

ADD ON...PRE-HOSPITAL CARE

The Initial Management of Acute Burns

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Introduction

Burns are distressing injuries and are challenging to manage. Whilst minor burns are common, major burns are rare in everyday practice. Lack of familiarity with burns and the unpleasant nature of the injury often distract the carer from following the basic principles of management. Burns victims are trauma victims and initial management does not deviate from BATLS and ATLS principles. However, accurate assessment of the burn injury, appropriate resuscitation and timely transfer to specialist care offers the best chance of achieving an optimal outcome.

There are some differences when comparing military and civilian burn practice. The proportion of all casualties seen with burns is much greater in the military environment. The likelihood of concomitant injury is also significantly higher with up to 50% of battlefield burns casualties having other injuries. There is also a greater risk of burns from dangerous materials such as phosphorus. In the UK a victim of a significant burn can normally expect to be in a burns unit within six hours. This standard cannot be matched in most operational and overseas deployments. It is therefore important that those working in the forward echelons of medical support have the ability to provide appropriate initial care for burns casualties and can continue that care along the evacuation chain. This fourth article in the pre-hospital care series aims to provide the knowledge base required for the initial management of the burns casualty.

Epidemiology

Burns are common in military casualties and the incidence has increased in modern warfare. Various reviews have put the percentage of burns casualties between 10 and 30%. The type of conflict impacts significantly on the incidence of burns. High use of armoured vehicles, warships and aircraft increase the proportion of burn victims. Overall, burns affected 14% of all UK casualties in the Falklands conflict yet were found in 34% of the injured from the "battle at sea" (1, 2). Up to 70% of Israeli tank battle casualties in the 1973 Yom Kippur War were burned (3).

New weapons that employ blast and heat to incapacitate personnel (such as thermobaric explosives) may cause more

burns to exposed skin and less fragmentation injury (3,4). Future strategies may place a higher emphasis on individual protection against burns including lightweight garments to reduce the effects of flash and thermal barrier creams for exposed skin (5).

It should be remembered that burns in the military are most frequently sustained away from fighting (Box 1). 54% of burns in a sample of 17,726 casualties in Vietnam were accidental (5,6). The causes of this are the same as seen in civilian life; using equipment incorrectly, ignoring safety procedures and other risk taking behaviour.

Box 1. Epidemiology of military burns (5)

- Combat burns directly related to munitions
- Combat burns related to ignition of fuel, propellants and clothing
- Accidental burns related to working with vehicles, fuel, chemicals and electrical equipment
- Accidental burns related to cooking, hot liquids, smoking etc.

Pathophysiology

Temperatures over 40°C denature proteins and cause cellular dysfunction. Cellular repair mechanisms are overwhelmed at temperatures above 45°C and cell death occurs within an hour. Temperatures over 60°C cause necrosis almost immediately. The extent of injury is dependent on both temperature and duration of exposure (7,8). Heat damage causes an acute inflammatory response in surrounding tissues. There is increased capillary permeability and a loss of fluid from the intravascular space (9).

This evolves for several hours after the burn. The magnitude of the inflammatory response is related to the volume of tissue injured. This is best expressed as the percentage of the total body surface area burned (recorded as %TBSA). Appropriate early management can minimise this process.

The most superficial burns cause only erythema and there is no significant capillary leakage. Areas so affected should not therefore be considered as part of the burn. In burns of greater than approximately 20% TBSA, the inflammatory process affects the whole body and casualties develop a Systemic Inflammatory Response Syndrome (SIRS). There is massive fluid loss from the intravascular space and burn shock develops. This is a progressive process that develops for many hours after the injury and appearance of the clinical signs of SIRS can be delayed. If there is hypovolaemic shock early after a

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burn, other causes need to be excluded.

A goal of the initial management of the major burn is to minimise the SIRS and prevent the development of burn shock. Historical experience has shown that any adult with a burn greater than 15% TBSA and any child with a burn greater than 10% TBSA will benefit from the prophylactic administration of intravenous fluids. Several formulae have been developed empirically to calculate the requirements for intravenous fluid. Which fluid to use is contentious and there is still much debate over colloid versus crystalloid regimes (10). The concept of replacing like with like, although attractive, is an over simplification. There are added considerations in the military environment such as the logistics of carrying large volumes of intravenous fluids. Regardless of which fluid is used, it is important to remember that the goal of fluid resuscitation is to anticipate and prevent burn shock and that resuscitation formulae provide only a guide to likely fluid requirements.

