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Case Report

Challenge In Management of Severe Burn Injury Patients in Rural Area in Indonesia: A Case Report of Two Patients

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Abstract

Background: The incidence of burns in the world varies. Deaths from burns in poor and developing countries are estimated to be seven times higher than in developed countries.

Case: We will report cases of burn injury in Sumenep, East Java which located in the eastern part of Madura Island. The first patient found to have superficial partial and deep dermal thickness burn, with a total burn area of 90% TBSA, while the second patient was a child and found to have 64% TBSA. Treatment was based on ABA algorithm.

Discussion: Rural burns were frequent and severe, which demonstrate the importance of appropriate prevention directed at rural populations, educational programs, and regulations concerning the restricted use of combustible fluids and hot water in individual homes should be developed. Lack of parental education, poverty, large families, substandard housing, and delayed admission are all associated with increased risk of burns in rural areas.

ABBREVIATIONS

TBSA: Total Burn Surface Area

INTRODUCTION

Burn injury is still one of the leading causes of morbidity and mortality in population. It can result both in temporary and permanent disabilities, and is the third greatest cause of mortality in trauma worldwide (1). In 2014, the World Health Organization (WHO) estimated that around 265.000 deaths annually worldwide are due to burns (2). The incidence of burns in the world varies. In developing and poor countries, the incidence of burns is 1.3 per 100,000 population while in developed countries, it is 0.14 per 100 000 population (3). Deaths from burns in poor and developing countries are estimated to be seven times higher than in developed countries (1). In developed countries the child mortality rate from burns is 3% of all trauma, while in developing countries it is 10%. Mortality of children due to burns in the world varies from 3.5% to 12% depending on many factors (4). The American Burn Association (ABA) records 1100 children die each year from burns (5).

Burn risk has been linked to a number of socioeconomic characteristics (6). The rate of death from burns is higher in rural communities (7). Burn risk has also been linked to family patterns (such as family size), unemployment, and a lack of education (8). As people living in rural areas are generally less well informed than urban populations, it is possible that they are less familiar with the precautions for avoiding burns and that they therefore are exposed to burn injury more frequently (9). We will report cases of burn injury in Sumenep, East Java which located in the eastern part of Madura Island. This paper aims to elaborate and evaluate how to manage such a patient or injury in rural area with limited available resources. This paper has been reported in line with the SCARE 2020 criteria (10).

CASE PRESENTATION

Patient 1

A 21-year-old male patient was involved in a burn injury after falling down from a 3 meters roof and landed in a huge tub filled with boiling water to produce tofu. He came from a poor family with low socio-economic context.

After the injury, he was immediately sent to the emergency room by a private vehicle and arrived to hospital 1 hour after the incident. The emergency treatment using the algorithm from the Advanced Trauma Life Support (ATLS) was applied by the

emergency room general practitioner. There were facial burns but intubation is only done when the patient has been transferred to ICU. The collar neck was administered as there was a history of falling. Oxygen was given using a non-rebreathing mask 15 lpm. Initial evaluation revealed mildly tachycardia in the 110 beat per minute, IV line was administered with Ringer Lactate Infusion. He was awake and alert with no loss of consciousness at the scene but sustained significant thermal injuries. The clothing as well as accessories from the patient's body were removed and found deep dermal and full-thickness burn (grade II-III) to face, necks, trunks, bilateral arms and legs (Figure 1).

Secondary survey and imaging revealed no further injuries. The burn wounds, classified as superficial partial and deep dermal thickness burn, with a total burn area of 90% total body surface area (TBSA). Fluid resuscitation with Lactated Ringer's solution was then performed according to the modified Parkland-Baxter formula without maintenance fluid, and hourly urine output via urinary catheter was measured and maintained to 0.5 mL/kg/hour. Intravenous metamizole was used as the analgesia with intravenous ceftriaxone as antibiotic. Tetanus prophylaxis was administered. Laboratory tests were performed, with the following abnormal results were detected from: routine blood examination (leucocytosis 12.10 x $10^{9/L,}$ AST 146.8 U/L, ALT 5.5 U/L, hypoalbuminemia 3.19 mg/dl). The patient underwent nasogastric tube (NGT) and urinary catheter insertion. After stabilization in the ER, the patient was transferred to the isolation room of the Intensive Care Unit (ICU) and intubated by the anesthesiologist.

