The Burns Unit at the Prince of Wales Hospital is the largest and busiest in the territory and receives patients from its own direct catchment area and from referring hospitals which includes a significant number of patients injured in the Mainland.

Burns management can be complex and lengthy but the priority in acute burns management is simple and is to reduce mortality and morbidity by adherence to basic principles of trauma care with some modifications. Much depends on speedy first aid, accurate assessment of the severity of the burns injury and timely referral to a specialised burns unit where definitive treatment can be given. This article aims to provide an overview of the acute management of the burns patient.

First aid

The aim of first aid is to minimise the extent of the injury particularly in terms of contact time. Whilst using caution to ensure your own safety, stop the burning process.

- If the patient is on fire, then get him to 'stop, drop and to put out the fire or else smother the fire with a thick blanket or towel. Remove burnt clothes and cool the burnt areas with water for up to half an hour.
- Remove the patient from electrical contact.
- For chemical burns, remove soiled clothing and flush affected areas with running water for as long as tolerated.

Ensure that the patient is kept warm for transfer to the emergency department.

Initial assessment

The assessment of the patient in the emergency department is essentially the same as for any trauma patient with treatment priorities based on the stability of the vital signs. The primary survey aims to detect life-threatening injuries particularly inhalational injury. It is important to realise that burns are not simply skin injuries, there may be other injuries related to the event e.g. explosions or the sequelae from running away, jumping out of windows to escape the fire.

- **Airway:** evaluate the stability of the cervical spine and immobilise as necessary. Consider endotracheal tube intubation and ventilation if indicated.
- **Inhalational injuries** can be rapidly lethal. A high index of suspicion is required - history of fire in an enclosed space, singed nasal hairs, burns or soot in the upper airway, change of voice etc. Prophylactic intubation is preferable to an emergency airway.
- **Breathing:** 100% oxygen for all burns >20% TBSA or involving a flame/flash mechanism.
- **Circulation:** check peripheral circulation and insert 2 large-bore peripheral lines. Commence IV resuscitation with Hartmann's solution for adults TBSA >15% or children TBSA > 10% (see later for comprehensive regime)
- **Disability:** neurological evaluation using the AVPU method or GCS, which provides an indicator of the adequacy of cerebral oxygenation and perfusion.

Secondary Survey

The secondary survey aims to detect severe injuries requiring a thorough head-to-toe examination of the patient. A history should be elicited - the minimum is an ‘AMPLE’ history which includes allergy history, medications, medical problems, last meal time and the event i.e. the mechanism of injury, time of injury, time of extrication and fluids or other treatment given during transport.

Assessment of the burn

The effect of a burn injury on an individual patient depends on:

- Area and depth of burn
- Presence of inhalational injury. Viewing the upper airway with a flexible endoscope is useful.
- Age of patient and the presence of concomitant medical problems
- Special areas (eyes, hand / genitalia) as well as circumferential burns of the limbs, neck and chest have added significance.

The size of the burn is important as it is related to the magnitude of the inflammatory process which causes fluid shifts from the vascular compartment, thus directly affects the acute fluid resuscitation required. Various...
methods to estimate the percentage of the body surface which is burnt have been described. The simplest method is the “Rule of Nines” which divides the body surface into areas of nine percent (9%) or multiples of 9% (Figure 1). An alternative way assumes that the closed palm of the patient is equal to approximately 1% of the body surface and is most useful for assessing scattered burns. The most accurate assessment is made using the Lund and Browder chart particularly in children as it takes into account the relative changes in proportions of head and legs in the growing child (Figure 2); charts also allow an easy way to chart and record the distribution and depth of the burns. Whichever method is used, it is very important not to include simple erythema in the estimation of the burn injury - erythema is a reversible hyperaemia which is not associated with tissue damage and as such it will not give rise to pathophysiological changes.

The depth of the burn determines the likely course of healing. The depth of the burn is best described in descriptive terms, simply classified as being full or partial -thickness burns with the latter further subdivided into superficial partial thickness and deep partial thickness (Figure 3). It is possible to make an estimate of the depth of the burn from the clinical appearance (Table 1) but burns evolve particularly over the first 24 hours and are often heterogeneous in nature. The assessment of burn depth can be difficult and affects subsequent decisions regarding surgical management of the burn and choice of dressing but accurate assessment in the emergency setting is not a priority beyond recognising that full thickness injuries require referral for specialist treatment.