The depth of a burn will dictate later wound management but has little bearing on pre-hospital care or resuscitative measures. The wound is dynamic and its appearance can change over the first few days (11). The classification of burn depth is purely descriptive. Burns either involve the full thickness of the skin and are called full thickness burns or they involve only part of the thickness of the skin and are called partial thickness burns. Partial thickness burns are sub-classified depending on which parts of the skin are involved; epidermal, superficial dermal and deep dermal. Epidermal burns cause erythema alone and are most commonly seen as sunburn. They are not included when calculating %TBSA. The redness settles in about 48 hours.

Superficial dermal burns (superficial partial thickness burns) cause blistering but leave the deep dermal vasculature and epidermal appendages intact. The redness of these burns is like erythema in that it blanches with pressure and a capillary refill can be seen. It is normally very painful. If managed correctly it should heal spontaneously within 10 days. Deep dermal burns damage the deeper blood vessels and haemoglobin is sequestered in the tissue. This redness is darker and does not blanch (so-called "fixed staining"). Presence or absence of pain sensation is not a reliable sign. Chances of healing spontaneously are poor and these burns normally need skin grafting. Full thickness burns destroy the normal dermis and leave a firm leathery layer of necrotic tissue known as eschar. They can be waxy white or have lobster red fixed staining. Soot or charred tissue may mask the underlying appearance. Except for very small burns, these always require surgery.

Inhalation injury consists of three variable components:

- the true airway burn
- lung injury
- systemic toxicity.

An inhalation injury can consist of any combination of these and its presence significantly worsens the prognosis following a burn. The true airway burn is caused by inhalation of hot gases (flame, smoke or steam). The larynx will normally close quickly and the resulting thermal injury affects the supraglottic airway. The initial manifestation is upper airway oedema, which develops over a period of hours and is maximal between 12 and 36 hours.

If the products of combustion are inhaled beyond the larynx, they dissolve in the fluid lining the bronchial tree and alveoli. The result is a chemical injury to the lungs which produces varying degrees of pulmonary failure, often delayed by many hours or days.

Absorption of the products of combustion into the circulation through the alveoli can lead to systemic toxicity. The most common causes are carbon monoxide and cyanide. Carbon monoxide competes with oxygen for binding to haemoglobin, displaces oxygen and causes hypoxaemia. A low level of carboxyhaemoglobin (<10%) causes no symptoms and can be found in heavy smokers. Above 20% feelings of fatigue and nausea can start and higher mental functions are impaired. Levels above 40% lead to progressive loss of neurological function, and death occurs with levels over 60%. It should be noted that in the presence of carboxyhaemoglobin, pulse oximeter readings are unreliable indicators of oxygen saturation (%SaO₂).

Initial Management

Burn victims are trauma victims and the initial assessment is the same as for any other seriously injured casualty.

First Aid

The immediate priority is to stop the burning process. Smouldering clothes (or those soaked in scalding fluids), jewellery and watches all act as a reservoir of heat and should be removed without delay. Dousing the affected area in cold water will stop the burning process. If chemical burns are suspected, recognised decontamination procedures should be carried out.

There is evidence that further cooling of the burn wound modifies local inflammation and reduces heat damage (12). This is best achieved by the topical application of cool water (preferably flowing). Cooling the wound also has a beneficial analgesic effect. Very cold water and ice cause local vasoconstriction and may worsen the situation. Ideally the cooling should be started immediately and continue for ten to twenty minutes. It is uncertain if there is any

benefit beyond this time. Protracted cooling will lead to systemic hypothermia, particularly in small children and should be avoided. Cooling very large burns will also lead to hypothermia and a degree of common sense should prevail. The maxim "cool the burn but warm the casualty" is accurate but difficult to achieve in practice.

There are proprietary wet gel dressings available which are designed to provide immediate cooling and protection to burns. There is no evidence that they are superior to use of water alone but they do have a convenience advantage and are used routinely by many civilian Ambulance Services (12).

