War-related Burns in Syria in the Years 2013-2017 A Cross Sectional Study in Damascus Hospital

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Abstract

Intorduction:

Thermal injuries have always been a source of morbidity and mortality in times of war. Historically, they constitute 5% to 20% of all injuries and approximately 4% mortality.

This study will review the information acquired from patient's files on war-related thermal injuries in Damascus Hospital from 2013 to 2017. We will describe the epidemiology of burn injuries, and the assessment, and final treatment of burn patients.

Methods:

A cross sectional study of war-related burn injuries was conducted during the years 2013-2017 in Damascus Hospital. Chi-squre analysis was used to compare gender and mortality with sociodemographic factors and burn outcome variables. One-way analysis of variance (anova) and t-test were used to compare means of continuous variables (Age, TBSA,ABSI).

Results:

450 patients were included in this study. 289 (64.2%) were males and 207 (46%) were from the eastern region of Syria. Most injuries were flame injuries 197 patients (43.8%) and petroleum substance burns 93 (20.7%). Most common injury place was the four limbs 288 (28.4%), and head and neck 282 (27.8%). Mortality rates were 163 (36.2%) and the most common cause of death was respiratory failure 80 (49.1%). Gender and mortality were significantly associated with sociodemographic factors and burn outcomes (P-value<0.05).

Conclusion:

More details have been identified regarding war related burn injuries in Syria. This leads to conduct better health care programs and stress the importance of better triage with war circumstances. Additional studies are required to determine management and to get better insight on the treatment.

Introduction:

According to an article published by the World Health Organization on March 26, 2018, 1 burns constitute a real health problem, as they result in nearly 80,000 deaths annually, most of them in low-income third world countries and two-thirds in Africa and Southeast Asia.1

Child mortality in third world countries is seven times higher than in developed and high-income countries. 1 For age, the most vulnerable age group to burns are children, with burns being the fifth most common cause of nonfatal child injury. As for gender, women are more exposed than men.1 Burns generally occur at home or in the workplace.1 A study conducted in Bangladesh and Ethiopia revealed that 80-90% of burns occur at home.1 Women and children are often exposed to burns because of kitchen utensils, including container utensils On hot materials, flammable damage, or an exploding stove.1 Men are often exposed to burns in the workplace due to flames, chemical, electrical, or wet burns. 1

The burn is the most dangerous for children under the age of five and pregnant women. Therefore, when a person of these groups is exposed to a burn, medical care providers must be immediately resorted to avoid dangerous complications.2

The area and depth of the burn is estimated after the affected area is cleaned well. In severe cases, surgical intervention and a skin graft may be required.2

Burns are classified into degrees according to the layers of the affected skin. The skin consists of 3 layers:

• Epidermis: superficial layer 2

• Dermis: the layer that follows the epidermis and contains capillaries, nerve endings, sweat glands, and hair follicles2.

• The adipose layer: It is the deep layer of the skin that contains fat and tissues2

There are four classifications for the depth of burns, each of which has an appearance and symptoms that distinguish it from other degrees:

Superficial skin burn (first degree burn): Here the damage is at the level of the skin only, the skin is red, swollen, painful without bubbles2. The peels conclude the healing process as shown in the picture 18

Superficial dermis burn (superficial second degree burn): Here the damage includes the epidermis and part of the dermis, the skin becomes pale and painful and there may be some small bubbles2.

Deep dermal burn (partial burn) (deep second degree burn): Here the damaged layers include the entire epidermis and dermis.

• Full thickness burn (third degree burn): Here all three layers of the skin are destroyed. The skin here will be peeled off and the tissues under it will be exposed with a pale or blackish appearance, while the remaining skin will be dry, white, black or brown without bubbles and the texture of the skin will be waxy.

Burns are divided into four types: 18

1. Thermal burns

2. . Radiation burns 5% (i.e. exposure of the person to radiation)

3. Electrical burns 4%

4. Chemical burns 5% (acid and alkali burns)

The most common of these burns are thermal burns because they are found anywhere such as at home and at work, and they are divided into: 18

• Burns with hot liquid (oils, hot water, milk...) 50%, which is the most common (especially in children).

• Burns with flames (such as gas burns) 24%

• Burns in direct contact with a hot object (iron, heater) 13%

High temperature burns occur when all or some of the cells in the skin or other tissues are destroyed by: Hot liquids (blister burns) - Solids (contact burns) - Flames.1

Burns may be very painful and may cause: red or scaly skin - bubbles - swelling - chalky white skin. The amount of pain is not related to the severity of the burn. Very severe and serious burns may be painless. 2

The area of the burn is estimated by TBSA (Total Burn Surface Area): It is a percentage measure that measures the area of the burn by dividing the burned area (measured in cm 2) by the total body area (measured in cm 2) also 6), and it helps in classifying burns to simple - moderate - and severe, and therefore determines the next step for treatment, according to 7:

Survival can be assessed using the ABSI (Abbreviated Burn Severity Index), which is a numerical scale that approximates survival based on the following variables8:

• Presence of full-thickness burns

• TBSA

The presence of inhalational damage

• gender

• the age

Third-degree burns face a range of complications, including 10:

Cardiac arrhythmia

Electrical burns carry a high risk of cardiac arrhythmia 10. In burn patients, the activation of adrenaline increases due to the intensity and therefore arrhythmias may appear 11. The presence of a history of heart disease in the patient aggravates the occurrence of death or myocardial infarction by 6.6 times that of those without a history of heart disease11

• dehydration

The skin forms a barrier against the evaporation of water: its destruction causes severe evaporation and fluid loss, as the body becomes directly exposed to the external medium without the presence of an insulator. appropriately 12.