On the third day, antibiotics were changed to meropenem due to leucocytosis (20 x 10^9 /L). Surgical debridement (Figure 2) was performed by the attending general surgeon under general anesthesia on day 4 (after general condition improvement) and the wound dressing was changed within 3 days. Escharotomy was performed on the legs and arms.

The patient was discharged on the 10^{th} day of hospitalization as the forced discharged request by the patient. The patient resumed wound care in the surgery outpatient setting (Figure 3) with the same attending surgeon. Wound dressing consisted of silver sulfadiazine including framycetin sulfate BP 1% (Sofratulle), and dry sterile gauze was applied. The patient had a fever (38 °C) but refuse hospitalization. The patient died at home 1 day after the last visit in hospital.

Figure 1 Initial picture of patient 1.

Figure 2 Patient 1 after surgical debridement.

Figure 3 Patient 1 in Outpatient clinic, 5 days after discharge from hospital.

Patient 2

A 7-year-old male patient was involved in a burn injury after playing with fuel and fire. He came from Gili Raja Island, a small island around Sumenep. There was no hospital in the island.

The fire was immediately extinguished with water by his family. After the injury, his mother put toothpaste on his wound. He came to primary health care in Gili Raja Island. In Primary health care, IV line was administered with Ringer Lactate Infusion 700 cc and medication 500 mg cefotaxime twice daily and 150 mg metamizole twice daily. Then, the patient was referred to our ER by ship and private vehicle and arrived to our hospital 8 hours after being injured.

There were facial burns but intubation is only done when the patient has been transferred to ICU. Oxygen was given using a non-rebreathing mask 15 lpm. Initial evaluation revealed tachycardia in the 170 beat per minute. He was awake and alert with no loss of consciousness at the scene but sustained significant thermal injuries. The clothing as well as accessories from the patient's body were removed and found deep dermal and full-thickness

burn (grade II-III) to face, necks, trunks, bilateral arms and legs (Figure 4).

Secondary survey and imaging revealed no further injuries. The burn wounds, using "modified Rule of nine" were classified as superficial dermal and mid-dermal thickness burn, with total burn area of 64% total body surface area (TBSA). Fluid resuscitation with Lactated Ringer's solution was then performed according to the modified Parkland-Baxter formula (3 ml L/kg BB/%TBSA) with maintenance fluid, and hourly urine output via urinary catheter was measured and maintained to 1mL/kg/hour. Intravenous metamizole was used as the analgesia with intravenous ceftriaxone as antibiotic. Tetanus prophylaxis was administered due to uncertain tetanus vaccination status. Laboratory tests were performed with the following abnormal results detected from: routine blood examination (leucocytosis 15.10 x $10^{9/L}$, AST 146.8 U/L, AST 5.5 U/L, hypoalbuminemia 2.8 mg/dl). The patient underwent nasogastric tube (NGT) and urinary catheter insertion. After stabilization in the ER, the patient was transferred to the isolation room of Intensive Care Unit (ICU).

In ICU, the patient was intubated and using ventilator for 3 days. Central Venous Catheter also inserted in day 4. Intravenous albumin 60 grams daily was given until albumin rose to 3.5 mg/dl and followed with oral VIP albumin. On the second day, surgical debridement was performed by the attending general surgeon under general anesthesia and the wound dressing was changed within 3 days. On the 6th day, surgical debridement and wound care were performed again. Blood examination revealed there was elevated leucocytes (leucocytosis 20.10 x$10^{9/L}$), so the antibiotics was changed to intravenous Meropenem. The patient remained unstable on day 7 with hyperthermia (38-39 C) with no sign of pneumonia (x-ray was clear) and hypotension (MAP 65). We assessed the patient with sepsis according to the SOFA score. The patient died on the 10th day.