Further management at the scene or in transit depends on the operational circumstances and proximity of the medical support. Analgesia should be provided as soon as possible. Oxygen should be administered if available and intravenous access obtained early if feasible. Elaborate dressings are inappropriate and delay evacuation. Clingfilm or plastic bags make satisfactory simple dressings. Wet soaks can be placed over the clingfilm to continue the cooling process. Care should be taken when applying clingfilm dressings to chemical burns (see below).

Immediate Medical Care

The following measures follow standard BATLS principles and should be applicable in nearly all circumstances. The casualty must be fully assessed using the ABCDE approach.

A-Airway

In the initial assessment of the airway the most important aspect is to diagnose any degree of inhalation injury. The development of signs and symptoms from airway oedema occur progressively over several hours. The key to early diagnosis is therefore a high index of suspicion with the frequent re-evaluation of those considered to be at risk. The presence of any of the following indicate the possibility of an inhalation injury:

- A history of exposure to fire and/or smoke in an enclosed space (building or vehicle).
- Exposure to blast.
- Collapse, confusion or restlessness at any time.
- Hoarseness or any change in voice.
- Harsh cough.
- Stridor.
- Burns to the face.
- Singed nasal hairs.
- Soot in saliva or sputum.
- An inflamed oropharynx.

In all cases high concentration oxygen should be administered if available (humidified if possible). If any degree of upper airway obstruction is present, tracheal intubation is essential. This can be difficult if no anaesthetic expertise is available. The

majority of casualties will be conscious and intubation will be impossible without an anaesthetic. It may therefore be necessary to perform a surgical airway on an awake casualty. Judgement is required in cases where there is a high suspicion of inhalation injury but without evidence of upper airway obstruction. If it is considered safe to evacuate such cases without intubation, they should be nursed sitting up. If there is any doubt, tracheal intubation (by whichever route) should be performed.

B-Breathing

The pulmonary manifestations of burn injuries rarely occur early. A terrified casualty gasping for air is more likely to have lung injury from a blast. The only likely effect of a burn that will cause compromise of respiration in the first few hours is a restriction of ventilation by a circumferential torso burn. This is an indication for emergency escharotomy (see below).

C-Circulation

Hypovolaemic shock secondary to a burn takes some time to produce measurable physical signs. If the burn victim is shocked early, other causes should be excluded. A history of a blast, vehicle collision or a fall whilst escaping the fire should raise suspicion of other injuries. If the casualty has hypovolaemic shock, this should be treated according to current shock protocols independent of the severity of burn. It is possible to cannulate through burnt skin but this should be avoided if possible. If necessary cut-downs, intraosseous or, as a last resort, central routes may be used. The volumes required in burns casualties are discussed below and in Box 3.

D-Disability

Reduced level of consciousness, confusion and restlessness normally indicate hypoxia secondary to an inhalation injury. The possibility of other injuries should not be overlooked. In non-battlefield situations the possibility of drug and/or alcohol ingestion should also be considered.

E-Exposure / Environment

The entire body surface area should be inspected for burns and other injuries, but care should be taken to avoid hypothermia. One limb at a time should be unwrapped to avoid excessive cooling. If possible, the ambient temperature should be kept high.

Other initial interventions

Burns are painful and casualties are often terrified. Adequate analgesia should be administered early (13). Burns are usually sterile initially and infection is uncommon for the first few days. In normal civilian practice there is no requirement for antibiotic prophylaxis. In the battlefield situation

wound contamination is assumed and administration of prophylactic antibiotics according to Casualty Treatment Regimes is recommended. A booster dose of tetanus vaccine should also be considered.

Initial Management of the Burn Injury

Inhalation injury

There is little else that can be done beyond securing the airway and ensuring delivery of the maximally achievable oxygen concentration. The management of the pulmonary complications of burns requires expert intensive care. Any casualty with a suspected inhalation injury should be transferred and closely observed in an area equipped for intubation as soon as possible. Pulse oximetry readings should be interpreted with caution. There is no evidence that administration of steroids is beneficial (14).

The cutaneous burn

Whatever the cause of the burn, the severity of the injury is proportional to the volume of tissue damage. In terms of survival, the percentage of the total body surface area (%TBSA) involved is the most important

factor. Functional outcome is more often dependent on depth and site of the burn.