Contractures and scars

Scars and contractures occur when a burn damages the skin. In superficial burns where the burn affects the superficial layers, the burn scar disappears with time. In the event that when the deeper layers of the skin are affected, a more permanent scar that has a thick or irregular appearance is produced 13.

• edema

Thermal injury to the skin causes vasodilatation that increases the permeability of the vessels. Plasma rich in albumin, water and electrolytes is released into the interstitial medium and edemas (exudations) are formed, the intensity of which increases with increasing depth of burn. The dangers of increasing the permeability of capillary vessels at the level of the extremities are that it may cause ischemia, as the edema occurring at the site of the injury and the leaking fluid press on the nearby vessels and nerves, causing distal ischemia, numbness and numbness. Compartment syndrome is an emergency indication to make incisions in special places of the skin to separate it from each other with the incision of the muscular peritoneum and releasing the muscles to relieve pressure on the vessels and nerves. These incisions are called relaxation incisions and they are closed when the patient recovers18.

Multiple organ failure

Prolonged stay in intensive care and prolonged mechanical ventilation is associated with multiple organ failure and severe sepsis 14

• pneumonia

Severe hypotension that may lead to shock

Symptoms of hypovolemia appear as a direct result of plasma escape, which predisposes to hypovolemic shock very early. Occurrence of electrolyte disturbances and hypovolemic shock are involved in causing renal damage in burnt persons. Therefore, urinary catheterization that monitors the urinary flow is considered an important component in the follow-up of burn patients18.

Severe infection that may lead to amputation

The skin forms a barrier that protects the body from infections, and therefore when it is destroyed by burns or wounds, germs enter the body, causing infection 18.

We treat the burned patient by transfusion of fluids only, and we do not treat him with transfusion, as the patient's hematocrit is high, and blood transfusion may kill him due to the increase in blood viscosity18. The “resorption” of edema is absorbed on the third day, so the fluid of interstitial edema causes an increase in circulation and an increase in body fluids, and this may sometimes end in problems in the recovery process, so fluid compensation on the third day of the burn must be done in a deliberate manner and in limited quantities, which we will talk about later. . 18 It is possible that clothing plays a role in protecting the patient from burning, and it may play a role in

increasing the risk of burning according to its type. Therefore, we find in some Western countries laws that prevent the manufacture of children's clothing containing flammable materials, and violators of these laws are punished 16.

The blisters of second-degree burns that have not punctured protect against infection and the loss of electrolytes and fluids from the burn surface.

There are 18 basic steps that must be followed to manage burns:

1. Resuscitation 18 (ABC) any verification of

(A): airway

(B): breathing, breathing

(C): circulation

2. Fluid replacement, which is the cornerstone of burn management, as good fluid replacement directly and significantly improves the survival of burn patients 17.

The goal of rehydration is to maintain vascular permeability in the early stages of burn shock. At this stage, fluids drain from the intravascular space to the extracellular space, which leads to a decrease in volume if it continues without being counteracted by replacing fluids in sufficient quantity 17.

Burns with an area of less than 20% have minimal fluid loss. Here, it is sufficient to replace fluids orally, except for burns of the face and genital area, in addition to burns of children and the elderly. When the total burn area exceeds 20%, intravenous fluids are required 17.

The amount of fluid that is being compensated is calculated through several rules, one of which is the (Parkland) rule, which calculates the amount of fluid that needs to be replaced for a person based on the percentage of burn, which is the most used method 17.

Parkland Equation 17:

• The first 24 hours: Ringer's lactate solution 4ml/kg/percent burn in adults and 3ml/kg/percent burn in children. Ringer's lactate solution is added for maintenance in children according to 17:

- 4 ml / kg / hour for children weighing between 0-10 kg 17
- 40 ml / hour + 2 ml / hour for children weighing between 10-20 kg 17
- 60 ml/hour + 1 ml/kg/hour for children weighing more than 20 kg 17

In the Parkland equation it is not recommended to use colloidal solutions in the first 24 hours 17 .

• In the next 24 hours: Colloidal solutions are given in the amount of 20-60% of the plasma volume 17. We do not give crystalline solutions 17. Glucose is added to water in quantities that maintain a urinary excretion of 0.5-1 ml/hr in adults and 1 ml/hr in children 17.

3. First Aid 18

4. Analgesia 17

Opioids are the first line of pain relief in burn patients 17 .

Medicines are always given to the burned patient intravenously, because the patient suffers from increased capillary permeability and edema, and therefore the drug will not be absorbed when administered intramuscularly due to decreased peripheral circulation and fluid deficiency. The doctor continued intramuscular injections due to the patient's lack of improvement. The muscle will become a reservoir if he makes a mistake in the drug, and its contents will be released quickly into the blood when the normal state of the capillaries is restored and the permeability improves (within a maximum of 31-21 hours from the injury), and the symptoms of poisoning appear by increasing the dose. They are dangerous because of morphine's important effects on the cardiovascular system.

