

Early Burn Resuscitation Done By Referring Facilities And Burn Patient's Survival: A Retrospective Study

Aditya Wardhana, Nurliati Sari H.
Jakarta, Indonesia.

Background: An acute burn wound is a complex injury, which ideally needs to be handled in a special burn unit. Problems arise when a burn patient come to a facility with no burn unit available. The patient needs to be referred and transferred to the nearest burn unit. The adequacy of burn resuscitation done by the referring facility during the transfer process is important to the patient's survival. To evaluate this matter, a review of mortality during one-year interval of 2010 is being done in Cipto Mangunkusumo Hospital's burn unit.

Methods: We are conducting a retrospective review of all 143 patients with acute burn injuries admitted in 2010 to Cipto Mangunkusumo Hospital's burn unit, analyzed with bivariate analysis using SPSS.

Results: Out of the 143 patients being evaluated, we predict there is a significant level of burn resuscitation inadequacy done by the referring facility which influences the patient's survival.

Conclusion: Survival rates can be improved by providing adequate burn resuscitation during transfer process to the nearest burn unit. It is recommended that efforts on updating the knowledge and awareness of treating burn injury patients is given to nurses and physicians in referring facilities.

Keywords: burn injury, burn resuscitation, burn survival, burn mortality.

Latar Belakang: Luka bakar akut adalah sebuah masalah yang kompleks dan harus ditangani di sebuah unit luka bakar. Masalah timbul ketika pasien datang dan tidak terdapat unit luka bakar. Pasien harus segera dirujuk dan di transfer ke unit luka bakar terdekat. Jumlah resusitasi cairan yang adekuat yang dilakukan oleh fasilitas yang merujuk pasien luka bakar sangatlah penting. Untuk mengevaluasi masalah ini, kami menelaah data dengan interval satu tahun pada tahun 2010 di Unit Luka Bakar Rumah Sakit Cipto Mangunkusumo

Metodologi: Kami melakukan studi retrospektif pada 143 pasien dengan luka bakar akut yang dirujuk ke Unit Luka Bakar Rumah Sakit Cipto Mangunkusumo, yang kemudian kami analisa dengan metoda bivariate analysis menggunakan SPSS.

Hasil: Sebanyak 143 pasien diteliti, kami memprediksi bahwa terdapat hasil yang signifikan dari resusitasi tidak adekuat yang dilakukan oleh fasilitas yang merujuk yang mempengaruhi rerata survival pasien.

Kesimpulan: Rerata survival dapat ditingkatkan dengan memberikan resusitasi luka bakar yang adekuat dalam proses rujukan ke unit luka bakar terdekat. Sangat direkomendasikan bahwa usaha untuk meningkatkan pengetahuan dan kesadaran dalam merawat pasien luka bakar, harus diberikan ke perawat dan dokter umum di fasilitas yang merujuk.

Kata Kunci: burn injury, burn resuscitation, burn survival, burn mortality.

An acute burn wound is a complex injury, which ideally needs to be handled in a special burn unit. Problems arise when a burn patient come to a facility with no burn unit available.^{1,2} The patient needs to be referred and transferred to the nearest burn unit. The adequacy of burn resuscitation done by the referring facility during the transfer

From the Burn Unit, Division of Plastic Surgery, Department Of Surgery, Cipto Mangunkusumo General National Hospital, Universitas Indonesia.

Presented in The Fifteenth Annual Scientific Meeting of Indonesian Association of Plastic Surgeon. Semarang, Central Java. Indonesia.

process is important to the patient's survival.^{3,4} To evaluate this matter, a review of mortality during one-year interval of 2010 was done in Cipto Mangunkusumo Hospital's burn unit.

METHODS

We designed a retrospective study to assess the adequacy of early fluid resuscitation in burn patients referred to Cipto Mangunkusumo Hospital's burn unit. Ideal fluid resuscitation is

Disclosure: The authors have no financial interest to disclose.

Table 1. American Burn Association Burn Center Referral Criteria.

1. Partial-thickness and full-thickness burns greater than 10% of the total body surface area (TBSA) in patients younger than 10 years or older than 50 years of age
2. Partial-thickness and full-thickness burns greater than 20 TBSA in other age groups
3. Partial-thickness burns involving the face, eyes, ears, hands, feet, genitalia, or perineum of those that involve skin overlying major joints
4. Full-thickness burns greater than 5% TBSA in any age group
5. Electrical burns, including lightning injury (extensive volumes of tissue beneath the surface may be injured and may result in acute renal failure and other complications)
6. Extensive chemical burns
7. Inhalation injury
8. Burn injury in patients with preexisting illness that could complicate management, prolong recovery, or affect mortality
9. Any burn patient in whom concomitant trauma poses an increased risk or morbidity or mortality may be treated initially in a trauma center until stable before transfer to a burn center
10. Children with burns seen in hospitals without qualified personnel or equipment for their care should be transferred to a burn center with these capabilities
11. Burn injury in patients who will require special social and emotional or long-term rehabilitative support, including cases involving suspected child abuse and neglect

calculated according to the Parkland formula. Retrospective medical chart reviews were undertaken on patients admitted to the burn unit over the year of 2010. Out of the 143 patients, we were able to trace 84 medical charts from the medical records office. Only patients who met the burn unit admission criteria set out by the American Burn Association were included in the study⁵ (Table 1).

