

Relationship of pneumonia and time of admission to survival of inhalation injury patients in Dr. Wahidin Sudirohusodo Hospital Makassar



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ABSTRACT

Introduction: Burn injuries are unique traumas that are recognized as serious public health problems both in low and high-income countries. The lung is the first organ to undergo failure in dying burn patients. This study aimed to determine the relationship between the incidence of pneumonia and mortality in inhalation trauma patients.

Methods: The design of this study was descriptive-analytic using a cross-sectional study design. Data were obtained from the Burn Unit of Wahidin Sudirohusodo General Hospital, Makassar, Indonesia. The inclusion criteria were patients with inhalation trauma, diagnosed radiologically as pneumonia, moderate burn injury, and facial burn injury.

Results: This study included 51 subjects diagnosed with inhalation injury. The subjects were hospitalized via the Emergency Department of Dr. Wahidin Sudirohusodo Hospital Makassar. Data analysis was performed on 51 subjects aged 1 to 78 years old, with a mean of 33.0 ± 16.2 . The onset in all subjects varied between an hour and 336 hours after the inhalation injury. Based on the distribution of the percentage of living subjects, there was a significant correlation between the presence of pneumonia and survival ($p < 0.001$). There is a significant correlation between time of admission and survival ($p < 0.001$). Subjects admitted to hospital < 24 hours have more chance to survive than those ≥ 24 hours.

Conclusion: This study concludes that pneumonia can be a mortality predictor in inhalation injury patients. Time of admission is also a significant factor affecting burn patients' outcomes.

Keywords: Burn Injury, Pneumonia, admission, survival.

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INTRODUCTION

Burn injuries are unique traumas that are recognized as serious public health problems both in low and high-income countries.¹ According to the World Health Organization, burns were ranked 9th in the overall mortality rank for people aged 5–14 years with an estimated 41,575 deaths; 15th for people aged 15–29 years with an estimated 49,067 deaths; and 15th for people aged 0–4 years with an estimated 62,655 deaths.² Latest data regarding burns in Indonesia was obtained from the Ministry of Health (published in 2014), which revealed that burns were ranked 6th in unintentional injuries in Indonesia with a total of 0.7%.³

Inhalation injury is an acute respiratory tract insult caused by steam or toxic inhalants such as fumes, gases, and mists. Inhalation injury may occur without cutaneous burn injury, though

the two injuries usually occur together. Approximately 80% of fire-related deaths are due not to burn injury to the airway but to inhalation of toxic products, especially carbon monoxide and hydrogen cyanide gases. Inhalation injury is generally caused by thermal burns, mostly confined to the upper airways. Major airway, pulmonary, and systemic complications occur with inhalation injury, which increases the incidence of burn patient mortality.⁴

Another cause of mortality from burns is mainly caused by infection. It is estimated that 75% of all burns-related deaths are caused by *P. aeruginosa*, *S. aureus*, *Klebsiella* spp, *Acinetobacter* spp, and *Candida*.¹ Respiratory tract infection is the most common complication in patients with burn injuries. It has been shown that the age and burn size-specific mortality increased by a maximum of 20% with inhalation injury alone, by 40% with

pneumonia alone, and by 60% with both. The lung is the first organ to undergo failure in dying burn patients.⁵ Aim of this study is to determine the relationship between the incidence of pneumonia and mortality in inhalation trauma patients.

METHODS

The design of this study was descriptive-analytic using a cross-sectional study design. Data were obtained from the Burn Unit of Wahidin Sudirohusodo General Hospital, Makassar, Indonesia. The inclusion criteria were patients with inhalation trauma, diagnosed radiologically as pneumonia, moderate burn injury, and facial burn injury.

The collected data is processed using Statistical Package for the Social Sciences (SPSS). In this study, diagnostic tests will be carried out according to the variables

studied. Analysis using Chi-Square test for associative test. The significance of statistics is obtained if $p < 0.05$. Research Ethics Committee, Hasanuddin University, Makassar, Indonesia, has approved this research. Number; 319/UN4.6.4.5.31/PP36/2019.

RESULTS

There were 51 subjects diagnosed with inhalation injuries included in this study. The subjects were hospitalized via the Emergency Department of Dr. Wahidin Sudirohusodo Hospital Makassar.

Data analysis was performed on 51 subjects aged 1 to 78 with a mean of 33.0 ± 16.2 . The onset in all subjects varied between an hour and 336 hours since the inhalation injury.

In this study, 31 subjects (60.8%) present with pneumonia. The time of admission is <24 hours since the trauma in 39 subjects (76.5%) and the remaining (23.5%) are ≥ 24 hours. The percentage of subjects who survive is 58.8%, and 21 of the subjects (41.2%) are deceased.

Based on the distribution of the percentage of living subjects, there was a significant correlation between presence of pneumonia and survival ($p < 0.001$).