5. Antibiotics 18

Infection is a serious and common complication of burns and must be combated with appropriate antibiotics when it becomes "virulent" beyond the limits of the lesions.

- Localization: by increasing the depth of the superficial injury.
- Side: Inflammation of the lymphatic vessels occurs
- General: With the development of frequent sepsis, especially from intravenous and visceral catheters. The burning of the patient's skin will certainly be accompanied by the burning of germs on this skin, which confirms that the infection in the burn is secondary, and that is why we do not give antibiotics until after two or three days and not from the first moment of the burn, emphasizing the necessity of clean dressing for prevention.

6. Tetanus Prophylactic 18

7. Nutrition 18

Undernutrition is associated with hypermetabolism, and undernutrition is dangerous because it encourages the appearance of all other complications, particularly sepsis and the absence of scarring. It should be supplemented by feeding (oral and interstitial sharing), early excisions and vaccinations. Oral feeding of the burned patient prevents major burns, and he is fed intravenously in the early stages, as the intestines, "intestinal villi in particular" are also affected by increased permeability of capillary vessels and edema, and therefore absorption is poor. The patient dies because of this, so we insert a nasogastric tube (to withdraw stomach secretions), and another nasogastric tube for feeding after a while.

Oral feeding is introduced gradually when the patient improves. It is very necessary and we do it as early as possible, as it prevents the atrophy of the villi and also prevents the absorption of gut bacteria due to the destruction of the mucous wall of the intestine.

8. Prevention and treatment of hypothermia if present 18

9. Wound management 18

There are two ways to deal with burn cases:

1. The open or exposed method: It is usually used for extensive burns, where dressing the patient is painful and time-consuming18. That is why we put the patient inside a sterile room for burns as much as possible, and we put sterile cloths under the patient, and apply antibiotic ointments to the affected area daily once or twice.

Advantages: Saves time and costs - Ease of patient monitoring - Ease of burn repair pain relief when applying a dressing 18.
Disadvantages: the need for a sterile atmosphere - psychologically unacceptable to the patient 18.

2. Closed method: the site of infection is sterilized with liquid povidone, and then the wound is debred (ie, necrotic tissue is removed); We repeat the process of debridement daily due to the emergence of new areas that need debridement (for fear of infection), and then paint the burn with antibiotic 18. After that, we put Vaseline or Sfratol gauze on the burn and bandage and put cotton bandages in large quantities to absorb the oozing fluids due to the lack of skin 18. The dressing is changed twice daily if it is oozing and contaminated, but if it is clean, it is enough once a day or even every two days once. The gauze should not be removed violently, as it is irritating to the skin; We may injure the formed skin and leave scars. In this case, we begin to gradually remove the upper layers of the bandage, until we reach the layer attached to the skin, then we moisten the gauze with saline serum or liquid povidone and wait until it absorbs well and then remove it. The closed method is used most often in burns of the extremities, especially the hand, to fix the hand in an acceptable functional position, and it is the preferred method for children.18

Advantages: enables the patient to move, and in general it is psychologically better for the patient. Reduce the pain because the area being bandaged will not rub against the outer surface. It is performed because of the fear of infection because it isolates the place of infection from the external medium

Disadvantages: a difficult and time-consuming method - expensive, especially for extensive burns due to frequent dressing changes.18

When dressing a burnt patient with a burn in the extremities, we must keep the ends of the fingers exposed (if possible) to detect ischemia injuries, if they occur, by examining the fingers.18

If a burned patient comes to the hospital and his condition requires admission, and he has deep second-degree or third-degree burns, a graft must be performed. 18 This taste may be classic late after debridement for three weeks or it may be early offensive within a week of admission to the hospital and we will discuss both options 18:

- Classic grafting: Beginning with surgical excision and debridement, “dead tissue removal” is performed under general anesthesia daily until the end of the third week for fear of infection. The bait, as the bait needs a ground to absorb and feed through, so we carry out the process of grafting 18.
- Early offensive vaccination: Here, surgical excision and early vaccination are performed after the shock stage and before the fifth day of infection. The patient is stable during this period and his vital signs and electrolytes are established after fluid replacement, and the risk of entering into shock exceeds, then we vaccinate him.

This theoretically aims to:

a) Reducing the risk of local infection associated with bacterial proliferation in dead tissues, as the longer we delay vaccination, the more the patient is exposed to infection 18.

b) Reducing functional sequelae in functional areas of the body (hand, face, neck...) by avoiding the proliferation of connective tissue and thus forming a scar in the future.18

c) decreasing hyper-metabolic time; This is because hypermetabolism continues until the burn has healed.

d) The patient's stay in the hospital is less, and therefore the cost is lower

e) The vaccination is performed immediately after early debridement (that is, by the same process).