General measures for the burns patient include:

- Decompression: remove all rings, watches and jewellery and tight clothing. Check the circulation of the limbs with circumferential burns; if there are elevated compartmental pressures, escharotomy or fasciotomy may be needed (though rarely required in the emergency department).
- Foley catheter insertion is useful for monitoring of hourly urine output, detection of haemoglobinuria or myoglobinuria in major burns.
- Nasogastric tube should be inserted in burns patients > 20% TBSA for early enteral feeding.
- Pain relief and anxiolytics should be adequate: intravenous morphine is preferable to intramuscular injection
  - Adult: 1-4 mg intravenously every 2-4 hours
  - Children: 0.2mg/kg for the first dose and titrate the dose subsequently
- Immediate wound care: as a temporary measure wrap the wound in clean and dry/moist dressings. Continued cooling is not recommended after the first half hour. Avoid any antimicrobial cream / lotion as this may affect the assessment by the burns physician
- Other general measures include tetanus toxoid / immunoglobulin as required.

**Transferring patients to Burns facilities/units**

The timely transfer of a burns patient is a vital step in the management. There is a set of agreed criteria for the transfer of patients to specialised units that should be adhered to.

**Admission criteria for Specialised Hospital Burns Care Facilities (RHTSK, TMH, KWH, QEH)**

- Burns > 5% BSA
- Burns that involve and threaten functional / cosmetic impairment of the face, hands, feet, genitalia, perineum and major joints
- Full thickness burns
- Electrical / chemical burns
- Burns associated with inhalational injury
- Circumferential burns of limbs / chest
- Burns at the extremes of age (children and elderly)
- Burn injury in patients with pre-existing medical disorders which could complicate management, prolonged recovery, or affect mortality
- Any burns patient with concomitant trauma

**Referral criteria for Transfer to Burns Unit (PWH/QMH)**

- Burns > 20% BSA
- Burns associated with inhalational injury requiring ICU admission
- Burns which have major cosmetic and/or functional implications
- Burn injury in patients with SIGNIFICANT pre-existing medical disorders which could complicate management, prolonged, or affect mortality

The decision to transfer a patient can become more difficult when there are serious associated injuries. The treatment of these may require precedence over the treatment of the burn, e.g. an intra-abdominal injury, major long bone fracture, open chest injury or intracranial bleeding. A decision should be made jointly with a senior clinician in the referring hospital and a senior specialist in the burns unit. Once a decision has been made to transfer a patient to the burns unit it is essential that the patient has been properly stabilised before transfer particularly with regards to the airway. It is essential to include all available information about the nature of the injury as well as the physical findings and extent of the burns. In addition there should be a clear set of notes documenting resuscitation measures, drugs given and blood results.

Doctor-to-doctor contact is essential to ensure the safe transfer of the patient. This is particularly the case where a patient has been intubated in the referring hospital. It must be recognised that the communication should be a two-way process and the burns unit should inform the referring hospital of the outcome of treatment of the burns patient not only as a matter of professional courtesy but also from the point of view of continuing medical education.

**Management at the specialist units**

At the Burns facility/unit, the wound is assessed by the burns surgeon and should be re-assessed after it has been cleansed with either normal saline or antiseptics.
such as Betadine or Hibiscrub solution before the definitive dressings; loose skin/tissues should be trimmed and big blisters de-roofed. Clinical photos for documentation are taken on admission and regularly during the patient’s stay. Partial thickness burns tend to be exudative for the first 48 hours and the dressing regime reflects this:

- **Face** - paraffin oil for superficial/mid-dermal burns, whilst for deeper burns Bactigras (chlorhexidine-infiltrated tulle) and saline-soaked gauze secured with crepe bandage are used for the first 48 hours. An ophthalmological consultation is advisable. The hair is shaved if the scalp is involved for proper assessment and for toileting.
- **Perineum** - silver sulphadiazine (SSD) or variant
- **Trunk & limbs** - the ‘standard’ dressing is Bactigras saline-soaked gauze for the first 48 hours.
- **Hand** - for more superficial burns, the hand can be placed inside a sterile/clean plastic bag with either SSD or other antimicrobial such as mupirocin whilst for deeper burns the fingers are individually dressed and splinted in position of safety. Elevation is essential.
- **Foot** - elevation and ankle splint as necessary.

**Fluid Resuscitation**
Fluid is given to compensate for expected losses (redistribution from intravascular volume to tissue space as well as true excretory/exudative losses) and as a general rule, the threshold for IV fluid therapy for adults is a burn surface area > 15% whilst for children it is > 10%. In our unit, the Parklands formula is used as a guide.

First 24 hours
- **Adult** 2-4 ml Hartmann’s / % burn / kg
- **Children** 3-4 ml Hartmann’s / % burn / kg

Maintenance fluids are needed in children (but not adults):
- 100 ml per kg up to 10kg body weight
- 50 ml per kg from 10kg to 20kg
- 20 ml per kg for every kg over 20kg

One half of the estimated amount of the resuscitation part should be given in the first 8 hours, and the rest in the remaining sixteen hours whilst maintenance is given evenly throughout the 24 hours. The resuscitation period starts from the time of the burn and any deficit due to delay should be calculated and given along with the first two hours of fluid if practical.

