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The Epidemiology of Unintentional Burn Case in Sanglah General Hospital, Denpasar, from 2014 to 2018

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Abstract

BACKGROUND: Burn injury is one of the serious public health problems. Many of burn patients end up with experiencing disability (morbidity). Meanwhile, the epidemiology of burn patients in eastern part of Indonesia is rarely reported.

AIM: We aimed to investigate the sociodemographic characteristic of burn patients in Sanglah General Hospital as the center referral hospital for eastern part of Indonesia.

MATERIALS AND METHODS: Viable data were collected from burn patients admitted to Burn Center of Sanglah Hospital between January 2014 and December 2018. A cross-sectional study design was used with statistical analysis which was performed using IBM Statistics 23 for Windows.

RESULTS: A total of 725 subjects were involved in this study. Subjects were divided into two groups of emergency (n = 607, 83.72%) and non-emergency (n = 118, 17.28%). There were 525 (72.4%) burn subjects who were ≥17 years old with combustion caused by flame as the most common case (n = 264, 56.9%), whereas 200 (27.6%) subjects were <17 years old, while the group of age 0–5 years old (n = 115, 57.5%) gave largest proportion admission in pediatric group of scalding as the main cause (n = 100, 69.4%).

CONCLUSION: We found that adults and elders had the highest risk of acquiring combustion caused by flame. Scalding was the most burns case found in the pediatric population.

Introduction

Burn injury is one of the serious public health problems. The higher mortality was seen in low-middle-income countries compared with the high-income countries, probably due to limited resources available, insufficient preventive measures, and inadequate treatment [1]. Globally, there are 300,000 people dying from burn in approximately 11 million people with burn injuries seeking medical care annually [2]. Therefore, many of burn patients end up experiencing disability (morbidity) which often leads to rejection stigma from their community, which will ultimately reduce the quality of life of sufferers [3].

In 2018, there were 180.000 deaths per year estimated by the World Health Organization (WHO) in world which was caused by burn injuries. The majority of these occur in low- to middle-income countries and almost two-thirds occur in the African and South-East Asia regions. In India, over 1 million people are moderately or severely burnt every year. Nearly 173,000 Bangladesh children are moderately or severely burnt every year. In Bangladesh, Colombia, Egypt, and Pakistan, 17% of children with burn injuries have temporary disabilities and 18% have a permanent disability. Burn injuries are the second most common injury in rural Nepal, accounting for 5% of disabilities. In 2008, over 410,000 burn injuries occurred in the United States of America, with approximately 40,000 required hospitalization [4].

In Indonesia, burn injuries prevalence in 2013 was 0.7% and decreased by 1.5% compared to 2008 (2.2%). The province with the highest prevalence was Papua (2.0%) and Bangka Belitung (1.4%) [5]. A study held at Burn Centre of Cipto Mangunkusumo Hospital in January 2011–December 2012 brought 275 patients. Two hundreds and three were adults and the number of death from these patients was 76. The mortality rate of burn injuries was quite high, about 27.6% (2012) in Cipto Mangunkusumo Hospital and 26.41% (2014) in Dr. Soetomo Hospital [6]. Based on data taken from year 2012 to 2014 at Dr. Kariadi Hospital Semarang, there were a total of 72 patients with burn injuries, out of which 61 came as new cases and 5 (8.20%) died [7]. Meanwhile, the epidemiology of burn patients in eastern part of Indonesia is rarely reported. Therefore, we aimed to investigate the

sociodemographic characteristic of burn patients in Sanglah General Hospital as the center referral hospital for eastern part of Indonesia.

Materials and Methods

This study has been granted ethical clearance by the committee of ethic of Sanglah Hospital with the number of certificate 2020.02.1.0379. Data were retrospectively collected from burn injury patients admitted to Burn Center of Sanglah Hospital between January 2014 and December 2018. The data also supported by viable medical records to obtain demographic characteristic of the study population which included gender, age, etiology of burns, total body surface area (TBSA) and the degree of burn injury, type of surgery and the amount of surgery, incidence of inhalation trauma, length of stay (LOS), and acute complications that consider the occurrence of compartment syndrome and mortality. "Unknown" refers to of incomplete or unavailable data. A cross-sectional study design was used with statistical analysis which was performed using IBM Statistics 23 for Windows.