Early excision and debridement are performed in one of two ways:

a) Dissection with scissors and a scalpel, which is the best, and we continue cutting and dissection until we reach a bloody area of the skin “with spot hemorrhage”, where the non-hemorrhagic areas are considered dead areas that we remove 18.

b) Successive tangent excision of the dermatome “skin graft picking tool” until reaching the healthy tissue characterized by petechial hemorrhage, where the dermatome removes thin, non-dead bloodless layers of skin until it reaches a hematopoietic area18.

Functional areas are a priority for early excision and grafting to avoid scarring and contractures, and these areas include the facial neck region, flexor folds, and the back of the hands. Early excision and grafting can be done in these areas not only on third-degree burns, but also on deep second-degree burns because of:

a) It is difficult to distinguish between them precisely

b) the risk of the injury to the third degree due to infection

c) slow spontaneous scarring of these injuries

d) The best functional and aesthetic result to be obtained

The main problem is the difficulty in diagnosing the burn of medium thickness, especially in the first three days after the injury; That is, it is difficult for us to determine the degree of burn, and therefore the inability to perform early excision and vaccination 18. It is important to know that in the case of extensive burns subject to treatment and vaccination, the patient does not return to what it was before in terms of aesthetics in the burned area, because the aim of the graft is to restore the function of the burned organ in the first place, while the aesthetic aspect is considered of secondary importance 18.

The limb/skin may already be dead in which case we will need to perform debridement, biopsy, or even amputation of the dead part18.

Inhalational damage greatly exacerbates burn injury and, together with post-burn pulmonary complications, is responsible for 72% of burn-related deaths18. Pulmonary damage is caused by inhaled materials and poisoning by the products of combustion is more than damage by the heat itself. Thermal damage (heat) is generally dispersed and spread in the upper airways, with the exception of high pressure steam that is concentrated in certain places, where it has a capacity 255 times greater than the ability of dry air to Heat transfer, thus causing thermal lung damage and much greater injury, so it must be detected as early as possible18.

Shows Clinical examination specific signs that suggest inhalation injury, including 18:

- progressive hoarseness
- creak
- cyanosis and irritation
- Burning and uprooting of nasal hairs
- burns of the pharynx
- Mustache burns
- Production of sputum with coal soot from the mouth
- Burns in and around the mouth like the lips
- dyspnea

The initial chest radiograph can be normal, it does not exclude inhalational injury, and the fibroendoscopy can positively identify lower airway injuries and has diagnostic and therapeutic value18.

Diagnosis B18 confirms:

a) Laryngoscopy

b) bronchoscopy

c) When doing blood tests, the carboxyhemoglobin titer should be more than 10%.

Inhalational injury management 18:

Treatment is generally based on mechanical hyperoxic ventilation including open airway support, and intubation of the patient if respiratory failure and shock are imminent or if the patient is unconscious. Encourage the patient to cough and improve his airway. Chest physical therapy, excretory aspiration, and bronchoscopy may be necessary to remove thickened secretions. Monitor fluid and electrolyte intake to prevent pulmonary edema from overload. Sputum fluid and bronchodilators are given, steroids are not indicated, and antibiotics are given when there is a diagnosed infection (bacteremia, pneumonia...) and not immediately. Give when CO poisoning is present. We give 122% moist oxygen.

Treatments for burns are similar in general and include the treatments mentioned above, but there are types of burns that need special treatment, such as:

Electric current burns 18

Electric current travels and spreads after entering the tissues of least resistance to the current, which are 18:

• Nerves "due to the nature of their work"

• blood vessels "because they contain fluid"

• muscles

On the other hand, bone is considered the most resistant tissue to the passage of current. The passage of the current generates heat, so the tissues will be damaged, and it plays the largest role in that bone, as it constitutes a heat depository as it is resistant to the current, which contributes to increasing tissue damage. between them 18. That is, the superficial injury is small compared to the deep injury, as the superficial injury is limited to the area of entry into the current, while the deep injury includes large areas of tissue due to heat 18. The electric current stimulates the muscle when it enters it, so the muscles will respond with the appearance of muscle contractions and contractions, in addition to releasing myoglobin from the muscles as a result of the injury, which in turn goes to the renal tubules and is deposited in them, which predisposes to the occurrence of kidney damage 18.

The electric current also enters the heart and alerts it, which carries the risk of developing arrhythmias such as ventricular fibrillation, apart from thermal damage resulting from the burn, and because of this the patient is placed under observation in the internal department for at least 24 hours after the electrical burn to monitor the arrhythmias (18).

If the current continues to enter the blood vessels that carry the current will develop progressive thrombosis. The current eventually exits the body, and this leaves the resulting injury with an entry area and an exit area associated with burning injury (usually the current enters from the hand or mouth, and exits from it in an area connected to the ground, which is descriptively the feet18.

Management of patients with electrical burns 18:

1. Investigation of other injuries:

An electrical burn may occur as a result of falling from a height, causing a group of fractures and dislocations, which may also result from muscle contractures and strong tetanic contractions that result from electrical current sources.

