

Retrospective analysis of patients with burn injury treated in a burn center in Turkey during the Syrian civil war

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ABSTRACT

Objectives: To report the management of burn injuries that occurred in the Syria civil war, which were referred to our burn center.

Methods: Forty-three patients with burns, injured in the civil war in Syria and whom were referred to Dr. Lütfi Kırdar Kartal Educating and Training Hospital Burn Centre of İstanbul, Turkey between 2011-2015 were analyzed in a retrospective study.

Results: Most of our patients were in major burn classification (93%; 40/43) and most of them had burns >15% total on body surface area. Most of them were admitted to our center late after first management at centers with improper conditions and in cultures of these patients unusual and resistant strains specific to the battlefield were produced.

Conclusion: Immediate transfer of the patients from the scene of incidence to burn centers ensures early treatment, this factor may be effective on the outcome of these patients.

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People are widely exposed to adverse effects of war all around the world and thousands of civil persons have suffered severe burn wounds in Syria. Turkey has accepted many Syrian refugees whose exact number is uncertain, and most of them were placed in refugee camps under the direct authority of the Turkish Government with the cost of their treatments fulfilled.¹ There are a few studies managed in Turkey regarding war injuries in the Syrian civil war.²⁻⁴ This study presents our retrospective assessment about burn patients in Syria who were referred to our burn center in İstanbul, Turkey.

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Methods. This is a retrospective hospital-based study involving data collected from 2011 to 2015, it was approved by the Institutional Review Board and Ethics Committee. A large number of patients from Syria with war burns and related injuries are admitted to the Dr. Lütfi Kırdar Kartal Educating and Training Hospital, Burn Centre of İstanbul, Turkey. İstanbul is 1200 km far from the borderland of Syria.

Dr. Lütfi Kırdar Kartal Educating and Training Hospital Burns Centre is the most equipped burn center in Turkey. It has 6 intensive care unit (ICU) rooms, 16 burn service beds, and 2 separate operating rooms all housed in one building. All 6 rooms of our ICU were designed according to the American Burn Association (ABA) criteria with hepafilters, laminar flows, and with cabin entrances. The infected patients from Syria were isolated from other patients by using different dressing and operation rooms.

All patients from 1 to 67 years of age who were admitted to the Burn Intensive Care Unit (BICU) of the hospital were studied. The patients' charts and ICU documentation log were reviewed. The patients with BICU follow up less than 3 days were excluded from the study.

In this center a multidisciplinary crew working due to the ABA criteria,⁵ consisting of general surgeons, plastic surgeons, anesthesiologists either in ICU or in operating rooms, infectious disease doctors, pediatric surgeons, physiotherapists, psychologists, dieticians, and burn nurses. It has a helicopter landing field and it accepts patients from every region of the country as well as from neighboring countries. We examined the age and gender of the patient, the depth of the burn injury, total burned surface area, the distribution of the burn areas, according to the ABA criteria, infection foci of the patients, unusual microorganism growth in cultures, and the treatment.

A retrospective analysis of the notes was carried out and a database was created using FileMaker Pro (File Maker Inc., Santa Clara, California, USA). Descriptive statistics were performed and inter-group differences were examined for statistical significance using StatPlus:mac software (AnalystSoft Inc., Walnut, Canada), with *p*-values <0.05 deemed to be statistically significant.

This study was performed according to the principles of Helsinki Declaration.

Results. In the study period, a total of 2462 patients were hospitalized; 596 of them were in the BICU and 1866 of them in burn service. During these 4 years, a total of 43 burn patients were admitted to our burn

center due to the Syrian civil war. First treatments of 21 (48.9%) patients were carried out in cities close to the boundary. Mean 7.8 ± 11.9 days (1-22 days) passed when they were referred to our burn center. Nineteen patients (44.2%) were brought to the center by air ambulance to the Health Ministry.

