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The Incidence Pattern of Electrical Burns at the Department of Plastic Surgery Dr. Soetomo General Academic Hospital, Surabaya, from January 2014 to December 2017

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ABSTRACT

Introduction: Burns are direct or indirect damage to the skin tissue and can reach internal organs. This study aimed to investigate the incidence pattern of electrical burn patients at the Department of Plastic Surgery Dr. Soetomo General Academic Hospital, Surabaya, from 1 January 2014 to 31 December 2017, focusing on the age, gender, and occupation aspect of the patients.

Methods: This was a descriptive retrospective study evaluating 50 patients treated for electrical burns from 1 January 2014 to 31 December 2017 using the patients' medical records. The parameters assessed were age, gender, occupation, cause of injury, and annual incident. The data was collected from the medical records Dr. Soetomo General Academic Hospital, Surabaya.

Results: Most electrical injuries occurred in May, as many as 12 (24%) patients. There were 49 (98%) male and 1 (2%) female patients. The patients ranged from 8–60 years old, with 17 (34%) patients in the 26-35 age group. 76% of patients were private employees. Work accidents caused approximately 82% of electrical injuries.

Conclusion: There was a significant association between electric burns with males at productive age and working as private employees. Many electric accidents occurred while working, especially in May.

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Introduction

Burns are direct or indirect damage to the skin tissue and can reach internal organs, caused etdirect contact with heat sources, namely fire, water, steam, chemicals, radiation, electric current, and very cold temperatures.[1] The weight of a burn is determined by the depth of the burn, the extent of the burn, and the location of the burn. Severe burns can cause relatively high morbidity and disability compared to other injuries. The costs required for handling it are also high because burns result in skin integrity loss and cause a very complex systemic effect.[2]

The cause of most burns is burning by direct fire. Nevertheless, the most severe effects of burns are caused by electricity and lightning, followed by chemicals (acids or bases), fire, hot oil, and hot water.[3] Electric burns are injuries that occur when an electric current flows through the body, and there is a surge, or because of a high-voltage explosion, such as lightning. This can cause direct tissue damage and disruption of function in the internal organs of the body.[1]

The severity of electrical burns can be seen from the voltage (voltage) intensity, the direction of electric current, the amount of current (ampere), network resistance, network capacity, the path through which the current flows, duration during contact, and environmental factors.[4] Electrical trauma burns have its unique quality. Although burns on the skin appear mild, tissue damage is more severe. This damage is progressive over time. Burns, both due to high and low electrical stresses, have high morbidity and mortality, but the progression of tissue damage due to low voltage runs slower.[4–6] During electric shock, the human body acts as a conductor. Electric energy changes to thermal energy, and muscle and bone can be damaged in addition to the skin and soft tissue.[5]

Electrical burn injuries account for 3%–5% of all thermal burn patients. However, they show variable clinical manifestations from small superficial-thickness burns to massively destroyed underlying structures.[5] The incidence of electrical trauma has been increasing lately and is also described by many sources, and some of the most popular topics of description are age, sex, and occupation. This study retrospectively analyzed electrical burn cases and evaluated epidemiological variables to identify preventable measures and to increase the awareness and quality of care given to electrical burn victims in the future and ultimately lower the health risk caused by electrical injuries through the parameters previously mentioned.

Methods

This was a descriptive retrospective study conducted at the Department of Plastic Surgery Dr. Soetomo General Academic Hospital, Surabaya, from 1 January 2014 to 31 December 2017. The population studied were all electric burns patients treated at the Department of Plastic Surgery Dr. Soetomo General Academic Hospital who met the criteria. The total sample of electric burns patients was 51 patients. In the end, the total sample size taken was 50 samples. The sampling technique used was a consecutive sampling method. Data were processed using Microsoft Excel 2016.

Criteria for inclusion in this study were all patients who suffered from electric burns. The data were obtained from the medical records Dr. Soetomo General Academic Hospital, Surabaya, from 1 January 2014 to 31 December 2017. Data were analyzed with descriptive statistics and presented in tables and diagrams. This study had obtained ethical approval by Ethical Committee for Health Research Dr. Soetomo General Academic Hospital, Surabaya.

Results

The result showed that out of the 50 samples taken from the medical records, there were 49 (98%) male and 1 (2%) female patients. The patients ranged from 8– 60 years old, with 17 (34%) patients in the 26-35 age group. 76% of patients were private employees. Work accidents caused approximately 82% of electrical injuries. The most electrical injury occurred in May, as many as 12 (24%) patients.

Table 1. Gender distribution of electrical burn patients

No.	Gender	Total (%)
1.	Male	49 (98)
2.	Female	1 (2)
Total (%)		**50 (100)**

Source: Research data, processed

Table 2. Distribution of age groups of electrical burn patients

No.	Age groups (years old)	Total (%)
1.	0-5	0 (0)
2.	6-11	1 (2)
3.	12-16	1 (2)
4.	17-25	13 (26)
5.	26-35	17 (34)
6.	36-45	9 (18)
7.	46-55	7 (14)
8.	55-65	2 (4)
9.	>65	0 (0)
Total (%)		**50 (100)**

Source: Research data, processed

The youngest patient was eight years old, and the oldest was 60.