Results

Patient admissions

A total number of admissions from 2014 to 2018 were 725 patients with two categories which are emergency and non-emergency. Emergency patients were 607 who admitted from emergency unit and the non-emergency patients were 118 who had contracture or chronic wound. The number of visits per years is presented in Table 1.

Age and gender prevalence

In this study, 200 subjects were <16 years old (27.5%) that 143 patients were admitted from the emergency department and 57 patients were admitted from the non-emergency department (Table 1). Those in the age group of 17–35 years old comprised the highest proportion of emergency admission, and the age group of 26–35 years old comprised the highest proportion of non-emergency admission (Table 1). In this study, the majority of the subjects were male (n = 526, 72.5%) with a ratio 2.64:1 between males and females (Figure 1).

Etiology of burns

The main etiology of all burn case in Sanglah Hospital was caused by flame and the second was caused by electrical injury. There were 525 subjects ≥17 years who had flame as the most common cause (n = 264, 56.9%). There were 200 (27.6%) subjects <17 years old, while the group of age 0–5 years old (n = 115, 57.5%) gave largest proportion in pediatric group. We also calculated that 100 cases of burn in pediatric group (69.4%) was caused by scald with statistical analysis showed p = 0.00 from both emergency and non-emergency admission in 2014–2018 (Table 1). The distribution of etiology according to group age, most of the burns patients aged 17–35 years old caused by flame or electricity (Table 2).

Table 1: Distribution table of patient admission, age, etiology, types of surgeries, and depth of burn, in emergency and non-emergency cases

Parameter	Emergency	Non-emergency
Admission		
2014	151	11
2015	113	31
2016	84	19
2017	130	26
2018	129	31
Age		
0–1	44	6
2–5	49	16
6–11	31	17
12–16	19	18
17–25	119	15
26–35	119	24
36–44	101	9
45–99	78	8
≥60	47	5
Etiology		
Flame	285	30
Electrical injury	157	28
Scald	108	24
Contact	2	1
Chemical injury	4	0
Heated gas	2	0
Unknown	49	35
Types of surgeries		
Non-surgical procedure	53	6
Excisional debridement	294	19
Excisional debridement+skin graft	224	32
Other	36	61
Depth of burn		
1st–2nd degree	10	0
2nd degree	465	46
2nd–3rd degree	83	44
3rd degree	35	28
Unknown	14	118

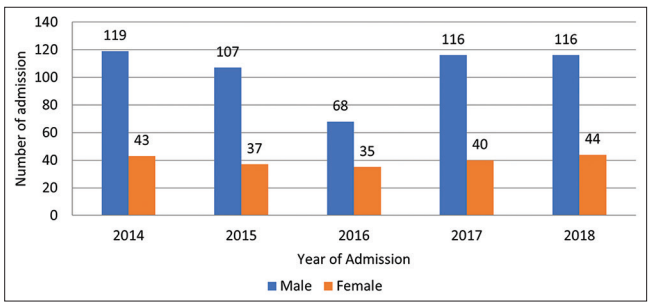

Figure 1: Distribution table of patient admission by gender

Depth of burns and extent of burns/ TBSA%

The majority of both groups suffered from second degree burn (Table 1). The largest number of patients suffered from 0 to 19% of TBSA in the adult group (n = 205, 44.2%) and pediatric group (n = 88, 61.5%) (Table 3). Distribution of depth and extent of

burns in the emergency and non-emergency case is provided in Table 1.

