

Profile of Burn Patients with Cefuroxime Antibiotic Administration at Dr. Soetomo General Hospital in March 2021 – February 2022

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Abstract

Background: Infection is one of the biggest causes of mortality and morbidity in patients with burns, so the use of antibiotics is very important. Inappropriate use of antibiotics in burn patients can lead to antibiotic resistance. Cefuroxime is a type of antibiotic that used for burn patients in Dr. Soetomo general hospital as the new policy since March 2021. Therefore, there is a need for studies related to cefuroxime antibiotics in burn patients. **Objective:** This study aims to determine the profile of burns patients that given cefuroxime at Dr. Soetomo general hospital in the period of March 2021 – February 2022. **Method:** This study was a retrospective study with cross-sectional observational data collected from patient medical records. **Results:** There were 19 patients in total and this study was dominated by male (58%) and late adults (36-55 years) around 37%. The length of stay of patients was dominated in the range of 15-21 days (37%) and for %TBSA (Total Body Surface Area) dominated by %TBSA ≤ 10 and %TBSA 20.1-30 with 26%. The cause of burns that had the highest number of patients were due to flame and scald with 42% and all the patients had the major burn severity. The outcome showed that most of the samples survived with total 15 patients (79%) and 4 patients (21%) did not survive. The most common causative agent of infection was *Pseudomonas aeruginosa* (100%). **Conclusion:** There were a total of 19 patients with patient characteristics dominated by the male gender, late adulthood, length of stay 15-21 days, fire etiology and %TBSA ≤ 10 and %TBSA 20.1-30. Overall, the most common causative agent of infection was *Pseudomonas aeruginosa* (100%).

Keywords: Burns, Cefuroxime, *Pseudomonas aeruginosa*

1. Introduction

Burns are injuries to the body organ tissues, especially the skin that are mainly caused by heat due to electricity, radioactivity, radiation, friction and contact with chemicals. According to WHO [1], burns cause around 180,000 deaths each year and most of them occur in low to middle-income countries. In Indonesia there has been an increase in the incidence of burns around 35% from 2014 to 2018 and this incident causes around 195,000 deaths each year. Previous study at Dr. Soetomo general hospital in 2011 showed that out of 145 patients, 127 patients (87.6%) were recovered and 15 patients (10.3%) died [2].

Severe burns can induce response that affects almost all body organ systems and infection is one

of the biggest causes of mortality and morbidity in patients with burns. *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii* and *Klebsiella pneumoniae* are four types of multi-resistant bacteria that often infect burn patients by contributing 65-80% of positive results in patient's wound swab cultures [2]. Antibiotic therapy should be administered immediately after the diagnosis of infected or septic burn patients is made because if bacteremia and sepsis occur in succession, the mortality rate will increase rapidly. Seventy five percent of patients with extensive burns die from severe infections [3].

Antibiotics in the treatment of burns are important as a prevention and treatment of microbial infections [4]. Cefuroxime is an antibiotic that has been used in burn patients at Dr. Soetomo general hospital as the new policy. Cefuroxime is a second-generation cephalosporin antibiotic that has a broad spectrum that can active against gram-negative and gram-positive [5]. This generation of cephalosporins is generally recommended for burn patients because it has relatively good effectiveness, much cheaper and does not promote drug resistance [6]. However, there were limited studies regarding the administration of this type of antibiotic, even though the administration of antibiotics to burn patients must be used properly to avoid various complications. Therefore, study of the use of cefuroxime in burn patients is needed so that it can be considered as a management strategy in the care of burn patients.

2. Materials and Method

This study used a retrospective descriptive design based with total sampling technique on medical records of burn patients at Dr. Soetomo general hospital from March 2021 – February 2022. The inclusion criteria were inpatients that used cefuroxime with complete medical records data and this study has received ethical approval from Dr. Soetomo general hospital. All cases were obtained according to the variables, analyse with descriptive technique, and served as tables.

3. Result

This research was conducted at the Dr. Soetomo General Hospital Surabaya, Indonesia and taken from the medical records of burn patients who were given cefuroxime for 7 days and there were 19 samples that met the inclusion criteria for this study.