Patients who were not referred from outside health care facilities, left burn unit against medical advice, moved to another hospital, or who had incomplete charts were excluded. Information extracted from the charts included the time of injury, time of arrival in the referring emergency department, time in transit to the burn unit, and time of arrival. In addition, the volume of intravenous fluid administered during each time interval, TBSA by referring health care facilities and by the burn unit, age, weight of the patient, estimated fluid needs based on the Parkland formula, and outcome were documented.

The number of patients under resuscitated, adequately resuscitated, or over resuscitated was noted. A comparison was made between the TBSA as calculated by the referring health care facilities and by the burn unit. Statistical analysis of this study was done using SPSS.

RESULTS

The total number of patients who met the criteria was 50. Average patient age was 26.12 years (range, 1–64 years). Average weight was 45.49 kg (range, 8–80 kg). The average time

from initial burn to transfer to the burn unit was 37.91 hours (range, 1.5–456 hours). The average TBSA evaluated by the referring health care facilities was 33.09% (range, 5–99%) compared with the burn unit evaluation average of 33.43% (range, 6–95%; Table 2). TBSA calculation discrepancy was found in 34% of patients with the average of 11.31%. Evaluation for adequacy of fluid resuscitation revealed that only 6% of patients fell within the accepted range. Furthermore, 10% of patients were over resuscitated whereas 84% were under resuscitated.

Table 2. Patient Demographics and Initial Evaluation.

Characteristic	Average	Range
Age (yr)	26.12	1-64
Weight (kg)	45.49	8-80
TBSA by referral (%)	33.09	5-99
TBSA by burn unit (%)	33.43	6-95
Time of injury until arrival at burn unit (hours)	37.91	1.5-456
Fluids given (mL)	1142	0-7500

TBSA = Total Body Surface Area

From outcome evaluation, 24 patients (48%) died and 26 patients (52%) survived. Among the patients who died, 22 out of 24 patients were under resuscitated, while all of the patients who were adequately resuscitated survived (Table 3).

Referring health facilities mostly came from out-side Jakarta region (54%: Table 4) and were

referred by private hospital (58%: Table 5).

Table 3. Early Resuscitation and Outcome Evaluation

Outcome	Early Resuscitation Status			Total
	Over	Adequate	Under	
Died	2	-	22	24
Survived	3	3	20	26
Total	5 (10%)	3 (6%)	42 (84%)	50

Table 4. Referring health facilities by region

Referral Region	Number of patients
Jakarta	23
Outside Jakarta	
-Bogor	7
-Depok	1
-Tangerang	10
-Bekasi	6
-Others	3

Table 5. Referring health facilities by type

Referring health facilities	Number of patients
Clinic	2
Government hospital	19
Private hospital	29

DISCUSSION

Various fluid resuscitation formulas are available, all of which address the early fluid needs of burn patients.^{6,7} We have found that the Parkland formula is the one widely used in daily practice. Half of the calculated volume is administered during the first 8 hours, and the second half is administered during the next 16 hours. Using this formula, we calculated an acceptable range of fluid resuscitation and then selected those patients who were under, adequately, or over resuscitated. This range has also been included to help emphasize that fluid formulas are merely guidelines and should be adjusted according to the patient's individual requirements.¹

Our retrospective study demonstrates that a substantial number of burn patients are inappropriately fluid resuscitated before their arrival in the burn unit and also experienced a delay in transfer. A discrepancy between the es-

timated TBSA by the referring healthcare facilities and our burn unit was noted and might be the cause of deviated fluid resuscitation given prior to burn unit arrival. However, under resuscitation of a burn patient can lead to unnecessary complications or increased mortality.⁸ In our study, we have found inappropriate early fluid resuscitation in 94% of patients referred to the burn unit (84% under resuscitated and 10% over resuscitated).

The causes of delay in transfer and internal situation in the referring healthcare facilities that may have affected the handling of acute burn injury patients, including the staffs' composition and competency, still need further analysis. From our data, referring health facilities mostly came from outside Jakarta region (54%: Table 4) and referred by private hospital (58%: Table 5). The distance and traffic condition are considered to be correlated with this delay.