Calculating %TBSA burn

The difficulties of establishing the size of a burn in the field should not be understated. (Consider for example a soldier who is covered with charred combats and a mixture of oil, soot and blood). Accurate treatment depends on an accurate assessment of the %TBSA burn. This can usually only be estimated accurately using a Lund & Browder chart in a casualty who has been completely exposed and thoroughly cleaned (Figure 1). In practice this is difficult before arrival at a Field Hospital. It is therefore more appropriate to make an initial estimation.

At the point of first aid a rough assessment can be made using serial halving. If half the casualty is burnt then it is 50% TBSA. Half of a half is 25% and so on. In very large burns it is often easier to work out how much is not burnt. Half of a half of a half is 12.5% and approximates to the cut off for those that need intravenous resuscitation. A slightly more accurate assessment can be made using the "Rule of Nines" (Figure 2). At this stage differentiating between full and partial thickness burns is not only difficult but also not essential. The palmar surface of the casualty's hand including the fingers equates to 1% TBSA and can be used to estimate small areas of burn.

Preventing burns shock

Any burn greater than 10% TBSA in a child and 15% TBSA in an adult is going to require intravenous fluids to prevent the development of burn shock.

The British Army formula is described in the BATLS manual (Box 2). Our recommendation is to use crystalloid in the first 24 hours based on the Parkland formula. The volume required is given by the formula:

$$2\text{-}4\text{ml Hartmann's solution} \times \%TBSA \text{ burn} \times \text{kg body weight}$$

The higher value of 4mls should be used initially. The formula gives a total volume of fluid. Half of this volume must be administered in the first eight hours and the second half over the next sixteen hours. The requirement for fluid starts at the time of injury. The administration rate therefore needs to allow for any catch-up (Box 3). An adult's weight can be obtained by asking the casualty or estimation. For children a recognised formula should be used such as:

$$(\text{age}+4) \times 2 = \text{weight in kg}$$

Attempts to simplify these calculations have been made by the publication of burns 'wheels' and tables such as Table 1 (based on

