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Prognostic Factors for Mortality of Pediatric Burn Injury in a National Tertiary Referral Center

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Abstract

Introduction. In Indonesia, burn injuries cause about 195,000 deaths annually. Data from the Ministry of the Health Republic of Indonesia showed the incidence of burns predominated at 1-4 years old. The mortality of pediatric burn patients in a tertiary hospital was 37.26%. This study aimed to find an association between known and unknown prognostic factors of mortality in Indonesian-specific characteristics.
Method. A retrospective analytical study included all pediatric burns admitted to Dr. Cipto Mangunkusumo General Hospital (CMGH) from 1998 to 2010. Variables within a period of the first 72 hours of admission were the focus of interest and were extracted from the medical record.
Results. Of 609 pediatric burns, the mortality rate is 37.8%. Some contributing variables significantly associated with the mortality were TBSA, inhalation injury, length of hospitalization, hemoglobin 0-h level, hematocrit 24-h, and 48-h level, INR 0-h, and 48-h, fluid balance 24-h, base deficit, serum lactate, pulmonary edema, systemic inflammatory response syndrome (SIRS) + multiorgan failure (MOF), and acute coronary syndrome (ACS) ($p < 0.05$). On multivariate analysis, the significant variable was length of hospitalization <14 days, SIRS+MOF, abnormal hematocrit 0-h level, and abnormal serum lactate level.
Conclusion. The more identified prognostic factors a patient finds, the more the mortality risk. In addition, excessive fluid resuscitation leads to a high likelihood of pulmonary edema, SIRS+MOF, and ACS complications, followed by increased mortality risk.

Keywords: pediatric–burns, prognostic factors, mortality

Introduction

Burn injuries are common emergency cases that account for 1% of global diseases, causing more than 7.1 million injuries, nearly 18 million disabilities, and more than 265,000 deaths. In addition, burns are fourth-ranked in all injuries and have become a global concern, especially in pediatric patients. According to World Health Organization, burn injuries are ninth–rank in deaths of those aged 5—14 years, with an estimated 41,575 deaths; 15 for victims aged 15–29 years, with an estimated 49,067 deaths, and 15 for victims aged 0–4 years with an estimated 62,655 deaths.[1]
In Indonesia, burn injuries cause about 195,000 deaths annually. In the burn unit of Dr. Cipto Mangunkusumo General Hospital (CMGH) – the national referral center for burns in Indonesia – more than 130 victims annually. Data from the Ministry of Health in 2014 reveals that burns are the sixth-ranked unintentional injuries in Indonesia, with 0.7% of death. According to this data, the highest incidence of burns in Indonesia is among those aged 1-4 years.[2]

A study by Dhopte et al. in India showed that the mortality of pediatric burn patients in a tertiary hospital was 37.26%.[3] In addition, there is an association between the depth of burn, type of burn, total body surface area, hematological examination, hemodynamic assessment, and complications leading to mortality.[4] Pediatric burn injuries have become a severe health problem. Thus, the disability and disorders in the psychological, social, and functional aspects experienced by the subject require special attention.[4,5]

Method

A retrospective analytical study included all burn patients up to 18 years admitted to CMGH from 1998 to 2010. Data from the medical record regarding parameters focused on subjects were managed within the first 72 hours of admission and were the variable of interest. Therefore, those who presented over 72 hours post-burn injuries or death on arrival at the emergency room were excluded. The independent variables were: (1) extent of the burn, represented by total body surface area (TBSA), and classified as extensive burn if >20% and non–extensive if <20%; (2) inhalation injury; (3) presented at the emergency room, classified as delayed when >2 hours; (4) length of hospitalization, classified as >14 days and ≤14 days; (5) hemoglobin level, normal and hemoconcentration; (6) hematocrit level, normal and hemoconcentration ; (7) international normalized ratio (INR); (8) central venous pressure (CVP); (9) mean arterial pressure (MAP); (10) central venous oxygen saturation ($SvcO_2$); (11) fluid balance, categorized as positive or negative; (12) serum albumin; (13) base deficit; (14) serum lactate; (15) serum urea; (16) serum creatinine; (17) pulmonary edema; (18) systemic inflammatory response syndrome (SIRS) + multiorgan failure (MOF); and (19) acute coronary syndrome (ACS). The dependent variable was in-hospital mortality.