Table 2: Distribution of etiology according to the group of age

Age	Etiology							Total
	Flame	Electrical injury	Scald	Contact	Chemical	Heated gas	Unknown	
0–1 years old	7	2	39	0	0	0	2	50
2–5 years old	11	2	37	0	0	0	15	65
6–11 years old	20	4	16	2	0	0	6	48
12–16 years old	13	12	8	0	0	0	4	37
17–25 years old	51	62	7	0	0	0	14	134
26–35 years old	66	52	5	0	1	1	18	143
36–44 years old	65	26	8	0	1	1	9	110
45–59 years old	46	23	7	1	2	0	7	86
≥60 years old	36	2	5	0	0	0	9	52
Total	315	185	132	3	4	2	84	725

Types of surgery

A total of 812 surgeries were performed on 725 patients with the highest number of excisional debridement alone (n = 294, 48.4%) which were performed in emergency cases, and excisional debridement followed by skin graft (n = 32, 27.1%) was performed in non-emergency cases. Most of the number of surgeries were performed once in a patient both in the emergency case (n = 506, 83.4%) and non-emergency cases (n = 108, 91.5%) (Table 1). "Other" in distribution of surgery type in emergency case consists of excisional debridement followed by one of these measures, including flap, skin graft and flap, amputation and skin graft, amputation and flap, amputation, fasciotomy, skin graft and fasciotomy, skin graft and VAC, skin graft and escharotomy, and replantation. On the contrary, "others" in distribution of surgery type in the non-emergency case consists of release contracture, amputation, and excisional debridement followed by one of these measures, including flap, skin graft and flap, amputation and skin graft, amputation, skin graft and VAC, and replantation.

Table 3: Extent of burn in admitted patient

Total body surface area	Emergency case		≤16 years old		>16 years old	
	Total					
	n	%	n	%	n	%
0–19%	293	48.3	88	61.5	205	44.2
20–39%	182	30.0	36	25.2	146	31.4
40–59%	58	9.6	8	5.6	50	10.8
60–79%	27	4.4	2	1.4	25	5.4
80–100%	6	1.0	0	0.0	6	1.3
Unknown	41	6.8	9	6.3	32	6.9
Total	607	100.0	143	100.0	464	100.0

The distribution of the number of surgeries shows that both emergency and non-emergency burn patients mostly need only one surgery (Table 4).

Table 4: Distribution of the number of surgeries

Etiology	Emergency case		Non-emergency case		Total (%)
	Total		Total		
	n	%	n	%	
Non-surgical	48	7.9	5	4.2	53 (7.3)
One surgery	506	83.4	108	91.5	614 (84.7)
>1 surgeries	53	8.7	5	4.2	58 (8)
Total	607	100.0	118	100.0	725 (100.0)

LOS and mortality rate

We found that burn patients with TBSA 0–19% gave the highest rate in 4–15 days LOS (n = 157, 53.0%). Burn patients with TBSA ≥20% gave the highest rate in ≥16 days LOS (n = 90, 42.2%) (Table 5). There were 18 incidence of inhalation trauma (3%) in the emergency department and 3 of them causing deaths (16.7%, p = 0.407). Inhalation trauma correlated mortality gave PR 1.7 with confidence interval 0.479–6.037 but not significant with p = 0.428 (Table 6). There were 44 incidences of death in burn case with TBSA ≥40% which twice higher than TBSA <40% which were 21 death. None death case happened in non-emergency cases (Table 7).

Table 5: TBSA and length of hospital stay in admitted patients

Total body surface area	Length of stay					Total
	24 h	2–3 days	4–15 days	16–30 days	>30 days	
0–19%	10	47	157	54	25	293
20–39%	5	15	72	55	35	182
40–59%	4	4	24	13	13	58
60–79%	0	4	15	8	0	27
80–100%	0	2	4	0	0	6
Unknown	0	7	24	6	4	41
Total	19	79	296	136	77	607

TBSA: Total body surface area.