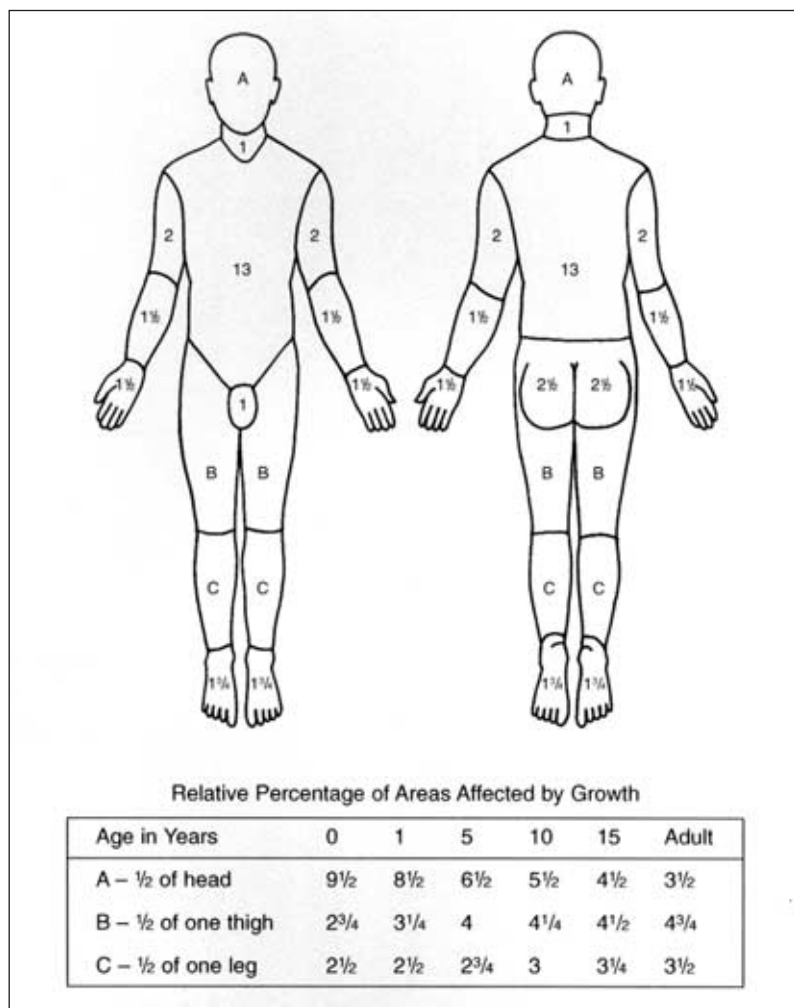


Fig 1. The Lund and Browder Chart. This chart takes into account the differences in surface area in different age groups.

Table 1. Battlefield burns resuscitation: estimated fluid requirements in millilitres for a 75 kg casualty using the Parkland formula (15)

Hours post burn	% TBSA burn								
	20	30	40	50	60	70	80	90	100
1	375	400	750	950	1125	1300	1500	1690	1875
2	750	1300	1500	1800	2250	2625	3000	3375	3750
3	1100	1800	2200	2800	3375	3840	4500	5060	5625
4	1500	2500	3000	3750	4500	5250	6000	6750	7500
5	1800	3100	3750	4700	5625	6560	7500	8440	9375
6	2200	3700	4500	5600	6750	7875	9000	10125	11250
7	2600	4200	5300	6500	7875	9190	10500	11815	13125
8	3000	4800	6000	7500	9000	10500	12000	13500	15000

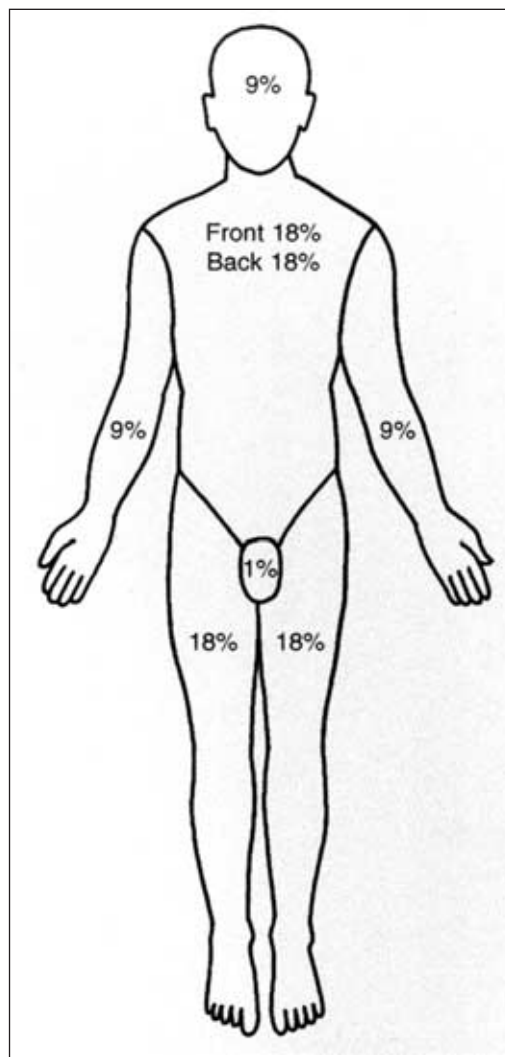


Fig 2. The Rule of Nines.

the Parkland formula) (15).

In situations where there is limited access to intravenous fluids (e.g multiple casualty scenarios or operations beyond conventional medical support), oral administration of the required volume of fluid may need to be relied upon. A young fit soldier is likely to tolerate the fluid loss from a burn of at least 20% TBSA with oral fluids alone. Moyer's Solution consists of sodium chloride and bicarbonate and is designed to replace electrolyte as well as volume loss. However, if an adult casualty with a minor burn is eating a normal diet, they will get sufficient electrolytes from their diet and a sufficient volume of any non-caffeinated, non-alcoholic

beverage will do just as well. In larger injuries it is unlikely that reliance on oral fluids will maintain sufficient tissue perfusion and the inflammatory response will be more severe.

In some circumstances, the exact details of when the burn occurred may not be known. In this situation the amount of fluid required should be estimated.