Hagstrom et al (2003) from the University of California Irvine Medical Center Burn Center, St. Francis Memorial Hospital, San Francisco reported, using the referring emergency department staff TBSA percentage, evaluation of the data revealed that only 23% of patients fell within the accepted range using the American Burn Association formula. Furthermore, 30% of patients were over resuscitated whereas 47% were under resuscitated. Of the over resuscitated patients, 1 patient was critically over resuscitated. In the group of under resuscitated patients, five were critically under resuscitated. Thirty-three percent of the patients' TBSA had a more than 50% discrepancy between the burn unit and the emergency department calculations.⁴

Mustafa et al (2005) evaluated 980 patients who were hospitalized in the Burns Unit at Dicle University Hospital (DUH) between June 1994 and July 1999 and examined factors affecting mortality. Acute renal failure and fluid electrolyte deficit occurred in patients who did not receive fluid replacement early on, especially those with major burns. Deaths of patients with extensive burns usually occurred in the first 5 days following injury due to acute renal failure and hypovolemic shock, while deaths from moderate and minor burns usually

occurred after 7 days and were due to wound infection and sepsis. Positive correlations between age and type of burn, degree and type of burn, and the extent of burn and mortality were found. The overall mortality rate was 6.3%.⁹

Klein et al (2007) reviewed 72 patients in University of Washington Burn Center. Average patient age was 40.6 years and average TBSA was 44.5%. Average fluid volume received during the first 24 hours after injury was 5.2/mL/kg/TBSA. Increased fluid volume received increased risk of development of pneumonia, bloodstream infections, adult respiratory distress syndrome, multiple organ failure, and death. TBSA, age, weight, and intubation status on admission were significant predictors of fluid received. Patients who received larger volumes of resuscitation fluid were at higher risk for injury complications and death.¹⁰

Survival rates can be improved and mortality rate can be decreased by providing adequate early burn resuscitation during transfer process to the nearest burn unit as well as preventing a delay in transfer. It is recommended that efforts on updating the knowledge and awareness of treating burn injury patients is given to nurses and physicians in referring facilities. Active communication between physicians in referring healthcare facilities and in the burn unit is also encouraged. Physicians in the burn unit who are more experienced in the care of burn patients can assist during early resuscitation and preparation for transfer to the burn unit. This active role should potentially result in markedly improved patient care and survival by having a proper assessment in terms of severity of burn injury as well as guiding fluid management.^{11,12}

Aditya Wardhana,

*Burn Unit, Plastic Surgery Division
Cipto Mangunkusumo General National Hospital
Jalan Diponegoro.No.71, Gedung A, Lantai 4.
aditya_wrdn@yahoo.com*

Acknowledgement

We gratefully thank Nyoman P. Riasa, M.D. for tremendous assistances in reviewing this articles.

REFERENCES

1. Herndon, DN, ed. Total Burn Care, 3rd edition, W.B. Saunders; 2007.
2. Artz CP, Moncrief JA. The Burn Problem. In: Artz CP, Moncrief JA eds. The Treatment of Burns, 2nd ed. Philadelphia, PA: WB Saunders Co., 1969: 1-21.
3. Bull JP, Fisher AJ. A study of mortality in a burns unit: a revised estimate. *Ann Surg* 139: 269-274,1954.
4. Hagstrom M, Wirth GA, Evans GRD, Ikeda CJ. A review of emergency department fluid resuscitation of burn patients transferred to a regional, verified burn center. *Ann Plast Surg*. 51:173-176,2003.
5. Nebraska Burn Institute. Advanced Burn Life Support Providers Manual. Lincoln, NE: Nebraska Burn Institute; 1987.
6. Warden GD. Burn shock resuscitation. *World J Surg*. 1992;16:16-23.
7. Boswick JA, ed. The Art and Science of Burn Care. Rockville, MD: Aspen Publishers; 1987.
8. Keck M, Herndon DN, Kamolz LP, Frey M, Jeschke MG. Pathophysiology of burns. *Wien Med Wochenschr*. 159:327-336, 2009.
9. Mustafa A, Kara IH, Girgin S, Guloglu C. Factors affecting mortality and epidemiological data in patients hospitalized with burn in Diyarbakir, Turkey. *Saudi Arabia Journal of Surgery*. 43(4): 160-2,2005.
10. Klein MB et al. The association between fluid administration and outcome following major burn: a multicenter study. *Ann Surg* 245:622-628,2007.
11. Schofield RF, Amodeo M. Interdisciplinary teams in health care and human services settings: are they effective. *Health and Social Work* 24(3): 210,1999.
12. Al-Mousawi, A.M., G.A. Mecott-Rivera, M.G. Jeschke, and D.N. Herndon. Burn teams and burn centers: the importance of a comprehensive team approach to burn care. *Clin Plast Surg*. 36:547-554, 2009.