Table 1. Characteristic of Burn patients at Dr. Soetomo General Hospital Surabaya

	Frequency (n)	Percentage (%)
Sex		
Male	11	58
Female	8	42
Age		
0-7 days	3	16
8-14 days	3	16
14-21 days	7	37
>21 days	6	31
Length of stay		
0-14 years	6	32

15-35 years	5	26
36-55 years	7	37
>55 years	1	5
%TBSA		
≤ 10%	5	26
11-20%	3	16
21-30%	5	26
31-40%	3	16
>40%	3	16
Etiology		
Flame	8	42
Scald	8	42
Electric	3	16
Burn Severity		
Minor	0	0
Moderate	0	0
Major	19	100
Outcome		
Survivors	15	79
Non survivors	4	21

The results showed that most of the samples were male with 11 patients (58%) and only 8 patients (42%) for the female. The majority of the patient's age data was found in the 36-55 years old group (37%), followed by 0-14 years old group (32%), 15-35 years old group (26%) and >55 years old group (5%). For the length of stay, distribution was dominated by 14-21 days (37%), then followed by >21 days (31%). The group range of 0-7 days and 8-14 days showed the same result with 3 patients (16%) for each group. The majority of the patient's %TBSA data was found in the range of ≤ 10% and 21-30% with 5 patients (26%) for each group, followed by 11-20%, 31-40% and >40% with 3 patients (16%) for each group. Most of the patient's etiology distribution were dominated by flame and scald with 8 patients (42%) and then followed by electric with only 3 patients (16%). All the patients had major burn severity with most of the samples were survived with total 15 patients (79%) and 4 patients (21%) were not survived.

Table 2. Result of burn patient's wound swab culture at Dr. Soetomo General Hospital Surabaya

Result	Frequency (n)	Percentage (%)
Negative microbe growth	14	73.7
Positive microbe growth	5	26.3
<i>Pseudomonas aeruginosa</i>	5	100

The results showed that from 19 patients, only 5 patients (26.3%) showed positive microbe growth on the wound swab culture and 14 patients (73.7%) showed negative microbe growth. The wound swab culture was taken 7 days after the patient used cefuroxime and from 5 patients which had microbe growth on the wound swab culture, all of them were caused by *Pseudomonas*

aeruginosa (100%).

4. Discussion

This study showed that 58% of the patients were male and 42% were female. Previous study conducted in Gilan province, Iran also showed the same result, the number of male patients was greater than women with the proportion of men was 61.87% and women was 38.13% [7]. A study conducted at Saiful Anwar Hospital, Malang also showed 61.1% of the burn patients were male and 39.9% of the burn patients were female [8]. This is occurred because basically male tend to be more active and usually male jobs have higher risk than female, so they are more often exposed to burn triggers. In addition, violence and the consumption or use of alcohol/other flammable substances are examples of risk behaviors that are socially associated with male gender practices [9,10].

Based on the data, this study was dominated by late adult age group with range 36-55 years old (37%) and the elderly age group had the lowest number of patients (5%). The study conducted in Dr. Soetomo General Hospital in 2014 had the same result, they showed that burn patients dominated with adults (76.9%) and the elderly had the fewest patients (3.9%) [11]. The high cases of adult patients can be explained based on the fact that generally adults tend to have more activities, so they are easily exposed to dangerous situations at work [12] and elderly do not do lots of activities and usually spend their time at home.

The results of this study showed that the length of stay range was dominated by patients who were treated for 15-21 days (37%) followed by patients who were treated for >21 days with 6 patients (31%). The range of length of stay 0-7 days and 8-14 days had the same number of patients and both had the lowest percentage with only 3 patients (16%) for each range. These results have the same result with research conducted at Dr. Soetomo general hospital in 2016 which stated that the length of stay 15-21 has the largest percentage (42%) [13]. This is occurred because 15-21 days was the ideal time for monitoring patient's condition after burn injuries.