In injuries with large areas of full thickness burn, there is extensive loss of circulating red blood cells. Replacement by blood transfusion at Field Hospital level should be guided by haemoglobin values. Once in a Field Hospital, further fluid requirements can be assessed by calculating the plasma deficit using the formula:

$$\text{Plasma deficit} = \frac{\text{Blood volume} \times \text{normal haematocrit}}{\text{observed haematocrit}}$$

Where blood volume = 70mls / kg and normal haematocrit = 44% for adult males and 40% for adult females.

Box 2. Current BATLS recommendations for fluid replacement in burns.

- Burns over 15% TBSA in adults require intravenous fluid.
- The total amount of fluid needed is 120 ml of colloid per 1% of TBSA burnt, administered over 48 hours. Half of this should be administered in the first eight hours from the time of burning. A quarter of the calculated volume is given in the next 16 hours and the final quarter given during the second 24 hours.
- In addition, 100 ml of fluid per hour is required for normal metabolic purposes. If the casualty can swallow, it should be given orally, if not, as IV crystalloid.

Monitoring

The Parkland formula provides an estimate of the resuscitation fluids required. It does not allow for other losses, nor for maintenance needs. It is therefore essential to monitor the adequacy of fluid resuscitation. This is best achieved by measuring urinary output, aiming for urine outputs of 1 ml/kg/hr in adults and 2 ml/kg/hr in children.

The burn wound

The aim of burn wound management is to maximise functional and cosmetic outcome. Apart from small superficial burns, wound management needs to be supervised by a burns surgeon. Beyond stopping the burning process and cooling the burn as described above, there is rarely an indication for any other pre-hospital intervention other than as described above.

A circumferential full thickness burn can act like a tourniquet and compromise circulation. Division of the constriction is known as escharotomy. This is not a straightforward undertaking and normally should be performed in an operating theatre by skilled persons. There is rarely a need to perform an escharotomy within the first few hours. The exception is a full thickness burn of the entire trunk which is preventing respiration (see below).

Box 3. An example of burns resuscitation using the Parkland Formula.

A soldier's combats catch fire at 06.00 during a re-fuelling accident. He arrives at a Dressing Station at 06.30 and is found to have mixed depth burns to all of both his legs with erythema of his buttocks and perineum. The TBSA burn is assessed as being 36%. He weighs 75 kg. By the time he has been assessed and intravenous lines established it is 07.00

Parkland formula:
 $4\text{mls} \times 36\% \times 75\text{kg} = 10,800 \text{ mls}$ crystalloid in 24 hours

Half required in first 8 hours after injury = 5,400 mls by 14.00

Time now 07.00 = requirement of 770 mls/hr until 14.00

Second half required in subsequent 16 hours = 340 mls/hr from 14.00 until 06.00

Special Burns

Electrical burns

Passage of electricity through the body produces heat which can cause burns. The type of injury seen depends on voltage and two groups are generally recognised:

Low voltage - under 1,000 volts.

This includes the normal domestic mains of 240 volts and the common industrial supply of 415 volts. Electrocutation leads to cutaneous contact burns at the sites of entry and exit. The tissue damage extends through the full thickness of the skin and deep structures immediately under the wounds can be damaged.

High voltage - over 1,000 volts.

Entry and exit wounds have a blast component with massive local damage. There may be multiple entry and exit wounds as the current can arc across joints. As current flows through the tissues, extensive deep damage occurs. Entire compartments can be destroyed, sometimes without involving the overlying skin. Fasciotomies are frequently required. A flashover can occur causing secondary ignition of clothes and a large cutaneous burn.

In both types, the obvious cutaneous burn is an under-representation of the true extent of the injury. Reliance on the Parkland formula may lead to under-resuscitation and close attention must be made to monitoring the urine output. Urinary excretion of the breakdown products of haemoglobin and myoglobin is common in extensive electrical burns and renal failure is a significant risk in this situation. This is best prevented by administering additional intravenous fluids aiming for a urinary output of 2 ml/kg/hr.

Many electrocutions result in falls and there can also be violent tetanic muscle spasms. There is therefore a high risk of associated injuries. Cardiac dysrhythmias can occur following passage of current across the thorax. Cardio-respiratory arrest is often reversible and prolonged efforts at resuscitation are justified.