2. CPR

Ventricular fibrillation and arrhythmias that appear in the first 24 hours after injury should be monitored. If no EEG changes appear on the initial EEG, and no cardiac arrest occurs, additional monitoring is not necessary

3. Effective rehydration and alkalization of urine

In these patients, extensive muscle damage leads to the release of myoglobin that is filtered into the renal tubules (myoglobinuria) and may lead to obstructive nephropathy. 18 Therefore, active hydration and intravenous infusion of 5% sodium bicarbonate (urine alkalosis) and mannitol (25 g per 6 hours for an adult) are indicated to support urinary output and prevent deposition of myoglobin in the renal tubules, and urine flow should always be monitored 18.

4. Intravenous fluids:

These patients require additional venous volumes above the prescribed amounts depending on the area of the burn because most burns are deep and cannot be evaluated by regular physical examination18. Here, urine output must be constantly monitored, and maintained at a level of 1 ml/kg/hour or 30-50 ml/hour, which is the most important indicator for monitoring the condition of the burnt patient 18.

Chemical Burns:

Most of them are accidental household accidents as a result of improper handling of household detergents, but the most severe cases occur in the industry, and the degree of tissue damage and the level of toxicity are related to 18:

• The nature of the causative agent and its concentration 18.

• The duration of contact with the skin. 18

• The behavior of people around the patient (ie whether they help him or not) 18.

Chemicals cause harm by destroying protein, denaturing it, or drying out tissues. Burns with acid differ from burns in the following: 18

• In the case of acids, the epidermis and dermis burn (protein coagulates), producing a tough membrane that prevents the damage from spreading to deeper tissues, and therefore requires lower recovery volumes (ie less fluid volumes)18.

• While the burn injuries caused by the foundations are considered more severe than the injuries caused by the acids, as the burns may penetrate beyond the limits visible upon examination because they are lubricated, and penetrate into the adipose tissue and reach deep areas18.

Chemical Burn Management 18:

Speed is key in the measure, as 18:

a) If the burning substance is a dry powder, it must be removed with a brush from the affected areas before washing it with water, taking care not to splash it on us or on the healthy areas of the patient 18.

b) Washing with large quantities of clean running water after lifting clothes wet with the chemical

c) The washed side should be left to drain the earlier, more concentrated water current 18.

d) Care must be taken to let the washing water run away from uninfected areas to avoid additional infection and away from healthy people.

e) It is not recommended to try to modify chemical substances with opposite substances, ie to modify the acid in the base or vice versa, the heat resulting from the modification reaction (acids + alkalis) incites additional damage. 18

f) All patients should be monitored according to the severity of their injury.

g) Resuscitation should be directed by the surface area of the burn, however total fluid requirements may differ from the calculated volumes18.

h) The burn is monitored as in thermal burns, and when the wound becomes clean it is covered with a graft or a slice according to the case, and it is possible in some cases to conduct an early vaccination 18.

i) It is necessary to know the chemical causing the burning and the appropriate antidote for it in the event of poisoning 18.

Heat damage is an essential component of any war 3. Historically, they accounted for 5-20% of all burns and 4% of deaths. 4 Causes of war burns include 16:

• flame burns

• Explosive injuries

• High tension burns

• Chemical burns

Flammable gases

War injuries that occur in adults are usually caused by flame burns, while those that infect children are often liquid burns, and the most exposed places are the face and hands because they are exposed 15. During the recent years, the military burns showed a sharp increase, which doubled from what they were, due to the presence of explosive weapons and advanced military mechanisms, and as a result, the severity of the resulting injuries also increased 4-3. In the Iraq war, for example, according to an American study conducted in 2006 on 270 burn victims, 142 of them (52%) were caused by explosive injuries 5. It is not necessary that war-related burns be specifically aggressive, as burns that occur due to lack of attention due to tension during war may exceed those resulting from direct military harm.3 Unfortunately, the majority of war casualties are civilians, at 80%.3 vary Methods of providing treatment according to the resources of each country and according to the frequency of each injury. At the beginning of each war, doctors begin to assess the availability of materials to cover that injury and what their needs are, and establish a protocol to provide the most appropriate treatment in line with the situation. Among the important things that help them in developing a treatment plan are:

• The proportion of resources to the severity of the burns and the number of injured persons3

• Initial resuscitation given where the person was injured 3

• The speed of transporting the injured person to a specialized health unit 3

Management of war burn patients

War burns are treated either by conservative treatment that includes fluids, antibiotics, and dressings, or by debridement and grafting, or by biopsy or amputation, due to the severity and depth of the burn. 16

Initial management of burns in war zones requires rapid assessment technique, airway protection, and good resuscitation as well as thorough examination to detect additional war injuries. Proper management of burns in a war zone begins with an understanding of the mechanism of injury as well as the properties and characteristics of the substance that caused the injury. Several weapons can cause penetrating wounds and burns and result in a large number of deaths16. We may perform prophylactic intubation in patients with severe facial burns who show signs of inhalational injury, and in severe burn patients in whom significant edema is expected soon after injury to ensure airway protection and mechanical respiratory support. Replacing fluids in the appropriate amount is a challenge for burn patients in general and burn patients in war zones in particular, as it requires a balance between compensating the intravascular space and

avoiding complications resulting from replacing fluid in large quantities. When we treat a burn patient with opiates for pain relief, this can make it difficult to diagnose co-morbidities. Surgical treatment yields better results in younger patients who have small, disabling injuries such as burns on both hands. On the other hand, patients whose burn area covers 40-50% of the entire body area rarely survive, and the best way to preserve their lives is to provide adequate fluids and analgesia. 16