These variables were analyzed using IBM Statistical Package for Social Sciences (SPSS) version 20.0. Commencing with the Kolmogorov-Smirnov test for data distribution, continued with the Chi-square test or a Fisher exact test for dichotomous variables. Next, continuous data proceeded with Mann-Whitney. Finally, the multivariate analysis proceeded with logistic regression. The findings were considered statistically significant with a p-value <0.05.

The independent board reviewer, i.e., the Committee of Ethics, Faculty of Medicine, Universitas Indonesia, approved the study (KET-524/UN2.F1/ETIK/PPM.00.02/2022 and protocol number 22-06-0605).

Results

Out of 609 pediatric patients included in this study, the median age was 8.0 years (1.0-18.0). The mortality rates were 230 death (37.8%), where the survivors had a median age of 9.0 years (1.0–18.0), while those who did not survive were 7.0 years (1.0–18.0); this finding showed no significance. Patients with extensive burns, those who delayed presented, and shorter lengths of stay were significantly associated with mortality. The subject's characteristics are presented in Table 1.

Table 1. Subject characteristics

Variables	Overall subjects	Mortality		p
		No (n = 379)	Yes (n = 230)	
Age, years	8.0 (1.0–18.0)	9,0 (1.0–18.0)	7.0 (1.0–18.0)	0.078
Total body surface area, (%)	28.0 (1.0–97.0)	24.0 (1.0–91.0)	42.3 (10.0–97.0)	<0.001*
Presented in ER after injury, hours	8.0 (2.0–72.0)	8.0 (2.0–72.0)	9.0 (2.0–36.0)	0,028*
Length of stays, days	11.0 (1.0–42.0)	14.0 (1.0–42.0)	3.0 (1.0–26.0)	<0.001*

ER: emergency room; Mann Whitney test; * significant (p <0.05); data that were not normally distributed are presented in the median (min-max)

The median age was 39.5 years (3–64 years), dominated by females with disease periods varied from one to 96 months. Most of them had modified Osserman classification category of class II (34.6%) and III (57.7%), and no one with classes I and V. Most subjects received preoperative plasmapheresis (100%). In addition, all subjects received preoperative steroid therapy and underwent a sternotomy extended thymectomy procedure (transsternal). Histopathological findings showed thymoma in 14 subjects: 12 of class I and two of class II, and a small number with thymic hyperplasia. Eight subjects (30.7%) had remission, and the remaining 18 (69.3%) did not. Three subjects (11.5%) with complete remission, five subjects (19.2%) with pharmacological remission, and two subjects (7.7%) died.

The remission rate in those with a disease period <12 months was 71.4%, and the early modified Osserman classification was 66.7%. The Fisher's test showed an association between the disease period with p–a value of 0.014 and the modified Osserman classification with a p-value of 0.008 with remission after thymectomy. The other factors, such as age, gender, preoperative plasmapheresis, and histopathology findings, showed a p-value of 1.0, 0.197, 0.628, and 1.0, respectively. No statistical analysis proceeded on the type of surgery and preoperative steroid therapy as all subjects underwent transsternal thymectomy procedures and received preoperative steroid therapy (Table 2).