There is a significant correlation between time of admission and survival ($p < 0.001$). Subjects admitted to hospital <24 hours have more chance to survive than those ≥ 24 hours.

DISCUSSION

The main aim of this study is to know the relationship between time of admission and pneumonia in inhalation injury patients to the outcome or survival of the patients. Inhalation injury itself can become a predictor of mortality in burn injury.⁴

In this study, we found that most of the patients admitted with inhalation injury present with pneumonia (60.8%) and were admitted to the hospital on the same day of inhalation injury (76.5%); also, 21 out of 51 subjects (41.2%) are deceased. In another study by Edelman et al. of 117 subjects, the incidence of pneumonia was 37%, and the average patient with inhalation injury and pneumonia developed their infiltrate on day 6 after the incident.⁵ Result of a study

Table 1. Distribution of Subject Characteristic (n=51)

Variable		N	%
Pneumonia	Present	31	60.8
	Absent	20	39.2
Time of Admission	<24 hours	39	76.5
	≥ 24 hours	12	23.5
Survival	Alive	30	58.8
	Deceased	21	41.2

Table 2. Survival According to Pneumonia

Pneumonia		Survival		Total
		Alive	Deceased	
Present	N	25	6	31
	%	80.6	19.4	100
Absent	N	5	15	20
	%	25	75	100
Total	n	30	21	51
	%	58.8	41.2	100

Table 3. Survival According to Time of Admission

Time of Admission		Survival		Total	P*
		Alive	Deceased		
<24 hours	n	30	9	39	<0.001
	%	76.9	23.1	100	
≥ 24 hours	n	0	12	12	
	%	0	100	100	
Total	n	30	21	51	
	%	58.8	41.2	100	

by Cotte et al., early onset pneumonia was diagnosed in 38.2% of patients with face and neck burns.⁶ most subjects' admission time (76.5%) is <24 hours since the trauma. This result is in accordance with the literature by Wolf et al. in their study, 70% of the patients arrived at the hospital within 48 hours of burn trauma.⁷

The result of survival according to the presence of pneumonia shows a significant correlation. As we know, infections are a major cause of morbidity and mortality in burn patients.⁸ It is also the most common complication after burn injury, especially pulmonary infection following inhalation injury.⁹ Two main predisposition factors of infection in inhalation injury patients are the burn and the accompanying immunosuppression. Based on a review

of all burn deaths in the Burn Unit of the Massachusetts General Hospital during the 6 years, the lung was the first dialing organ in dying burn patients.¹⁰

According to a study of 1058 consecutive burn patients by Shirani et al., the presence of pneumonia in patients with visually tracheobronchial inflammation by bronchoscopy appears to be a more extensive tracheobronchial injury with massive tissue necrosis and disruption of the alveolar-capillary membrane. On the other hand, inhalation injury itself, in addition to the damaging epithelium in the respiratory tract, also impairs the production of surfactant in the lung and disrupts mucociliary transport. Inhalation injury also impairs pulmonary macrophage function as well. The final result of these

pulmonary changes, combined with the global immunosuppression because of the burns, is the development of respiratory tract infections, mainly pneumonia. Early pneumonia was more common in patients with inhalation injury than in patients without inhalation injury.⁹

In that study also concludes that pneumonia has a significant independent effect on burn mortality, but these effects vary with age and predictably burn size. The conclusion by Shirani et al., is in accordance with our result.⁹

Based on the time of admission, there is a significant correlation with the survival of the inhalation injury patients. It has been found that based on a study of 103 burn patients, the patients most likely to die are those with delayed intravenous access and fluid resuscitation, patients with lower admission hematocrit, lower base deficit on admission, and also higher serum osmolality on arrival in hospital. Mortality increases with delays in starting an intravenous line and instituting volume resuscitation.⁷ This means that as soon as the patients are admitted to the hospital, they are more likely to survive burn injury. This also applies to inhalation injury after burn trauma, considering inhalation injury even needs more aggressive treatment.

There are several limitations of this study, such as the design of the study, lack of samples, and some confounding factors

that are not excluded so the study can be biased. Two major confounding factors are the subjects' age and total burn surface area (TBSA). Based on several literatures, those two variables also have a role in decreasing the survival rate of burn trauma patients, particularly in inhalation injury patients.⁴

For study in the future, we suggest making a better design like a prospective study. The study variables can be widened and the sample criteria should be more specific.

CONCLUSION

From this study, we can conclude that pneumonia can be a mortality predictor in inhalation injury patients. Time of admission is also a significant factor affecting burn patients' outcomes. This conclusion can be used to improve the treatment of burn trauma patients, particularly those with inhalation injuries. Considering all the limitations of this study, further research with larger samples are needed to even complete and confirm the result.

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CONFLICT OF INTEREST:

No conflict of Interest

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