This study showed that the most dominant %TBSA were in the %TBSA $\leq 10\%$ and 21-30% with 5 patients (26%) for each range. Followed by 3 other ranges that have the same percentage, range 11-20%, range 31-40% and >40% range with 3 patients (16%) for each range. Previous study conducted in Southwest Hospital, China period 2011 – 2015 showed that the %TBSA was dominated by the range 0-10% (64.1%) [9]. Another research conducted at Jimma Medical Center in 2021 showed slightly different results. This study showed that %TBSA was dominated by the range of 10-20% (55.67%) [14]. A study conducted at the Viet Nam National Burn Hospital in the 2016 – 2018 period also showed different results. This study was dominated by the %TBSA range >20 of 81.4% [15]. Significant differences between this study and other studies most likely due to differences in etiology and environmental conditions in each region or country. In this study, the most dominant etiology was an explosion of LPG (Liquefied Petroleum Gas) and hot liquid which both etiologies usually make higher %TBSA. In addition, the accuracy of %TBSA measuring is also still being studied further. In pediatric and obese patients, overestimation and underestimation often occur, so an accurate %TBSA needs to be considered [16].

The results of this study showed that the cause of burns with the highest number of patients were due to flame and scald with 8 patients (42%) and followed by electric which was obtained in 3 patients (16%). Research conducted in the province of Al-Diwaniyah, Iraq in 2019 had the same results, showed that the most causes of burns was fire (45.7%) and followed by scald (40.1%) [12].

Another study conducted at University Hospital San José, Colombia in the period 2000 – 2010 also stated that the 2 main causes of burns were scald (49.3%) and fire (34.3%), followed by electric (7.7%) [17]. In the medical record data of this study, burns caused by flame and scald generally occur because of household activities. LPG leakage is the most common cause of burns in adults and all pediatric burn patients in this study were caused by scald in the form of hot water or hot oil. Children basically do not understand dangerous situations and parents who are negligent make burns caused by liquids common occurrence in society. Neglectful parents or caregivers may allow children to play around in the kitchen and the child may be exposed to hot liquids from food [18].

This study showed that all the patients had major burn severity with 15 patients (79%) were survived and 4 patients (21%) did not survived. 3 patients died due to sepsis preceded by infection and 1 patient died due to inhalation trauma. Research conducted at the same hospital in 2014 showed that the mortality rate was 35% [11], higher than this study that conducted in 2022. The mortality rate of burns in Indonesia is still quite high because it is still above the average according to several studies in other countries. The mortality rate reported from previous studies is around 6.8 – 18.8% and the main causes of death from burns are sepsis, shock, acute respiratory distress syndrome, multi organ failure, acute renal failure and cardiac arrhythmias. The causes of high cases of death from burns can depend on the extent of the burn, inhalation involvement and the age of the patient [19].

Out of 19 burn patients who had been given cefuroxime for 7 days, 5 patients (26.3%) were positive for microbial growth. This percentage (26.3%) was higher than other studies conducted in Turkey in the period of 2014-2015 (10.3%) [20]. All infections were caused by the same causative agent, gram-negative bacteria called *Pseudomonas aeruginosa*. This result is different from previous research conducted at the same hospital in 2016. That study stated that the most dominant microorganism based on culture results was *Acinetobacter baumannii* (50%) and only 1 patient was positive for *Pseudomonas aeruginosa* (12.5%) [13]. This shows that there is a shift in the dominance of microorganisms that cause burn infection in Dr. Soetomo general hospital from *Acinetobacter baumannii* in 2016 to *Pseudomonas aeruginosa* in 2022. *Pseudomonas aeruginosa* is also the most common source of burn infection in the United States and Iraq [21]. *Pseudomonas aeruginosa* carries many intrinsic and acquired antimicrobial resistance properties that make infected burns more difficult to treat [22]. Out of 5 patients who had infection, 2 patients survived (40%) and 3 patients did not survived (60%) due to sepsis. This mortality rate is higher than a study conducted at burn units, Parkland Memorial Hospital in 1998-2000 that showed the mortality rate of burns patients who had infection was 36% [23].

5. Conclusion

Based on this study, profile of the burn patients with cefuroxime antibiotic administration at Dr. Soetomo general hospital Surabaya in March 2021 – February 2022 was dominated by male patients (58%), late adulthood with range of 36-55 years old (37%), length of stay 15-21 days (37%), burns caused by flame and scald (42%) for each etiology and %TBSA ≤ 10 & %TBSA 20.1-30 with 26% for each range and all patients had major burn severity. The outcome showed that most of the samples survived with total 15 patients (79%) and 4 patients (21%) did not survive. Overall, only 5 patients (26.3%) had positive results on the culture and all of them were caused by the same microbe, *Pseudomonas aeruginosa* (100%).

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