Table 2. Factors associated with mortality in pediatric burn injury

Variables	n	Mortality		p	Unadjusted Odd Ratio	95% CI
		Yes	No			
Age, year	609			0.683	1.09	0.78—1.52
>5—18	371	143	228			
0—5	238	87	151			
Total body surface area	609			<0.001*	5.48	3.37—8.91
Extensive (>20%)	448	208	240			
Non–extensive (≤20%)	161	22	139			
Inhalation injury	492			<0.001*	4.23	1.94—9.20
Yes	31	21	10			
No	461	153	308			
Arrival at ER	609			0.336	1.63	0.71—3.74
Delayed, >2 h	508	222	358			
Non-delayed, <2 h	29	8	21			
Length of stay	605			<0.001*	17.88	8.90—35.91
≤14 days	438	221	217			
>14 days	167	9	158			
Pulmonary edema	609			<0.001*	102.57	6.23—1690.27
Yes	27	27	0			
No	582	203	379			
SIRS +MOF	609			<0.001*	301.22	41.59—2181.12
Yes	103	102	1			
No	506	128	378			
ACS[#]	609			<0.001*	39.77	2.33—678.13
Yes	11	11	0			
No	598	219	379			
INR 0-h	267			<0.001*		
Abnormally high	220	80	140		12.86	3.04—54.42
Normal (0.9—1.10)	47	2	45			
INR 48-h	185			0.002*	23.49	1.40—393.85
Abnormally high	161	52	109			
Normal (0.9—1.10)	24	0	24			
Hemoglobin 0-h	608			<0.001*	3.10	2.06—4.67
Hemoconcentration	430	193	237			
Normal (11.4—14.8)	178	37	141			
Hemoglobin 24-h	540			0.212	1.26	0.89—1.78
Hemoconcentration	272	122	150			
Normal (11.4—14.8)	268	105	163			
Hemoglobin 48-h	470			0.607	0.89	0.62—1.29
Hemoconcentration	247	94	153			
Normal (11.4—14.8)	223	91	132			
Hematocrit 0-h	608			0.100	1.78	0.94—3.35
Hemoconcentration	555	216	339			
Normal (34—43)	53	14	39			
Hematocrit 24-h	561			0.015*	1.82	1.15—2.89
Hemoconcentration	458	196	262			
Normal (34—43)	103	30	73			
Hematocrit 48-h	405			0.041*	0.63	0.41—0.98
Hemoconcentration	294	123	171			
Normal (34—43)	111	59	52			
CVP 0-h[#]	277			0.219	5.74	0.27—120.66
Abnormally low	275	147	128			
Normal (8—12)	2	0	2			

Table 2. Factors associated with mortality in pediatric burn injury (cont.)

Variables	n	Mortality		p	Unadjusted Odd Ratio	95% CI
		Yes	No			
CVP 24-h	276			0.825	1.39	0.41—4.65
Abnormally low	265	142	123			
Normal (8—12)	11	5	6			
CVP 48-h	271			0.142	1.61	0.90—2.89
Abnormally low	212	115	97			
Normal (8—12)	59	25	34			
MAP 0-h[#]	98			0.227	2.13	0.55—8.26
Abnormally low	25	4	21			
Normal (50—100)	73	6	67			
MAP 24-h	98			-	8.43	0.16—447.42
Abnormally low	0	0	0			
Normal (50—100)	88	10	88			
MAP 48-h[#]	56			0.370	0.38	0.2—7.34
Abnormally low	7	0	7			
Normal (50—100)	49	7	42			
$SvcO_2$ (%) 0-h[#]	35			0.269	0.14	0.01—2.67
Abnormally low	33	4	29			
Normal (94—100)	2	1	1			
$SvcO_2$(%) 24-h[#]	35			0.857	0.56	0.02—15.59
Abnormally low	34	5	29			
Normal (94—100)	1	0	1			
$SvcO_2$ (%) 48-h[#]	28			0.179	0.06	0.01—1.83
Abnormally low	27	4	23			
Normal (94—100)	1	1	0			
Fluid balance 24-h	584			0.035*	5.04	1.14—22.27
Positive	567	228	339			
Negative	17	2	15			
Fluid balance 48-h[#]	536			0.108	17.58	1.05—295.41
Positive	531	192	339			
Negative	5	0	5			
Serum albumin 0-h[#]	448			0.313	3.96	0.19—82.92
Abnormal low	446	197	249			
Normal (4.0—5.8)	2	0	2			
Serum albumin 48-h[#]	258			0.056	0.29	0.08—1.03
Abnormally low	247	84	163			
Normal (4.0—5.8)	11	7	4			
Base deficit	378			0.024*	1.86	1.11—3.12
Abnormally low	298	145	153			
Normal (> -5)	80	27	53			
Serum lactate	378			<0.001*	6.42	3.99—10.32
Abnormally high	237	157	80			
Normal (<2)	141	33	108			
Serum urea 0-h	394			-	0.79	0.02—40.50
Abnormally high	394	175	219			
Normal (5.1—21.9)	0	0	0			
Serum urea 24-h	145			-	1.45	0.03—74.30
Abnormal high	145	86	59			
Normal (5.1—21.9)	0	0	0			
Serum creatinine 0-h[#]	468			0.105	6.88	0.37—128.57
Abnormally high	464	201	263			
Normal (0.10—0.84)	4	0	4			
Serum creatinine 24-h[#]	253			0.458	3.57	0.14—88.52
Abnormally high	252	137	115			
Normal (0.10—0.84)	1	0	1			
Serum creatinine 48-h	14			-	0.43	0.01—25.16
Abnormally high	14	4	10			
Normal (0.10—0.84)	0	0	0			