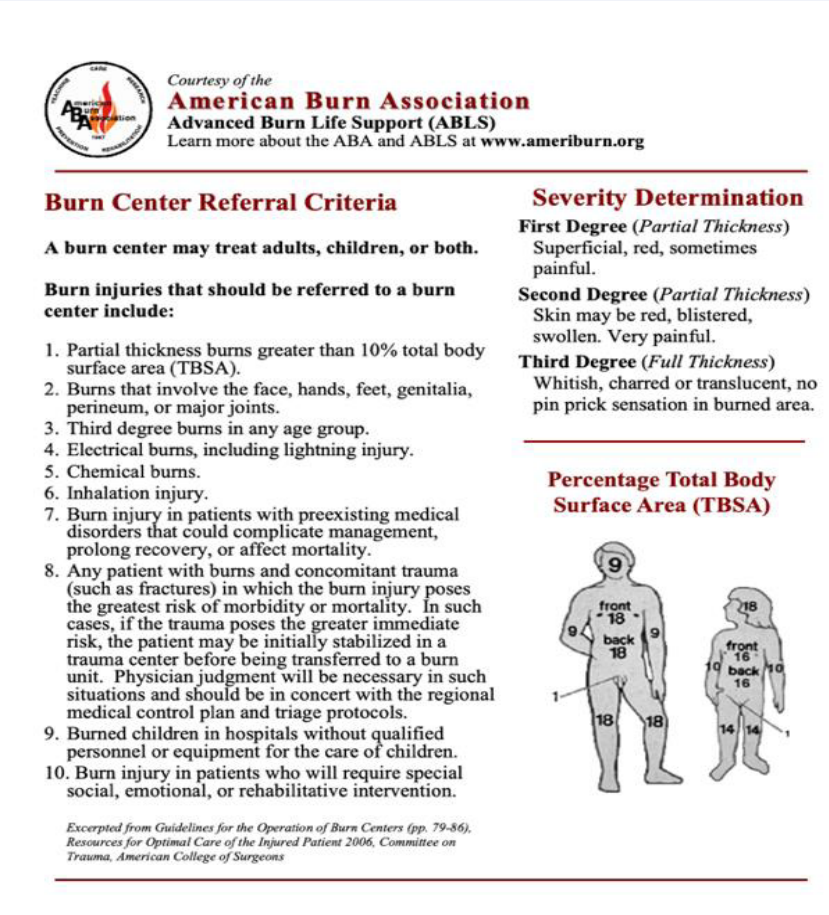
DISCUSSION

This case report revealed two cases of very severe burn injury patients in a hospital with limited resources and no burn team available. Evaluating overall burn area can be difficult for the untrained. Full-thickness burns involving more than 20% of TBSA (>10% in children younger than 10 years) and all kinds of electrical burn injuries are defined as major burns.[11] Morbidity and mortality rate increase with the size and the depth of the major burn. In our patient, burned TBSA was estimated according to "the rule of 9s". It was calculated as 90% TBSA for the first patient and 60% TBSA using "modified rule of 9s" for the second patient which could be accepted as a fatal ratio.

In these cases, we used the ABA guideline while some modifications were performed for the aspects which were unable to be fulfilled. The best possible alternative devices or procedures were utilized with the aim to achieve optimal wound healing and reduce the patient's morbidity and mortality. According to the ABA referral criteria (12) (Figure 6), the patient needs to be transferred or have early consultation with a burn unit, yet the nearest city with such facility is approximately 170 km or 4 hours from the hospital, meanwhile the hospital from their home is already one to two hours using boat. Pearson et al. attributed difficulties in accessing health-care services to the low socioeconomic level and educational attainment of rural populations, which were also found in this study (13). Thus, individuals in rural areas may be discouraged from seeking medical attention. The mean response and transport times for transfer of the patient from the scene to the hospital have been shown longer for rural incidents (14). They believe that dying in their hometown is better than being referred. Therefore, the patient had to be treated in our non-isolation ICU with the facilities and resources we had.

In our case, the patients immediately came to ER without first aid in the injury scene. In this study, we found that community knowledge and practice about burn prevention and first aid were poor. The villagers were unaware about what to do when a person caught fire. Immediate copious running water was not applied due to inadequate knowledge whereas copious irrigation will limit the severity including the size and the depth of injury

Figure 4 Patient 2 initial pictures.



Courtesy of the
American Burn Association
Advanced Burn Life Support (ABLS)
Learn more about the ABA and ABLS at www.ameriburn.org

Burn Center Referral Criteria

A burn center may treat adults, children, or both.