In chemical burns, the health care provider should wash the area with plenty of water and remove all residue, then the main step is to cover the wound with saline-impregnated dressings until the final decision is made on the wound 16. In the event that transporting the patient to a hospital requires more than 12 hours, the medical caregiver must cover the affected surface with an antibiotic to prevent the growth of germs16. After stabilizing the patient and evaluating the severity, depth and area of the burn, we start the treatment phase by protecting the skin from infections, and this has become easier by applying topical and systemic antibiotics, and it has succeeded in preventing wound infection over the years 16. It is also very important to resuscitate with adequate fluids, whether colloid or crystalloid 16. Numerous studies indicate the need to manage wounds and close them early and have a positive effect on survival. Debridement and vaccination, as well as nutritional support, are important for the treatment of burn patients. In recent decades a number of drugs such as beta-blockers, antihypertensives and erythropoietin have been used to dampen the hypermetabolic response. 16

As for the explosive injuries, they are not just skin burns caused by high heat, but a thorough examination of all vital organs must be conducted because the internal chambers of the body may be exposed to severe damage. 16

It is also very important to perform external fixation of fractures and to perform a biopsy if necessary at the site of the injury directly to prevent the limbs from dying. 16

In cases of war, optimal care is not available and is limited by the surrounding circumstances, the lack of adequate medical staff and the inability to transfer patients to specialized centers easily due to the lack of safe roads and the unavailability of transportation due to the effects of war 16. Consequently, a large proportion of the burned patients are treated by non-medical personnel. Therefore, a tight plan and instructions must be drawn up to be given to all those present at the scene of the accident to cover the basic tasks to preserve life, such as leaking fluids and covering the wound with gauze and antibiotics, and this proved the feasibility of treatment and good survival 16. The safety of the paramedic is one of the priorities of the instructions given to paramedics, as paramedics must not forget to ensure the safety of the place before approaching and providing treatment. Once this is confirmed, the paramedic intervenes and withdraws the patient from the scene of the accident and sterilizes appropriately 16. Small burns are then cooled with cold water to prevent the release of histamine. In this way, edema is reduced and thromboxane is inhibited, which in turn prevents infarction 16.

Including burn patient monitoring

• the heat

• the pressure

• the pulse

Breathing (to detect respiratory damage)

• Urinary flow 30-50ml/hour

• Fluids and Electrolytes

• vomiting

Thirst (to detect hypovolemic shock)

Hemoglobin

Cardiac arrhythmias

• Early mobilization (to avoid bed sores)

• Leukocyte count and formula

• Urine and creatinine

• density of urine

• Electrolytes and sugar blood proteins.

Study Aims:

- • Study of the prevalence of war-related burns in Damascus Hospital, Plastic Surgery Division, between 2013–2017
- • Determining the causes of military burns and the way to manage them.
- • Assessment of the severity of military burns by means of ABSI and TBSA scales
- • Studying the relationship between sex and death with demographic and social factors, and the results of war burns.

Methods:

A cross-sectional study was carried out:

¬ The hospital's approval was obtained to review patients' data from 2013 to 2017.

¬ Samples were collected from patient records in the plastic and industrial surgery division of the hospital.

¬ The questionnaire was created in an automated online Google form.

¬ Data archived by Microsoft Excel 2019.

¬ The study included 450 patients admitted to the Department of Plastic and Osseous Surgery, Burns Department, at Al-Mujtahid Hospital in Damascus. Below we review some characteristics of the sample according to demographic variables and the variables that measure the degree of military burn injury.

exclusion criteria

¬ Archiving errors.

¬ Cases lack data in a way that cannot be studied.

¬ Cases diagnosed as non-war burns.

Statistical analysis:

The statistical study was conducted using SPSS software. The demographic characteristics were described, and the sample distribution according to the study variables was described. The Chi-Square independence test was also used to test the independence of qualitative variables, and correlation tests according to the Krams coefficient to study the relationship between qualitative variables, and Spearman's coefficient to study the relationship between quantitative variables. The averages of the comparative independent groups were compared using T-Test Independent Samples, One way ANOVA with the LSD and Games-Howell test for homogeneity to compare group variance and dimensional comparisons.

Results:

Results

Patients' demographic characteristics:

The study included 450 patients with war-related burns who were admitted to the Department of Plastic and Industrial Surgery, Burns Department, in Damascus Hospital between 2013 and 2017. Most of the cases of war burns in 2014 and 2013 ranged from 123 (27.3%) and 113 (25.1%), respectively. The majority of patients were in the age group 0-20 and 21-40, numbering 231 (51.3%) and 160 (35.6%), respectively. Most of the patients were males 289 (64.2%) and from the Eastern Province 207 (46%).