Chi-square test, unless given specific notation; [#]Fisher exact test; * significant (p <0.05); OR: odds ratio; 95%CI: confidence interval; INR: international normalized ratio; CVP: central venous pressure; MAP: mean arterial pressure; $SvcO_2$: central venous oxygen saturation; SIRS+MOF: systemic inflammatory response syndrome + multiorgan failure; ACS: acute coronary syndrome

Table 2 is completed with the odds ratio (OR) and 95% confidence interval (95%CI), showing the risk of mortality in these subjects. The variables with an OR >1 were associated with increased mortality risk, namely, extensive burns >20% TBSA (5.5 times), inhalation injury (4.2 times), length of stay <14 days (17.9 times), hemoconcentration (abnormal hemoglobin level) 0-h (3.1 times) and abnormal hematocrit 24-h level (1.8 times), abnormal high INR 0-h (12.9 times), abnormal INR high 48-h (23.5 times), positive fluid balance 24-h (5.0 times), abnormal base deficit (1.9 times), abnormally elevated serum lactate level (6.4 times), and ACS (39.8 times). The highest mortality risk was shown by pulmonary edema (102.6 times) and SIRS+MOF (301.2 times). Meanwhile, the variable that reduced the mortality risk because it has an OR value <1 was the abnormally high hematocrit 48-h level (1.6 times).

Multivariate analysis

The variables with a p-value <0.25 on the former bivariate analysis were subjected to multivariate analysis to determine the variables with a predictive value. For this purpose, the logistic regression model was used—statistically significant variables (p <0.05) referred to as prognostic mortality factors. The logistic regression using the enter method included 237 subjects, as shown in Table 3.

They were the length of stay <14 days (OR: 1.79×10^2), SIRS+MOF (OR: 2.39×10^3), abnormal hematocrit 0-h level (OR: 2.29×10^1), and abnormal serum lactate level (OR: 1.53×10^1). Length of hospitalization <14 days and SIRS+MOF were the most dominant factors affecting mortality because they had the greatest OR value.

Table 3. Logistic regression multivariate analysis

	Coeff	OR	95% CI		p
			Lower	Upper	
Extensive burn >20% TBSA	0.76	3.07	0.48	19.47	0.234
Inhalation injury	1.23	4.75	0.59	37.95	0.142
Length of hospitalization ≤14 days	5.19	1.79×10^2	12.73	2535.44	<0.001*
SIRS+MOF	7.78	2.39×10^3	105.75	54066.55	<0.001*
Hematocrit 0-h	3.13	2.29×10^1	1.66	317.85	0.020*
Base deficits	1.12	3.01	0.43	22.07	0.264
Serum lactate	2.73	1.53×10^1	4.55	51.74	<0.001*
Constant	-12.26				

Notes: PPV = Positive predictive value, NPN = Negative predictive value, LR = Likelihood ratio

Discussion

Age's characteristic

The age of pediatric burn patients at CMGH was not significantly associated with mortality. The median age of patients experiencing mortality was 7.0 (1.0–18.0). The mean age in this study is one year younger than the Dhopte study[3] et al., which showed that the mean mortality rate for pediatric patients was 8.68 years. However, Dhopte[3] et al. showed that the mean age of surviving patients was 5.54 years. Purcell[6] et al. and Fomukong[7] et al. showed that the median age of survived patients was three years and four years, respectively. In contrast to this study, survived pediatric burn patients had a median age one year higher than those who experienced mortality. Its median value reached 9.0 (1.0-18.0) years.

Pediatric burn injuries happened most in the age group >5-18 years, reaching 60.9% of the total patients. Mortality in the age group >5-18 years also had an odds ratio (OR) of 1.09 times higher than the age group 0-5 years. The OR values close to one indicate no difference in mortality risk between 0-5 years and >5-18 years. The mortality proportions between the two groups were 36.6% and 38.5%, respectively. The difference was only 2.1% and was not statistically significant (p >0.05). These results are similar to the study by Purcell[6] et al., which showed that age was not associated with mortality. However, in the study by Purcell[6] et al., pediatric burn injuries were more common at the age of <5 years and were often the result of accidents.[7] Due to the high prevalence in this young age group, pediatric burn patients are at high risk for morbidity and mortality.[8,9] Children aged <48 months with burn injury >30% TBSA had a higher risk of mortality than adults with the same burn area. It happens because children aged <48 months have not been able to tolerate extensive thermal injury like adults.[3,10]