Burn reasons were recorded in Table 1. In the study period it was impossible for us to know the exact number of people who were injured by burns, but the distribution of patients due to burn environments were recorded in Table 1. War is the main reason for all burns, with 32.5% of our burn cases occurred directly in battlefields.

Most victims, 25 in number (58.1%) were male. The mean age was 26.7 ± 23.7 years. The youngest patient was 1 year and the oldest was 67.

With respect to the ABA criteria, 40 of the our patients were in major burn classification and most of them had burns >15% total body surface area. The mean total body surface area (TBSA) burned was 56.7% (11-95%). Burned TBSA of 9 patients were 90-95% and all of them died within 48-72 hours. Affected body regions in our patients were recorded in Table 1.

The patients admitted to our center with multiple infection foci. It is certain that the acceptance of infected patients from another health center corrupts a hospital's infection control program. These infected patients can easily infect other patients in our ICU. For this reason, at their acceptance, blood and urinary catheters, and endotracheal tubes were changed. Tissue cultures from injury sides, blood cultures and cultures from catheter tips, tracheal aspiration materials, and rectal swabs were studied (Table 2). Infection diagnosis was made according to the criteria reported by the National Nosocomial Infections Surveillance System.⁶

Twenty-two of the patients (51.1%) performed a bronchoscopic examination with suspected inhalation injury and 13 (30.2%) were positive. Twenty-nine of the patients (67.4%) were followed in the BICU of our hospital. The mean length of stay in the ICU was 26 ± 20.1 (9-43 days).

In treatment, silver sulfadiazine cream, bacitracin, and neomycin sulfate pomade were used daily as topical agents convenient with literature.⁷ Furthermore, the second degree burn areas were dressed with Aquacell® and Acticoat® (Smith and Nephew Plc, London, UK), which were not needed to be changed daily.

Escharotomies and fasciotomies had been performed in 16 patients at previous treatment centers before they were admitted to our hospital due to circular burns in upper and lower extremities. Escharotomy was performed in 8 patients (18.6%) and fasciotomy was

performed in 5 patients (11.6%) in our center after their admission. In 11 patients early tangential excision and in 6 patients fascial excision on third degree burn areas were applied. Partial thickness skin grafts were applied in 16 patients after tangential excision. Versajet® (Smith & Nephew, London, UK) was used during debridement of burn regions of 7 patients. In 4 patients one step dermal matrix (Pelnac®: EuroSurgical Limited Merrow Business Park, Guildford, UK) was applied on face, neck, and extremities under partial thickness skin grafts.

Injuries involving loss of sight were observed in 3 patients (6.9%), while in 6 patients (13.9%) amputation of the extremities was performed. A tracheotomy was performed in 2 patients due to difficult intubation, and in one patient due to prolonged intubation.

Table 1 - Distribution of patients due to burn causes, burn environments, and burn regions.

Patients	n	%
Burn causes		
Flame	34	79.0
Scalding	6	14.0
Chemicals	2	4.7
Contact	1	2.3
Burn environments		
Battlefield	14	32.5
House settings in Syria	11	25.5
Refugee camps	10	23.3
In Turkey	8	18.7
Burn regions		
Face-scalp	36	83.7
Neck-scruff	34	79.1
Anterior and posterior trunk	31	72.0
Hands-upper extremities	26	60.5
Feet-lower extremities	29	67.4

Table 2 - Microorganisms growth in tissue cultures from injury sides and blood cultures.

Microorganisms	n	%
Growth microorganism in injury sides		
<i>Pseudomonas aeruginosa</i>	19	52.8
<i>Acinetobacter baumannii</i>	10	27.8
<i>Staphylococcus epidermidis</i>	3	8.3
<i>Staphylococcus haemolyticus</i>	2	5.5
<i>Proteus mirabilis</i>	1	2.8
<i>Candida tropicalis</i>	1	2.8
Growth microorganism in blood cultures		
<i>Acinetobacter baumannii</i>	15	55.6
<i>Pseudomonas aeruginosa</i>	8	29.6
<i>Klebsiella pneumonia</i>	2	7.4
<i>Staphylococcus haemolyticus</i>	2	7.4

In one patient, external fixation of left femur due to fragmented fracture was performed. Amputation of hand and wrist under elbow was made in one patient because of the loss of integrity of tissues due to explosive material. Amputation of the left leg from the femoral region by disarticulation was made in one patient because of the loss of integrity due to gunshot wound infection. The mean hospitalization period was $43 \pm 25,0$ days (12-79 days). Seventeen patients (39.5%) died during their follow up.