Burn injuries results:

It is worrying that most of the injuries did not reach the hospital within the 24 hours after burning 302 (67.1%), while the majority of burns in patients were of the second and third degree. (20.7%) and explosive injuries 89 (19.8%) are the most common causes of injuries resulting from wars. The majority of pediatric and elderly patients had severe TBSA more than 10% of 172 (38.2%) while most adult patients had severe TBSA of more than 20% of 164 (36.4%). The majority of full-thickness cases had severe TBSA greater than 5%, numbering 160 (95.8%). The ABSI scale of the majority of injuries ranged from very few, 261 (58%), moderate, 89 (19.8%), moderate to severe, 56 (12.4%), while 12 (2.7%) and 2 (0.4%) had severe and extreme ABSI. . Approximately 447 (52.1%) were treated with conservative treatment, 138 (16.1%) debridement and grafting, 98 (11.4%) physiotherapy, 58 (6.8%) blood transfusions, 57 (6.6%) intensive care admissions and 35 (4.1) %) were subjected to biopsy and only 25 (2.9%) were amputated. 43 (9.6%) were exposed to permanent physical loss and 113 (25.1%) were exposed to inhalational injury. Death occurred in 163 (36.2%), most of whom died from respiratory failure 80 (49.1%), multi-organ failure 32 (19.6%) and septic shock 24 (14.7%).

Distribution of injuries according to gender:

When studying the relationship between gender and social demographic variables, war-burn injuries were more frequent in females from Eastern Region 88 (54.7%) compared to patients from Southern Region 63 (39.1%), Central Region 7 (4.3%), and Coastal Region 5 (1.7%).) ($p<0.005$). While the results did not show a relationship between the age groups of patients and gender.

The relationship between sex and the outcome of war burns:

When examining the relationship between gender and burning degree, the second and third degree of burning was more closely correlated with the female gender 131 (81.4%) compared to the other burning degrees ($p<0.005$).

When examining the relationship between the cause of injury and gender, burns due to flame 85 (52.8%) were more frequent in the female sex compared to those who had explosive damage 25 (15.5%), high tension burns 8 (5%), and petroleum burns 39 (24.2%).), flammable gases 4 (2.5%), gunshot 0 (0%) ($p<0.001$).

The location of military burns had a statistically significant relationship with gender, where burns of the four limbs were more frequent in males 191 (30.1%) compared to burns of the upper limbs 53 (8.4%), the lower limbs 36 (5.7%), and the trunk 156 (24.6%).), genital area 20 (3.2%), head and neck 178 (28.1%) ($p<0.018$).

Conservative military burn management was significantly associated with male sex 288 (99.7%) compared with debridement and vaccination 99 (34.3%), physiotherapy 70 (24.2%), amputation 22 (7.6%), and biopsy 23 (8%), who were admitted to intensive care 30 (10.4%), and transfusion 30 (10.4%) ($p<0.001$).

The results showed a statistically significant relationship between gender and complications, where the incidence of death was 75 (93.8%) significantly associated with the female gender compared with those exposed to inhalation injury 46 (57.5%), and amputation 3 (3.8%) ($p<0.000$).

As for the patients who did not undergo amputation, there were more of 158 (98.1%) of the female gender compared to those who had had the amputation 3 (1.9%) ($p<0.011$).

Whereas, patients who did not die were significantly associated with the male gender 201 (69.6%) compared to those who did not die 88 (30.4%) ($p<0.001$).

Distribution of injuries according to the incidence of death:

When studying the relationship between the incidence of death and socio-demographic factors, the results showed a statistically significant relationship between death and the geographical area of patients, where death occurred in patients from the eastern region 89 (54.6%) prominently, compared to patients from the southern region 55 (33.7%), Central Region 17 (10.4%), Coastal Region 2 (1.2%) ($p<0.030$).

Examining the relationship between death and outcomes:

The results revealed a statistically significant relationship between the incidence of death and the degree of burn, where death was significantly associated with the second and third degree of burn 137 (84%) compared with the rest of the degree of burn ($p<0.004$).

Death occurred significantly in patients who were exposed to flame burn 85 (52.1%) compared to those who sustained explosive injury 27 (16.6%), high tension burning 8 (4.9%), petroleum burning 37 (22.7%), burning gases 6 (3.7) %), gunshot 0 (0%) (p<0.001).

The location of military burn injury had a statistically significant relationship with death, as death occurred prominently among patients who sustained burns on the four extremities 126 (77.3%), compared with those who sustained burns on the upper extremities 12 (7.4%) and the lower extremities 22 (13.5%).), torso 121 (74.2%), genital area 27 (16.6%), head and neck 116 (71.2%) (p<0.000).

Death was significantly correlated with the incidence of inhaled injury, with 268 (93.4%) not having OD, not dying compared to those without OD 19 (6.6%) (p<0.000).

The results showed a statistically significant relationship between the cause of death and the incidence of death, where death occurred prominently in patients who had respiratory failure 80 (49.1%) compared to those who had septic shock 24 (14.7%), and kidney failure 14 (8.6%)), hypovolemic shock 7 (4.3%), multiorgan failure 32 (19.6%), hepatic failure 1 (0.6%), heart failure 3 (1.8%), pulmonary embolism 1 (0.6%), cerebral hemorrhage 1 (0.6%)) (p<0.000).