Burn injuries that should be referred to a burn center include:

1. Partial thickness burns greater than 10% total body surface area (TBSA).
2. Burns that involve the face, hands, feet, genitalia, perineum, or major joints.
3. Third degree burns in any age group.
4. Electrical burns, including lightning injury.
5. Chemical burns.
6. Inhalation injury.
7. Burn injury in patients with preexisting medical disorders that could complicate management, prolong recovery, or affect mortality.
8. Any patient with burns and concomitant trauma (such as fractures) in which the burn injury poses the greatest risk of morbidity or mortality. In such cases, if the trauma poses the greater immediate risk, the patient may be initially stabilized in a trauma center before being transferred to a burn unit. Physician judgment will be necessary in such situations and should be in concert with the regional medical control plan and triage protocols.
9. Burned children in hospitals without qualified personnel or equipment for the care of children.
10. Burn injury in patients who will require special social, emotional, or rehabilitative intervention.

Excerpted from Guidelines for the Operation of Burn Centers (pp. 79-86), Resources for Optimal Care of the Injured Patient 2006, Committee on Trauma, American College of Surgeons

Severity Determination

First Degree (*Partial Thickness*) Superficial, red, sometimes painful.

Second Degree (*Partial Thickness*) Skin may be red, blistered, swollen. Very painful.

Third Degree (*Full Thickness*) Whitish, charred or translucent, no pin prick sensation in burned area.

Percentage Total Body Surface Area (TBSA)

Figure 5 ABA Burn Center Referral Criteria.

(15). The exact mechanisms by which cool running water might improve outcomes remain unclear, but its effects are known to extend beyond the mere dissipation of heat. Some authors suspect that cooling may decrease burn wound progression (16) by altering cellular behavior (17), with past research demonstrating associations with decreased release of lactate and histamine, stabilization of thromboxane and prostaglandin levels, and inhibition of kallikrein activity (18).

On patient 2, the family delayed in decision-making and therefore the patient's transfer to the hospital was delayed by many hours. The second patient who came to the hospital being referred from the primary health care also did not get the right initial therapy, the patient was only given an infusion without an airway securing device, oxygenation and not given a dressing. In developing countries, delay in decision-making, delay in transferring patient with complications, and delay in providing timely treatment are contributing factors of patient mortality (19). In our study we also found, on patient 2, the mother gave toothpaste on her son's wound. The community has a misperception of things to do immediately after burn. Using substances like tooth- paste, egg, mud, and salt in burnt areas is still common and widely practiced. The authors regard that this mortality on patient 2 might be the result of delayed admission or the long transportation distance.

Even though burn injury diagnosis does not need any sophisticated modalities, but microbiological tests such as wound culture swabs were not performed in our case, which may result in unknown wound infection or antibiotics sensitivity. In our cases, we used broad-spectrum antibiotics (ceftriaxone) and changed to stronger antibiotics (meropenem) when the leucocytes rose to 20.10 x $10^{9/L}$. The most frequent cause of death in major thermal burns is infection. There is a high risk of colonization and infection in burn wounds. This susceptibility results from the combined effects of the disruption of the normal skin barrier, the presence of coagulated proteins and other microbial nutrients in the wound, and the avascularity of the eschar, which prevent the delivery of immunologically active cells, humoral factors, and blood-borne antibiotics to the eschar (20).

Healthcare providers should also know what major burns are and how to handle life-threatening emergencies and securely transfer the patients. During the transport, written instructions need to be made for the correct amount of fluid to be administered. In a conscious patient, oral resuscitation should be encouraged. The medico-legal formalities will have to be completed at the primary center before the transfer and the patient must be transferred without unnecessary delay. It is important to have good awareness on prevention and education for first aid, so in the long term, the incidence of major accidental burns can be

reduced and the severity of burns will also be reduced. Clear classification of the severity of burn injury needs to be done. Therefore, mild burns can be addressed locally, whereas major burns need to be taken to a proper burn unit facility. Transporting people from rural villages and tribal areas can be difficult, and it can take days for patients to get anywhere near a facility if they are not properly guided. Patients who are not well educated frequently refuse to be referred. According to the advocacy of burns, burn prevention should be a nationwide program created by specialists and the government with compassion, vision, and care. To reduce burn injury instances in rural areas, education and health promotion on how to live a safe lifestyle in a rural location must be integrated.

CONCLUSION

In conclusion, we found that rural burns were frequent and severe, which demonstrate the importance of appropriate prevention directed at rural populations, educational programs, and regulations concerning the restricted use of combustible fluids and hot water in individual homes should be developed. Lack of parental education, poverty, large families, substandard housing, and delayed admission are all associated with increased risk of burns in rural areas. While many of these factors are not modifiable, future prevention efforts should be focused on children of lower socioeconomic status.

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