Discussion

Burn unit of Sanglah Hospital-Denpasar established in 2004 as Australian government appreciation for dedication and care of Sanglah General Hospital to Bali Bombing victims patients on October 12, 2002. Burn unit of Sanglah Hospital provides comprehensive and high-quality care, which is equipped with operating theater, three high care unit, six intermediate care unit, six beds of recovery patients, and 19 nurses and a multidisciplinary team that are dedicated to burn patients only.

Table 6: Distribution of inhalation trauma which causing death

Parameters	Mortality		Total
	Recover	Death	
Non-inhalation trauma	527	62	589
Inhalation trauma	15	3	18
Total	542	65	607

Bali was become the center referral hospital for the eastern part of Indonesia. As the epidemiology of burn patients in eastern part of Indonesia is rarely reported, we focused on those patients who attended to the emergency and non-emergency department of Sanglah Hospital. We found an inconsistent number of admissions each year during 2014–2018 in our hospital with total 725 patients (mean 145 per year). This finding was in line with Dr. Kariadi Hospital-Semarang from 2012 to 2014 [7]. In contrary to other researches from other centers in Indonesia by Wardhana *et al*. and Hidayat

Table 7: Distribution of mortality based on extent of burn

Extent of burn	Mortality		Total
	Recover	Death	
0–19%	291	2	293
20–39%	163	19	182
40–59%	38	20	58
60–79%	10	17	27
80–100%	1	5	6
Unknown	39	2	41
Total	542	65	607

et al., there were increasing number of admissions each year in Cipto Mangunkusumo Hospital-Jakarta and Dr. Soetomo Hospital-Surabaya [8], [9]. This discrepancy could be caused by single-center nature of our study and demographic distribution, compared to the national, multicenter data collection of the report.

In our study, adult with range of age 17–35 had the first rank of admissions (n = 277, 38.2%). This result is parallel to one center in Jakarta, one report from Semarang, one report from Singapore, and three reports from India [7], [8], [10], [11], [12], [13]. The majority of the subjects were males (Figure 1) which had similar result with other reports from Indonesia [7], [8], [9], reports from many countries in Singapore, India, and China [10], [14], [15] but in contrary with five reports from Nepal, Iran, and the WHO [4], [11], [16], [17]. Male tends to have more mobility and activities than female [18]. The higher risk for females is associated with open fire cooking or inherently unsafe cookstoves, which can flame loose clothing. Based on prior knowledge, open flames used for heating and lighting could be the risks, and although understudied, self-directed, or interpersonal violence are also factors [4], [17].

Pediatric gave the second largest group of admission that scald became the first cause of admission, especially in the group of age 0–5 years old (n = 115, 57.5%). Children have a higher risk for developing burns because most of them cannot protect themselves [19]. It is also supported by the freeze mechanism that children's reaction to painful stimuli is not as rapid or consistent as adult [20]. This finding was conducted to other center in Jakarta, Surabaya, Australian, and New Zealand Burn Association and Song *et al*. [8], [9], [20], [21].

The most common etiology of burn in adult and elders was flame and followed by electrical injury. The types of flames whether caused by LPG or kerosene unmentioned due to the incomplete data in the medical records. There were only several files stated that the mechanism of injury was caused by LPG gas explosion. Therefore, the etiologies were classified as flame, electrical injury, scald, contact, chemical, and heated gas as written in the results. Wardhana *et al*. found that the prevalence of LPG-related burns was 132 patients [6]. These findings were supported by a report from India which mentioned that the most burns were related to the use of LPG at home and a lack of related awareness or education, especially in preventing burns [22]. The safety hazards of natural gas and LPG are well known in developed countries. One of them like America demands people to make sure the operations are safe and the storage is properly located, installed, operated, and maintained, which is why their storage and utility systems are regulated and subject to safety standards [23]. Less developed countries usually use substandard LPG tanks to reduce cost, which may contribute to the number of burns [24]. Hence, the WHO already had plan for burn prevention and care in 2008 [25]. However, the equity of information tends unwidely spread in the developing countries.

