ABC of burns

This is the fourth in a series of 12 articles

Initial management of a major burn: I—overview

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A major burn is defined as a burn covering 25% or more of total body surface area, but any injury over more than 10% should be treated similarly. Rapid assessment is vital. The general approach to a major burn can be extrapolated to managing any burn. The most important points are to take an accurate history and make a detailed examination of the patient and the burn, to ensure that key information is not missed.

This article outlines the structure of the initial assessment. The next article will cover the detailed assessment of burn surface area and depth and how to calculate the fluid resuscitation formula.

History taking

The history of a burn injury can give valuable information about the nature and extent of the burn, the likelihood of inhalational injury, the depth of burn, and probability of other injuries. The exact mechanism of injury and any prehospital treatment must be established.

A patient's history must be obtained on admission, as this may be the only time that a first hand history is obtainable. Swelling may develop around the airway in the hours after injury and require intubation, making it impossible for the patient to give a verbal history. A brief medical history should be taken, outlining previous medical problems, medications, allergies, and vaccinations. Patients' smoking habits should be determined as these may affect blood gas analyses.

Primary survey

The initial management of a severely burnt patient is similar to that of any trauma patient. A modified "advanced trauma life support" primary survey is performed, with particular emphasis on assessment of the airway and breathing. The burn injury must not distract from this sequential assessment, otherwise serious associated injuries may be missed.

A—Airway with cervical spine control

An assessment must be made as to whether the airway is compromised or is at risk of compromise. The cervical spine should be protected unless it is definitely not injured. Inhalation of hot gases will result in a burn above the vocal cords. This burn will become oedematous over the following hours, especially after fluid resuscitation has begun. This means that an airway that is patent on arrival at hospital may occlude after admission. This can be a particular problem in small children.

Direct inspection of the oropharynx should be done by a senior anaesthetist. If there is any concern about the patency of the airway then intubation is the safest policy. However, an unnecessary intubation and sedation could worsen a patient's condition, so the decision to intubate should be made carefully.

B—Breathing

All burn patients should receive 100% oxygen through a humidified non-rebreathing mask on presentation. Breathing problems are considered to be those that affect the respiratory system below the vocal cords. There are several ways that a burn injury can compromise respiration.

Initial assessment of a major burn

- Perform an ABCDEF primary survey
 - A—Airway with cervical spine control, B—Breathing, C—Circulation, D—Neurological disability, E—Exposure with environmental control, F—Fluid resuscitation
- Assess burn size and depth (see later article for detail)
- Establish good intravenous access and give fluids
- Give analgesia
- Catheterise patient or establish fluid balance monitoring
- Take baseline blood samples for investigation
- Dress wound
- Perform secondary survey, reassess, and exclude or treat associated injuries
- Arrange safe transfer to specialist burns facility

Key points of a burn history**Exact mechanism**

- Type of burn agent (scald, flame, electrical, chemical)
- How did it come into contact with patient?
- What first aid was performed?
- What treatment has been started?
- Is there risk of concomitant injuries (such as fall from height, road traffic crash, explosion)?
- Is there risk of inhalational injuries (did burn occur in an enclosed space)?

Exact timings

- When did the injury occur?
- How long was patient exposed to energy source?
- How long was cooling applied?
- When was fluid resuscitation started?

Exact injury*Scalds*

- What was the liquid? Was it boiling or recently boiled?
- If tea or coffee, was milk in it?
- Was a solute in the liquid? (Raises boiling temperature and causes worse injury, such as boiling rice)

Electrocution injuries

- What was the voltage (domestic or industrial)?
- Was there a flash or arcing?
- Contact time

Chemical injuries

- What was the chemical?

Is there any suspicion of non-accidental injury?

- See previous article

Airway management**Signs of inhalational injury**

- History of flame burns or burns in an enclosed space
- Full thickness or deep dermal burns to face, neck, or upper torso
- Singed nasal hair
- Carbonaceous sputum or carbon particles in oropharynx

Indications for intubation

- Erythema or swelling of oropharynx on direct visualisation
- Change in voice, with hoarseness or harsh cough
- Stridor, tachypnoea, or dyspnoea

Carbonaceous particles staining a patient's face after a burn in an enclosed space. This suggests there is inhalational injury

Mechanical restriction of breathing—Deep dermal or full thickness circumferential burns of the chest can limit chest excursion and prevent adequate ventilation. This may require escharotomies (see next article).

Blast injury—If there has been an explosion, blast lung can complicate ventilation. Penetrating injuries can cause tension pneumothoraces, and the blast itself can cause lung contusions and alveolar trauma and lead to adult respiratory distress syndrome.

Smoke inhalation—The products of combustion, though cooled by the time they reach the lungs, act as direct irritants to the lungs, leading to bronchospasm, inflammation, and bronchorrhoea. The ciliary action of pneumocytes is impaired, exacerbating the situation. The inflammatory exudate created is not cleared, and atelectasis or pneumonia follows. The situation can be particularly severe in asthmatic patients. Non-invasive management can be attempted, with nebulisers and positive pressure ventilation with some positive end-expiratory pressure. However, patients may need a period of ventilation, as this allows adequate oxygenation and permits regular lung toileting.

Carboxyhaemoglobin—Carbon monoxide binds to deoxyhaemoglobin with 40 times the affinity of oxygen. It also binds to intracellular proteins, particularly the cytochrome oxidase pathway. These two effects lead to intracellular and extracellular hypoxia. Pulse oximetry cannot differentiate between oxyhaemoglobin and carboxyhaemoglobin, and may therefore give normal results. However, blood gas analysis will reveal metabolic acidosis and raised carboxyhaemoglobin levels but may not show hypoxia. Treatment is with 100% oxygen, which displaces carbon monoxide from bound proteins six times faster than does atmospheric oxygen. Patients with carboxyhaemoglobin levels greater than 25-30% should be ventilated. Hyperbaric therapy is rarely practical and has not been proved to be advantageous. It takes longer to shift the carbon monoxide from the cytochrome oxidase pathway than from haemoglobin, so oxygen therapy should be continued until the metabolic acidosis has cleared.