There is a high incidence of compartment syndrome due to the muscle damage and the limbs should be regularly monitored for signs of neurovascular compromise. The threshold for both escharotomy and fasciotomy should be low.

Chemical Burns

Contamination and injury to others is a serious risk when dealing with chemical burns. All those involved should wear appropriate protective equipment. Any clothes or materials from the victim and used irrigation fluid must be treated as contaminated. This is particularly important in a chemical warfare environment and recognised decontamination procedures should be followed.

In all cases the mainstay of treatment is continuous copious irrigation with water (16). Application of soaks is inadequate. If powder or lumps of the chemical are visible these should be removed first. All clothes should be removed, including underwear.

Irrigation should continue for at least 20 to 30 minutes. Acids produce coagulative necrosis and the resulting eschar helps reduce penetration. Alkalis cause liquefaction and penetration into deeper tissues is more significant. Irrigation for alkali burns should therefore continue for longer (at least an hour). Indicator paper can be placed intermittently on the wound to see if the pH is returning to neutral. There is considerable risk of hypothermia with prolonged irrigation. Once the chemical burning process has been halted, management is the same as for other burns.

The use of neutralising agents can cause exothermic reactions and worsen the burn. Their use is therefore not recommended. Very serious injury can develop following what appears to be an innocuous exposure. There is sometimes a requirement to administer specific antidotes. Chemical burns should be discussed with an expert whenever possible.

It is often forgotten that petrol, kreosene and diesel produce chemical burns. These initially appear superficial but may progress to full thickness. Systemic toxic effects can occur if the contact surface area is large or the exposure is prolonged. Treatment is the same as for other chemical injuries.

Phosphorus burns are almost exclusively a military phenomenon. Visible lumps of phosphorus should be removed as soon as possible and the burn covered with wet dressings. It is essential that the dressings are kept wet to prevent progression of the burn. 1% copper sulphate solution neutralises the phosphorus and turns the fragments black. It is used to identify fragments but is toxic and should not be used by inexperienced personnel (17).

Covering chemical burns with clingfilm will keep any residual chemical on the skin

where it will continue to burn. It is therefore vital to ensure all traces of the chemical agent have been removed prior to clingfilm application.

Evacuation

All casualties should be transferred to the next level of care safely. For a burns casualty it is important to be certain that no airway obstruction will develop in-transit. If there is any doubt, the airway must be secured first. Intravenous access, appropriate dressings and analgesia are also important. The following evacuation priorities have been defined for **single** casualties:

- **Priority 1:** Any burn with a suspected inhalation injury that has actual or anticipated airway involvement. Burns of 15% TBSA and above (10% and over in children). Electrical burns.
- **Priority 2:** Burns of less than 15% BSA but involving face, eyelids, hands, perineum and across joints. Chemical burns.
- **Priority 3:** All remaining burn casualties

Multiple Casualties

The P1 hold category is introduced in multiple casualty situations. Burn casualties draw heavily on resources and survival is unlikely for severe injuries without expert critical care facilities. With modern techniques, however, meaningful rehabilitation from massive injuries is achievable. The use of P1 hold should be used in the context of the whole picture rather than be dictated by any individual's % TBSA burn. Current BATLS philosophy is that in multiple casualty situations, those with burns of more than 30% BSA should normally be held as P1 hold at a Role Three facility until they have survived the 48 hour shock phase.

Continuing Care

The casualty with major burns should reach specialist care without delay. Modern burn management is centred on expert critical care support and surgical excision of the burn as early as possible followed by immediate resurfacing. The resources required to deliver this are substantial. It is not realistic to provide such facilities for most operational deployments outside of the UK. Current practice is to stabilise the casualty within the theatre of operations and repatriate to the UK as soon as possible for definitive care. It may, however, be necessary to provide on-going care of a burn casualty beyond the first few hours. The availability of medical supplies and the number and severity of casualties are likely to influence management decisions and a certain degree of resourcefulness and initiative may be

required. If it is possible communicate with a burns team for advice on specific casualties, this should be done from an early stage. The use of telemedicine may have an ever-increasing role in this respect.

