baumannii in this study was associated with the fact that isolates of this bacterium were high in respiratory secretions and humid environments [23]. Acinetobacter baumannii was found to be the most bacteria (53%) in another study conducted by Keen, E.F. et al. [24] Studies from 2008 to 2012 reported the percentage of Acinetobacter baumannii as the cause of MDR was 90.8% [3, 25]. A similar study in 2018 at Dr. Soetomo General Hospital showed that the most common bacteria found were Acinetobacter baumannii (12%) and Bacillus cereus (12%) [26].

Other studies have shown different results. Chen et al. [19] found the most commonly isolated species were Staphylococcus spp. with 75 isolates (22.4%) and Acinetobacter spp. with 63 isolates (18.8%). Pseudomonas aeruginosa and Stenotrophomonas maltophilia became annual MDROs isolated in severe burn patients compared to other bacteria such as Acinetobacter, CRE, and ESBL species at the Victorian Adult Burn Service, Alfred Health, Melbourne, Australia [27].

The most MDRO cultures in this study came from blood (21 isolates). This is different from other studies in Australia with the most isolates coming from wound cultures (323 isolates), followed by respiration samples (21 isolates), blood cultures (13 isolates), and urine cultures (12 isolates) [27]. Another study showed the most positive MDRO isolates came from wound cultures with 48 patients (57.8%), followed by blood cultures of 64 patients (25.6%) [11]. Seven-year retrospective studies show the most common source of infection is pulmonary infection, followed by bloodstream infection and wound infection [28].

The research we did had some limitations. First, the research sample obtained is relatively small. The absence of bacterial culture in burn patients can be the cause of this. Generally, bacterial culture is carried out on burn patients with a stay of more than 14 days. Second, with incomplete medical record data, variable amounts of antibiotic consumption in burn patients were not included in the study. Third, the study also did not explain the findings of MDRO bacteria in burn patients and their correlation with the variables studied, such as patient demographic profile, length of hospitalization, cause of burn, degree of burn, and extent of burn. This can also be due to the lack of a number of samples that can be studied.

CONCLUSION

Our study shows that MDRO infection is still a matter of concern in burns. The clinical profile of burn patients with MDRO has been presented. Most MDRO acquisitions are found in burn patients with male sex who belong to the age group of 19-45 years. The burns that occur in patients are severe burns with a relatively extensive TBSA. The findings of the Acinetobacter baumannii are an unusual finding in burn patients, because generally the bacterial findings are Staphylococcus spp. Even so, the number of samples should be increased to see the significance and the relationship between variables in future burn studies.

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