C—Circulation

Intravenous access should be established with two large bore cannulas preferably placed through unburnt tissue. This is an opportunity to take blood for checking full blood count, urea and electrolytes, blood group, and clotting screen. Peripheral circulation must be checked. Any deep or full thickness circumferential extremity burn can act as a tourniquet, especially once oedema develops after fluid resuscitation. This may not occur until some hours after the burn. If there is any suspicion of decreased perfusion due to circumferential burn, the tissue must be released with escharotomies (see next article).

Profound hypovolaemia is not the normal initial response to a burn. If a patient is hypotensive then it is may be due to delayed presentation, cardiogenic dysfunction, or an occult source of blood loss (chest, abdomen, or pelvis).

D—Neurological disability

All patients should be assessed for responsiveness with the Glasgow coma scale; they may be confused because of hypoxia or hypovolaemia.

E—Exposure with environment control

The whole of a patient should be examined (including the back) to get an accurate estimate of the burn area (see later) and to check for any concomitant injuries. Burn patients, especially children, easily become hypothermic. This will lead to hypoperfusion and deepening of burn wounds. Patients should be covered and warmed as soon as possible.

Acute bronchoscopy being performed to assess amount of damage to the bronchial tree. Patient has been covered in a blanket and a heat lamp placed overhead to prevent excessive cooling

Signs of carboxyhaemoglobinaemia

COHb levels	Symptoms
0-10%	Minimal (normal level in heavy smokers)
10-20%	Nausea, headache
20-30%	Drowsiness, lethargy
30-40%	Confusion, agitation
40-50%	Coma, respiratory depression
>50%	Death

COHb = Carboxyhaemoglobin

Algorithm for primary survey of a major burn injury

F—Fluid resuscitation

The resuscitation regimen should be determined and begun. This is based on the estimation of the burn area, and the detailed calculation is covered in the next article. A urinary catheter is mandatory in all adults with injuries covering >20% of total body surface area to monitor urine output. Children's urine output can be monitored with external catchment devices or by weighing nappies provided the injury is <20% of total body area. In children the interosseous route can be used for fluid administration if intravenous access cannot be obtained, but should be replaced by intravenous lines as soon as possible.

Analgesia

Superficial burns can be extremely painful. All patients with large burns should receive intravenous morphine at a dose appropriate to body weight. This can be easily titrated against pain and respiratory depression. The need for further doses should be assessed within 30 minutes.

Investigations

The amount of investigations will vary with the type of burn.

Secondary survey

At the end of the primary survey and the start of emergency management, a secondary survey should be performed. This is a head to toe examination to look for any concomitant injuries.

Dressing the wound

Once the surface area and depth of a burn have been estimated, the burn wound should be washed and any loose skin removed. Blisters should be deroofted for ease of dressing, except for palmar blisters (painful), unless these are large enough to restrict movement. The burn should then be dressed.

For an acute burn which will be referred to a burn centre, cling film is an ideal dressing as it protects the wound, reduces heat and evaporative losses, and does not alter the wound appearance. This will permit accurate evaluation by the burn team later. Flamazine should not be used on a burn that is to be referred immediately, since it makes assessment of depth more difficult.

Referral to a burns unit

The National Burn Care Review has established referral guidelines to specialist units. Burns are divided into complex burns (those that require specialist intervention) and non-complex burns (those that do not require immediate admission to a specialist unit). Complex burns should be referred automatically. If you are not sure whether a burn should be referred, discuss the case with your local burns unit. It is also important to discuss all burns that are not healed within two weeks.

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Investigations for major burns*

General

- Full blood count, packed cell volume, urea and electrolyte concentration, clotting screen
- Blood group, and save or crossmatch serum

Electrical injuries

- 12 lead electrocardiography
- Cardiac enzymes (for high tension injuries)

Inhalational injuries

- Chest x ray
 - Arterial blood gas analysis
- Can be useful in any burn, as the base excess is predictive of the amount of fluid resuscitation required
- Helpful for determining success of fluid resuscitation and essential with inhalational injuries or exposure to carbon monoxide

*Any concomitant trauma will have its own investigations

Indications for referral to a burns unit

All complex injuries should be referred

A burn injury is more likely to be complex if associated with:

- Extremes of age—under 5 or over 60 years
- Site of injury
 - Face, hands, or perineum
 - Feet (dermal or full thickness loss)
 - Any flexure, particularly the neck or axilla
 - Circumferential dermal or full thickness burn of limb, torso, or neck
- Inhalational injury
 - Any substantial injury, excluding pure carbon monoxide poisoning
- Mechanism of injury
 - Chemical injury > 5% of total body surface area
 - Exposure to ionising radiation
 - High pressure steam injury
 - High tension electrical injury
 - Hydrofluoric acid burn >1% of total body surface area
 - Suspicion of non-accidental injury
- Large size (dermal or full thickness loss)
 - Paediatric (< 16 years old) >5% of total body surface area
 - Adult (≥ 16 years) >10% of total body surface area
- Coexisting conditions
 - Any serious medical conditions (cardiac dysfunction, immunosuppression, pregnancy)
 - Any associated injuries (fractures, head injuries, crush injuries)

Key points

- Perform a systematic assessment as with any trauma patient (don't get distracted by the burn)
- Beware of airway compromise
- Provide adequate analgesia
- Exclude any concomitant injuries
- Discuss with a burns unit early
- If in doubt, reassess

Further reading

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