Table 3. Occupation distribution of electrical burns patients

No.	Patient's occupation	Total (%)
1.	Student	2 (4)
2.	College student	1 (2)
3.	Government employee	3 (6)
4.	Private employee	38 (76)
5.	Entrepreneur	3 (6)
6.	Housewife	1 (2)
7.	Unknown	2 (4)
Total (%)		**50 (100)**

Source: Research data, processed

The private employees referred to here worked as construction workers and electricians. This was known from the results of the patient's history.

Table 4. Causes of trauma distribution of electrical burns patients

No.	Causes of trauma	Total (%)
1.	Work accident	41 (82)
2.	Traffic accident	1 (2)
3.	Household accident	2 (4)
4.	Unknown	6 (12)
Total (%)		**50 (100)**

Source: Research data, processed

Table 5. Annual incident distribution of electrical burn patients

No.	Month	Total (%)
1.	January	7 (14)
2.	February	1 (2)
3.	March	7 (14)
4.	April	3 (6)
5.	May	12 (24)
6.	June	4 (8)
7.	July	1 (2)
8.	August	2 (4)
9.	September	2 (4)
10.	October	3 (6)
11.	November	3 (6)
12.	December	5 (10)
Total (%)		**50 (100)**

Source: Research data, processed

Discussion

A similar study was conducted in India, showing that the average electric burn is more common in men than women due to occupational predisposition.[7] A 4-year retrospective study conducted at Komfo Anokye Hospital, Ghana, showed that of a total of 487 burn cases, there were 13 electric burn patients. This study showed that 11 patients were males (84.6%), and two (15.4%) patients were females.[8,9] The ratio of men and women in the incidence of electric burns shows a fairly high ratio (male:female = 44:1) compared to burns due to other causes. As explained in previous studies, this is due to higher exposure to men to electrical equipment and the status of their work in industry, factories, and buildings which make men more vulnerable to electrical injury.[8] Other studies showed the same results that most electric burns were in men. This is due to the high risk of work in men in the fields related to electricity.

A retrospective study in Brno Faculty Hospital, Czech Republic, for ten years from 1999-2009 showed the average age of electric burn patients was 28.59 years old with a total sample of 58 patients.[10] A similar study was conducted at Samsun Research Hospital, Turkey, from 2008-2012 with a total sample of 94 patients (84 men and ten women). The patients ranged from 47 months-72 years old. The average age of patients with electric burns was 27.40 for men and 18.80 for women.[11] A study by Mene (2016) showed a total of 16 patients ranging from 10-45 years old, with the average age being 26 years old.[12,13] Another study showed that most patients aged 30-40 years old. This age group is more vulnerable to electric burns because they work a lot using electrical devices and instruments.[14] Those previous studies showed the same results: most electric burns are experienced by productive age.

Work-related activities are responsible for most electrical injuries, with the most common jobs being construction workers and electricians. These electric burn patients tend to be patients of productive age who are at the peak of their earning potential. Prevention of electrical injuries is still difficult in this group because of work-related risks.[4,11,15] Electrical injuries most often affect young populations and the workforce. In a 10-year study at Tangdu Hospital, China, 383 patients experienced electric burns. 78.3% experienced electric burns while working, and the rest were household accidents.[16] It is in accordance with the medical record data of electric burn patients at the Department of Plastic Surgery Dr. Soetomo, General Academic Hospital, Surabaya, which showed work to be the main risk factor for electric burns, especially electricity-related jobs, such as construction laborers and electricians.

A study by Kurt (2016) in Samsun Research Hospital, Turkey, showed that most trauma causes of electrical injury are related to work involving young adult men.[11] Judging from the mechanism of workplace accidents the patients experienced, most patients work in high structures or open spaces. The patients are fixing electrical cables, roofs, satellite dishes, installing billboards, and being near trees. Many patients unconsciously hold iron sticks or other metal objects; hence electricity flows around them. Prevention of electrical injuries is still difficult in this group because of work-related risks.[12,13] The results of other studies showed the same results that the cause of electrical injury mainly occurred while working.

A study conducted in Tehran, Iran, taking data from 1976-2016, showed that electric burns occurred mostly in the spring and summer when the body is wet, either because it works so it sweats or because of heavy rain. Electric burns are also reported to occur near trees, high structures, or in the open when patients hold metal objects.[17] Another retrospective study conducted in Wuhan, China, showed that electric burn cases mainly occurred in summer (659 cases), as much as 34.1%, followed by autumn 27.8%, spring 23.5%, and winter, as much as 14.6%.[11,18] The smooth flow of electricity into the body depends on the wet or dry skin in contact with the current. If the skin is wet or moist, the flow will easily enter.[19,20] In Indonesia, May is the dry season. It is consistent with other studies that showed electric burns occurred a lot during hot temperatures.

Strength and Limitations

This study is expected to increase the awareness and quality of care given to electrical burn victims in the future and ultimately lower the health risk caused by electrical injuries through the parameters previously mentioned. The limitation of the study that could influence the results was the incomplete documentation of the medical records.

Conclusion

In conclusion, electrical burns are still a major occupation-related problem the Department of Plastic

Surgery Dr. Soetomo General Academic Hospital, Surabaya, especially for male employees working in the private sector. Therefore, steps should be taken to create awareness and implement a good preventive strategy for electrical burn wounds.

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Conflict of Interest
The authors declared there is no conflict of interest.

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Ethical Clearance
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