Total body surface area

The wider burn area increased the mortality risk. The mortality risk in the >50% TBSA was 9.34 times higher than in the group <50%. TBSA The wider the burn, the more fluid will be lost, so the patient gets into shock. Patients are also more susceptible to infection due to losing the protective skin layer.[7] Study by Fomukong[7] et al. showed mortality rates increased when the burn area was more than 25-36% TBSA. Therefore, systemic prophylactic antibiotics are also recommended in patients with severe burns to reduce the risk of contamination and infection. So it can reduce the risk of mortality.[11]

Inhalation injury

Patients who experienced inhalation injury after burn injury had a mortality risk of 4.23 times higher than those who did not experience inhalation injury. Inhalation injury is one of the most severe injuries after extreme temperature injury in burns. Nearly 80% of fire-related deaths occur from inhalation injuries from toxic combustion residues. Inhalation injury is associated with a 25%–50% mortality rate in ventilator-assisted patients more than one week after injury. Early diagnosis of bronchopulmonary injury in a primary care facility is essential for patient survival.[12]

Time of arriving at the hospital

As many as 83.4% of pediatric burn patients at the CMGH came late to the emergency room (ER). Of all patients who came late, the mortality rate reached 43.7%. It means that almost half of late patients are at risk of dying. Patients who experienced mortality were found to have a median time of arrival to the ER one hour later than those who survived. Although only an hour apart, the difference was statistically significant (p < 0.05). The study by Moenadjat et al. showed data from CMGH over 14 years. Only 2.5% of patients received treatment at the emergency department in less than 2 hours. As many as 95.1% of patients arrived at ER within 2-72 hours because they were referrals from other hospitals. About 2.4% of patients came within more than 24-72 hours after the burn incident. [13] Delays handling pediatric burn patients can lead to an increased risk of wound infection and contamination, leading to increased mortality risk. Therefore, the management of prophylactic systemic antibiotics, especially in patients >48 hours late after the incident.[11]

Length of hospitalization

The median length of hospitalization at the CMGH was 11 days (1.0–42.0). It is the same as the previous study at the CMGH conducted by Wardhana A[1] et al., which was 11 days, and decreased from the 2010 study, which was 13.7 days.[14] The length of hospitalization at the CMGH was longer than in Singapore, which was 10.8 days.[15] However, it was still shorter than the study in China, which was 18.9 days.[16]

Length of hospitalization <14 days increased mortality risk 17.9 times compared to the group of >14 days. These results are consistent with a retrospective study conducted by Guldogan[17] et al. It was found that length of stay/hospitalization (LOS/LOH) was statistically significantly associated with mortality (p < 0.001) in a multivariate study with logistic regression where an increase in LOS increased patient survival.[17,18]

A study by Li[16] et al. showed that LOS is strongly associated with the burn area. The more severe and extent of the burn area will be followed by the more surgical procedures required and the more prolonged healing phase. Thus, the LOS became longer.[16] About one percent burn area correlated to an increase in LOS for one day. CMGH has a burn unit with a prolonged LOS due to the high severity and degree of burn of the referred patients.[1]

Hemoglobin and hematocrit level

Abnormal hemoglobin levels can increase the risk of mortality. However, the risk was found to decrease over time during the examination. Abnormal hemoglobin levels (hemoconcentration) at 0, 24, and 48 hours were 3.1 times, 1.3 times, and 0.6 times, respectively. The mortality risk was indicated by the 0-hour hemoconcentration, which was statistically significant (p <0.05).

The examination of the hematocrit level was statistically significant only at 24-h and 48-h. The mortality risk of abnormal hematocrit levels at 24-h and 48-h was 1.8 times and 0.7 times, respectively. The results of this study indicated that it is crucial to perform resuscitation immediately so that the hematocrit level can immediately normalize in the first 24 hours to restore blood viscosity and vascular resistance to reduce mortality.[19,20] Abnormal INR results had an increased risk of mortality over time. For example, the study's mortality risk at 0-h and 48-h was 12.9 times and 23.5, respectively.