The systemic inflammatory response to a burn can lead to a fever, poor pulmonary function, difficulty in maintaining an acceptable blood pressure and failure of gut functions. The picture is almost identical to sepsis but it should be remembered that burns do not normally become infected for the first few days. Management is difficult. For example, large volumes of fluids may need to be given to maintain urinary output but this risks the development of pulmonary oedema. Similarly, respiratory function may deteriorate to the extent that anaesthetic expertise will be required.

Adequate intravenous fluids are the mainstay of treatment. It should be remembered that the Parkland formula only provides an estimate of fluid requirements. The actual amount required should be titrated to the clinical response. Large full thickness burns and those with an inhalation injury frequently require significantly more fluid than predicted. This can be in excess of 20 litres a day (18). The need for fluid is maximal in the first 24 hours. Normal maintenance fluids should also be given. Ideally this should be by the oral or nasogastric route.

In burns over 20% TBSA it is recommended that nasogastric feeding be started as soon as possible. This preserves gut function and reduces the risk of peptic ulceration, allows administration of calories, essential nutrients and maintenance fluids. It is also thought that feeding reduces the level of translocation of gut bacteria into the blood stream, which may be beneficial.

Wound care

If it is anticipated that the casualty will be held for more than about twelve hours, clingfilm as a dressing will be unsatisfactory. The burn should be washed down with copious amounts of warm antiseptic. Blisters should be burst and blister roofs removed. The current topical dressing is silver sulfadiazine cream (Flamazine®). This can be smeared directly onto the burn and then covered with a single layer of paraffin gauze. Large amounts of gauze secured with bandages should then be used to absorb exudate and protect the wound. If silver sulfadiazine is not available, paraffin gauze should be placed on the burn then a layer of gauze soaked in antiseptic. These dressings should be changed at least every 48 hours. Burns ooze significant amounts of fluid for the first 48 hours and the top layers of a soaked dressing can be changed without disturbing the deeper ones. Faces need not be dressed but should be kept moist for comfort. The eyelids are an important area as

burns here can quickly result in corneal ulceration and the risk of infection and blindness. They are a priority for skin grafting but in the absence of surgical facilities the risks can be reduced by temporarily suturing the eyelids together. If this is not possible the eyes should be covered with gel pads or wet dressings. Regular application of chloramphenicol ointment helps retain moisture and prevent infection.

Circumferential full thickness burns will need escharotomies if arrival at a surgical facility is not anticipated within about eight hours. This will be required earlier for torso burns that are compromising respiratory movements. The incisions should penetrate the full thickness of the eschar and extend into viable tissue beyond the burn. Genuine full thickness burns are anaesthetic but the unburned subcutaneous tissues are not and some pain will be felt. Chest incisions should be both sagittal (in the anterior axillary lines) and transverse if necessary to relieve restriction of the chest wall. Limb incisions should be made in the mid-lateral lines, avoiding the ulnar nerve at the elbow and the peroneal nerve at the fibular head. Following escharotomy, local perfusion increases and the wounds frequently bleed excessively. The need for blood transfusion should be anticipated.

Burns cause considerable local swelling. The casualty should be nursed sitting up with the affected parts elevated if possible. With adequate analgesia and good dressings most burns victims should not be in undue discomfort. Always ensure the casualty is kept warm.

Summary

The initial management of burns, in common with all trauma, follows the ABCDE approach. The outline management plan detailed above assumes the availability of certain medical supplies but even simple measures are invaluable in burn care if they are all that are available. The most basic supplies required to resuscitate a casualty are oral salt and water in appropriate volumes. Similarly it should be possible in field conditions to monitor vital signs and urine output, dress the burns with clingfilm or plastic bags and wrap the casualty in absorbent materials.

Further Reading

Casualty Treatment Regimes (CTRs) (Army Code No 62264)

The Battlefield Advanced Trauma Life Support (BATLS)

(Army Code No 63726).

Burns - The First Five Days by John A D Settle. This booklet was distributed free by Smith and Nephew Pharmaceuticals Ltd and gives an in-depth guide to the initial management of burns in the civilian setting. Sadly, it is no longer published, but can still be found in most libraries and burns units for reference.

The add-on series in pre-hospital care is edited by Maj R Mackenzie.

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