Burn surface area of TBSA was significantly associated with mortality, with death occurring in patients with TBSA greater than or equal to 10% 162 (99.4%) compared to those with TBSA less than 10% (0.6%) (p<0.000). Death also occurred significantly in patients whose TBSA was greater than or equal to 20%159 (97.5%) compared to those whose TBSA was less than 20%4 (2.5%) (p<0.000).

Studying the relationship between the average of quantitative variables with the study variables:

When examining the relationship between mean hospitalization and study outcome, geographic area, hospitalization within 24 hours, death, and cause of death had a statistically significant relationship with mean hospitalization among patients. Whereas, patients from the coastal region had a higher mean of hospitalization compared to patients from other regions (p<0.027).

While patients who were not admitted to the hospital during the first 24 hours of burning had a higher mean of hospitalization compared to those who were admitted to the hospital during the first 24 hours (p<0.038).

While the absence of death had a higher mean of hospitalization than patients who died (p<0.000). Patients who died of septic shock had a higher mean hospitalization (p<0.001).

When studying the relationship between the average surface area of TBSA burn and the results of the study, the geographical area, cause of injury, and cause of death each had a statistically significant relationship with the average surface area of TBSA burn for patients. Whereas, patients from the eastern region had a higher mean TBSA burn surface area than the rest of the regions (p<0.000). Flammable gas burn patients had a greater mean TBSA burn surface area than those with blast injury, high tension burn, petroleum burn, flame burn, and gunshot wound (p<0.000). Patients who died of respiratory failure had a higher mean TBSA burn surface area than all other causes of death (p<0.000).

When examining the relationship between mean ABSI and study results, gender, geographic area, and hospital admission within 24 hours had a statistically significant relationship with the mean ABSI of patients. Whereas, the male gender had a greater mean ABSI compared to females (p<0.034). Patients from the central region had a mean ABSI greater than the rest of the regions (p<0.010). For patients who were not admitted to hospital within 24 hours, the mean ABSI was higher than those who were admitted (p<0.000).

Discussion:

The study revealed burn injuries within Damascus Hospital between 2013–2017, where the results showed that 450 patients were subjected to military burns during this period, of whom 289 (64.2%) were males and 161 (35.8%) were females. While in a study conducted during the Iraq war on a sample of 272 patients, 206 (24.3%) of them were males and 66 (24.3%) of them were females19.

With regard to ages, our study revealed the occurrence of war burns at ages between 0–20 years in the first degree by 51.3%, or 231 patients, and this is similar to a study conducted on the wars of Iraq and Afghanistan, which revealed that war burns occur at a greater rate in children and adults15.

Concerning the cause of injury, our study revealed that the most common causes of burns were flame burns with 197 patients (43.8%), then 93 petroleum (20.7%) burns, then explosive injury with 89 patients (19.8%). A study conducted on civil explosive burns in the United Kingdom agrees on 42 people. The most common cause of burns was flame burns 31 (73.8%), then liquid burns 4 (9.5%), then chemical

burns 3 (7.1%). This contradicts a study conducted in the Iraq war, where explosive burns were dominant at 55%-20-5. Here it becomes clear to us the difference between the causes of burns in civil conditions and burns in war conditions. Where injuries such as war-related flames, which differ from civil flames (usually caused by a domestic flame), appear to be the cause of war-related flames to be criminal subversive burns, explosive burns, petroleum burns caused by illegal manual oil refining, and high tension injuries caused by The destruction of the infrastructure and the drooping of the city's electric wires, which puts the citizens at risk.

According to our study, the most common areas of injury among patients were the four limbs 288 (28.4%), while in the study conducted in Iraq, the lower limbs and trunk were the dominant ones in 126 cases with a percentage of (46.3%)19.

The war may be an obstacle to the timely transfer of the patient to the burn care unit. Where our results showed that only 32.9% of patients entered the hospital within 24 hours of being burned, and this is consistent with a study conducted in the Netherlands on the Iraq and Afghanistan wars, where it took 3–5 days to deliver patients to hospitals 15.

As for the deaths of war-related burn injuries, our study revealed that 36.2% of patients died more than what appeared in a study conducted in Iraq, where it was found that the mortality rate was 8%. Our results showed that the mortality rate increases when the inhalation injury occurs and the greater the burn surface area (TBSA), and this is consistent with the results of a previous study conducted on the Iraq war4. This is also consistent with a study of children with severe burns in America 21.

Conclusions

The study revealed the prevalence and quality of military burns during the Syrian war in Damascus Hospital, where burns caused by flames, petroleum products and explosive injuries were the most common type of burns. Military burn injuries appeared prominently among females in the eastern region, compared to the rest of the geographical regions. The second and third degrees of burning were significantly associated with females compared to the rest of the degrees of burning.

Declarations

Ethics approval and consent to participate

This study was approved by the Institutional Review Board (IRB) at Syrian Private University. Written consent was obtained from all participants. Participation in the study was voluntary and participants were assured that there would be no victimization of anyone who did not want to participate or who decided to withdraw after giving consent.

Consent for publication:

Not applicable.

Availability of data and materials:

All data related to this paper's conclusion are available and stored by the authors. All data are available from the corresponding author on reasonable request.

Competing interests:

None of the authors have any competing interests. The authors alone are responsible for the content and writing of the article. No conflict of interest is declared.

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