Hemodynamic

Abnormal CVP, MAP, and SvcO2 results were not associated with a statistically increased mortality risk. There is no clear pattern between the rise and fall of mortality risk at 0, 24, and 48 hours of the three variables. Ideally, the mortality risk will decrease during the 24-h and 48-h period because there has been improvement in microvascular and peripheral blood flow assisted by a decrease in systemic resistance leading to the redistribution of blood to the burn area. Cardiac output

generally increases 1.5-fold compared to the average population and persists for 3 to 4 days. Metabolic rate increases threefold compared to basal metabolism.[21–23]

The positive fluid balance in the first 24 hours increased mortality risk 5.0 times and was statistically significant. If the positive balance is continued for up to 48 hours, the mortality risk increases to 17.6 times. However, in this study, the results were not statistically significant.

Metabolic and electrolyte balance

Abnormal serum albumin levels 0-h increased mortality risk up to 3.96 times, although it was not statistically significant. The proportion of patients with an abnormal serum albumin level 0-h who experienced mortality was 44.2%. This result is lower than other studies, which showed that serum albumin <2 g/dL (cut-off 1.95 g/dL) had a mortality of >80% with a sensitivity of 84% and a specificity of 83%. Hypoalbuminemia is generally associated with vascular leakage leading to increased extravascular fluid, including edema, abnormal healing, and susceptibility to sepsis. These conditions lead to mortality.[24]

Abnormal base deficit and abnormal serum lactate level increased mortality by 1.9 times and 6.4 times, respectively. Both are also statistically significant. Increased base deficit and serum lactate levels occur due to decreased organ perfusion, thereby increasing anaerobic metabolism and lactic acid production. If left untreated, the patient may develop acidosis. Several studies support that the decrease in base and increase in lactic acid are significant markers of organ hypoperfusion to predict mortality and morbidity in burn patients.[25,26]

In this study, all patients had abnormal 0-hour, 24-hour, and 48-hour urea levels. The three variables' mortality rates were 44.4%, 59.3%, and 100%. The OR value of those three also increased over time, even though it was not statistically significant. It means that if abnormal urea levels are found for up to 48 hours, it can further increase mortality risk. Abnormal creatinine and urea levels indicated a disturbance in kidney function. In the case of pediatric burn injury, acute kidney injury (AKI) can occur due to decreased blood perfusion to the kidneys. This situation can be seen in the clinical form of oliguria. The state of sepsis can also trigger AKI. Mainly due to infection and the process of releasing pro-inflammatory mediators such as interleukin-6, interleukin-8, and tumor necrosis factor. The study by Jeschke[27] et al. showed that mortality in pediatric burn patients with AKI decreased from 100% before 1983 to 56% after 1984. Renal failure can be treated with immediate fluid resuscitation and even cytologic hemodialysis.[27]

Complication

Patients who experience complications such as pulmonary edema, SIRS and MOF, and ACS also had an increased risk of mortality compared to patients without complications. These complications appeared because of the hypoalbuminemia that occurs in the patient.[24] In the early hours post burned, the vascular permeability increases, letting intravascular fluid shift to the interstitium. This displacement will cause edema. While the decrease in intravascular volume can lead to tissue ischemia, it can cause acute coronary syndrome (ACS) if it occurs in the coronary arteries. Therefore, managing fluid resuscitation becomes crucial in this period to prevent complications and reduce mortality risk.[21–23]

The limitation of this study is the unequal completeness of the data on the examination results between variables. In addition, several laboratory examinations were unavailable, making it difficult to analyze statistically. However, this study has the advantage that it can summarize significant mortality prognostic factors based on pediatric burn data at CMGH during 1998-2010. Furthermore, studies in the pediatric burn injury field remain minimal, so the results of this study can help provide an overview of the prognostic factors of burns in the pediatric population so that their management becomes adequate.

Conclusions

The more prognostic factors presented in a patient will increase the mortality risk. Thus, it is necessary to identify prognostic factors and treat them according to the problem to reduce mortality risk. Adequate management strategies, prompt involvement of the burn unit team, and adequate facilities have an essential role in the management of pediatric burn injuries. In the study, we found that fluid resuscitation is not always the critical factor in the management because the resuscitation has proceeded at the health facility before referral. Excessive fluid resuscitation can cause high complications of pulmonary edema, SIRS+MOF, and ACS, leading to increased mortality risk.

Disclosure

The authors declare no conflict of interest.

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Role of authors

Conceptualization HA AK, Data curation HA, Formal analysis HA AK, Investigation HA, Funding acquisition HA, Methodology, HA AK, Project administration HA AK, Resources HA AK, Software HA AK, Supervision and validation AK, Visualization and writing original draft HA, writing final and review HA AK.

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