Discussion. Burn is one of the most severe injuries. The treatment is rather difficult and is frequently prolonged. In Aksoy et al's⁸ study the scalding rate was reported as 76.2% and flame burn rate was reported as 23.6%.

War burns have been described for many long years in medical history and fire was probably utilized as a weapon back then. In Syria, the firearms and explosives used in the war between government forces and rebels resulted with different injuries in the recent years.³

Individuals injured in the civil war in Syria were mostly transferred to Turkey. Those with burn injury are being referred to burn centers around the border region after their first treatments. But due to long duration of their transfer to main burn centers, dead tissues and eschars on their wounds caused infections.

War related burn injuries are more extensive, deeper, more complicated, associated with inhalation injuries and undertreated, compared with the "normal" case mix of accidental burns in everyday life. However, an improved mortality rate of 5% in combat and 2% in non-combat patients with equivalent percentage TBSA burned.⁹

Burn injury is a common potential risk to people during war and the burn threat has ranged from simple missiles to high technology nuclear weapons.¹⁰ The people with severe injury of burns encounter with handicaps and serious psychological implications from burns for the rest of their lives.¹¹

Serious burns at the battlefields are superficial burns to exposed skin, most often on the face, neck, forearms, and hands different from burns at civil life. These burn cases are additional injuries from multiple fragment wounds with a high rate of infection and long periods of hospitalization.¹²

Our results in this study were compatible with findings in the literature. Individuals injured in the civil war in Syria were mostly transferred to Turkey. Those with burn injury are being referred to burn centers around the region after their first treatments. But due to long duration of their transfer to main burn centers,

dead tissues and scars on their wounds cause infections. This produces difficulty for us during the treatment of burn injuries of them. Also, microorganisms isolated from wounds of these patients were unusual and rare and resistant strains specific to the battlefield were observed. These organisms also caused contamination of our treatment services, although we had separated their dressing and operation rooms.

Infection rates of our patients were high with respect to the general population¹³ because until coming to our center first interventions had done in unsuitable conditions and their wound dressings had been done improperly. In addition, we think that their burn injuries had become a suitable site for microbial production because in their first admission centers, no tangential excisions had been performed to remove the dead tissues and no early graft operations had been performed. Their catheters had been applied in improper conditions and the time of use of these catheters had been prolonged. As a result growth at catheter tips was as high as 30.2% with respect to other burn patients.¹³

Additionally, due to civil war, considerable social and medical problems were caused by migration to neighboring countries.¹⁴ They have no hospital attendants with them during their treatments. Some officials from social work centers are ordered for their demands. But as they do not know any other language other than Arabic, some communication problems can be observed and translators employed from District Health Offices or voluntary translators working in civil social organizations are helping health workers.

As a limitation of our study, we can indicate that the study was conducted about patients who were referred to our center from other hospitals concerning with people injured during Syrian civil war. In addition, reported cases in the present study may not reflect actual situations. It was impossible to define the exact number of burn patients injured during conflicts. A multi-centered study getting information from all centers concerning these people may elucidate more useful results about these patients and this can facilitate the organization of their treatment.

In conclusion, the treatment of the burns is a difficult, expensive, and a multidisciplinary team process, which can only be performed properly in specialized burn centers. The civil war in Syria caused many social, economical, and medical problems. These problems should be considered in a multidisciplinary manner and every organization either official or civil must have a role in this mission. We believe that our experiences can elucidate further investigations regarding these concerns.

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