Second 24 hours

a) **Adult** 0.5 ml albumin / % burn / kg
b) **Children** 0.5 ml albumin / % burn / kg

Half D5 / NS solution for maintenance

**Monitoring of resuscitation**
The adequacy of resuscitation needs to be continuously monitored by a combination of measures in order to be able to adjust treatment accordingly - the Parklands formula (or other formulas) is simply a guide, a starting point.

- **General condition of the patient**
- **Blood pressure, pulse rate, pulse oximetry, temperature**
- **Hourly urine output is the most important indicator**
  - **Adult** 0.5-1.0 ml/kg/hour
  - **Children** <30kg 1.0-1.5 ml/kg/hour
- **Modify IV rate if 2 consecutive hours too much or too little urine**

Myoglobinuria or haemoglobinuria requires IV mannitol (1gm/kg iv, 20% solution) and urinary alkalinisation with NaHCO3 to keep urine rate of 75-100 ml/hour and to maintain urinary pH>6.5 without the plasma pH exceeding 7.45. The urine pH should be monitored 4 hourly and acid-base balance / serum electrolytes 6-hourly. Invasive measures such as CVP or pulmonary artery wedge pressure can be used if indicated but are generally used in the intensive care setting:

**Dressing Guidelines for Minor and Moderate Burns**
The following should be adhered to when choosing the appropriate dressing for a burns patient:

1) Use the most appropriate dressing for the particular burn and ensure that the patient is not allergic to any dressing you use.
2) Use a dressing that both the patient and staff find acceptable and with which both will comply.
3) Use a dressing that is cost effective, i.e. do not use expensive dressings if the burn requires frequent dressing changes. Try to aim for a dressing that will need minimum change, i.e. 2-5 days (unless infected).
4) Consider changing the type of dressing as the burn character changes in particular exudates control.
5) Decrease the dressing bulk as soon as the wound will allow. This allows for greater freedom of movement as well as reducing the ‘sick role’ effect of bulky dressings on patients.

There are a large number of wound dressings available on the market today and new products will be developed. Existing products will be used in different ways and knowledge of burns and wound healing will continue to expand. Our dressing practices must remain open to change.

**Dressing guidelines when no surgery required or in the pre surgery stage**

**Superficial (and intermediate) partial thickness burns**

Superficial burns are often very painful and usually highly exudative in the initial stage. They also change characteristically rapidly, e.g. from being highly to minimally exudative. Intermediate burns can also be painful and exudative initially and may also go through stages of sloughing; some of these burns will require surgery.

The ‘Ideal dressing’ (which does not exist) will be a comfortable, moderately to highly absorptive dressing that will require minimal dressing changes as each
dressing change is painful. Dressings for deeper injuries should also help to debride the wound. Changing the type of dressing may be necessary, as the burn wound heals/progresses.

There are a wide variety of different dressings with little to choose between them in uncomplicated partial thickness burns:

- Alginates, foams, hydrogels
- Biological dressings such as porcine skin
- Silver based dressings such as Aquacel, Acticoat or other antimicrobials e.g. mupirocin to treat or prevent infection
- Bactigras and other tulle products with or without adjuncts e.g. sofrafatulle
- Hydrocolloids (not for when there is infection)
- Polyurethane films (when almost healed)

NB: silver sulphadiazine (SSD) cream should be avoided as an acute burns dressing particularly without a specialist assessment of the injury - SSD and other similar topical cream form an eschar which can hinder the accurate assessment of the depth of a burn.

**Deep Partial Thickness and Full Thickness Burns**

These burns will require surgical debridement and skin grafting to reestablish the surface layer. Dressings aim to keep the wound clean and free of infection and avoid excessive build up of slough (which prevents accurate wound depth assessment as well as increasing the risks of infection).

Common dressing choices include:

- Antimicrobials (preferably specific to any cultivated microbes)
- Hydrogels or hydrocolloids (for de-sloughing small burns only)

The Prince of Wales Hospital Burns unit is extremely active in its burns prevention programmes as well as in research. It works closely with the Hong Kong Burns Association (HKBA) formed in 2003 to help patients resume a normal productive life; in 2005 the unit together with the HKBA, setup a website (http://www.hkburns.org) that aims to educate the public to help reduce the number of incidents involving the more vulnerable patients at both ends of the age spectrum.

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<th>Table 1 Features of burns of various depths.</th>
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<td><strong>Descriptive</strong></td>
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Recent publications include:


Fig. 3. A schematic diagram of the structure of the skin demonstrating the various depths of burns.