We documented burn patients mostly suffered from the second degree burn in both adult and pediatric groups. We found that 0–19% of TBSA group had the largest number of patients both in adult and pediatric groups. This finding is almost similar to Iran where the highest TBSA was 5–10%, USA was 0.1–9.9%, and in Singapore was <10% [21], [26], [27]. Burn patient with TBSA ≥40% gave 44 mortality which is twice higher than 21 mortality in burn patient with TBSA <40%. These findings are in line with Italian researchers (Pavoni *et al*.) that mentioned that the factors influencing mortality rate are TBSA ≥50%. It was in line with this study that TBSA >40% caused twice higher mortality than TBSA 20%. In those studies, they also mentioned that infectious complication such as sepsis, septic shock, bacteremia, and urinary infections, respiratory complication, renal complications, and time of first escharotomy could be the factors of mortality rate in burn patient [28]. In our study, inhalation trauma was not significantly causing death. This statement is in contrast with another center from Dr. Soetomo Hospital, Surabaya. This discrepancy could be impacted by work-related burning, duration of burn onset to health-care facilities, the inefficient transporting for referral system, the incidence of infection, septicemia, organ failure, location of burn, and duration of first surgery. Unfortunately, there were no other data about factors contributing LOS and mortality in our study [9]. Osler *et al*. mentioned that the effect of age, burn size TBSA, and inhalation injury could be a simple three term to predict mortality in burn case using revised Baux score [29]. The factors that mentioned by Osler *et al*. may give different result in this study to predict the mortality rate in burn case.

Our study found that most patients had single surgery in both groups of emergency and non-emergency cases. The most common type of surgery in orderly performed were excisional debridement (n = 314, 43.3%), excisional debridement followed by skin graft (n = 256, 35.3%), and excisional debridement and skin graft and flap (n = 16, 2.2%). In this study, we only did the excision for the non-viable tissue, then, the wounds were covered by moist gauge mixed with epinephrine to suppress the bleeding. If the skin graft was unavailable, then we chose tangential excision without covering the wounds as the non-viable tissue should be removed, especially eschar. Debridement as the most type of surgery that preformed before was coincided with the reports from Wardhana *et al*. and Chien *et al*. [8], [30]. Hwee *et al*. found that patients with a longer duration of surgery are statistically significant at a higher risk of bacteremia. A surgery with the duration of 80 min is a predictor of bacteremia. Patients with a larger extent of burns had a longer duration of surgery and underwent more operations, which were both statistically significant. Most patients with TBSA <10% only underwent cleansing and no surgery was needed [10].

We found that burn patients with TBSA 0–19% gave the highest rate in 4–15 days LOS (n = 157, 53.0%). Burn patients with TBSA ≥20% gave the highest rate in ≥16 days LOS (n = 90, 42.2%). Hwee *et al*. and Li *et al*. found that the length of hospitalization was statistically significant longer in patients who underwent surgical intervention [10], [15]. Length of treatment in Dr. Soetomo General Hospital from 2007 to 2011 showed that mostly, burn injury patient was heal after 3–10 weeks treatment [9]. Median LOS in our study was 11.00 which had the same result with another center in Cipto Mangunkusumo Hospital, Jakarta [8].

In this study, there are some limitation as presumed. The incomplete information from medical records gave us a limited description about patients socioeconomic background and comorbidity to analyze the data. It is also difficult for us to obtain the heat source and measure the burn scars for non-emergency patients in detail. A further study demanded to assess the prognostic factors of burn outcomes to improve care and recovery rate in burn patients.

Conclusion

Based on outcome presentation and discussion of clinical characteristics of burn cases in Sanglah Hospital, Denpasar, from 2014 to 2018, the highest number of patients was male in productive ages (26–44 years old), with the most common source of burn was flame in adults and scald in pediatrics. In fact, an ounce of prevention is worth a pound of cure, in consequence, we hope these findings and better future presentations can give better prevention of burn incidence.

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