Critical Care Guidelines

EMERGENCY MANAGEMENT OF SEVERE BURNS AND TRANSFER TO A SPECIALIST BURNS UNIT

Patients who receive a severe burn injury will require transfer to a specialised centre for treatment, St John's Hospital in Livingston and The Royal Infirmary in Glasgow receive such patients. Initial treating personnel should complete a primary assessment and evaluate the patient for referral and transfer.

When the burn victim is first seen rapid assessment and treatment can be life saving. It is important to get an accurate history of the burn to alert medical staff to co-existing injuries eg road traffic accident, blast or explosion, chemical spills, electrocution or a jump/fall to escape. When a patient has been contained in a building prior to extraction there is an increased risk of carbon monoxide and cyanide poisoning.

When the patient is received into your ED/ICU, and prior to transfer, the following Primary Survey and management should be carried out:

A Airway Maintenance & C Spine Control

- Check airway patency and consider early intubation/tracheostomy in facial/neck/airway burns.
- Give high flow oxygen and assume there will be some degree of carbon monoxide poisoning – do not wait for an arterial blood gas result. (Nb The cherry red discolouration of CO poisoning occurs primarily in deceased patients.)
- Suxamethonium is NOT contraindicated for fear of raised potassium at first presentation of a major burn.
- Keep C Spine movement to a minimum until cleared.
- DO NOT cut ET Tube; this allows for facial swelling.

B Breathing & Ventilation

- Remove all clothing and ensure adequate chest expansion.
- Consider lung protective ventilation for intubated patients.

C Circulation with haemorrhage control

Stop bleeding with direct pressure.

- Establish wide bore iv access through unburned skin – consider central iv or io access as alternatives.
- Commence fluid resuscitation (see below)
- Capillary blanche test over burnt area - more than 2-3 seconds may indicate need for escharotomy over that area (eg limb, thorax).

D Disability: Neurological Status

- Establish level of consciousness
- Examine and record GCS status

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E Exposure with environmental control

- Remove all clothing and jewellery
- Keep patient warm – actively re-warm if necessary and provide head cover.
- Consider cyanide toxicity in patients who present with grey skin discolouration + high lactate/anion gap.

F Fluid Resuscitation and further management

- IV access as above
- Consider arterial line and take bloods for FBC/U&E/LFT's/Coag/Amylase /Arterial Blood Gas including Carboxyhaemoglobin, Haematocrit and Lactate.
- give Hartmann's solution initially as per Parkland formula:- 3-4mls Hartmann's solution /kg/%burn
- area burned is estimated by using Rule of Nines and a burn body chart. (Do not include erythema)
- It is important to get an exact time of burn to calculate fluid to be given.
- Half of the calculated fluid to be given over first 8 hours, then the rest over next 16 hours, from time of injury. (It is now felt that the Parkland formula probably over-estimates the amount of fluid needed, but it acts as a starting point.)
- If haemorrhage is occurring then replace with blood +/- products. Consider giving 1g tranexamic acid to trauma patients.
- Ensure patient is catheterised and patient's SpO2, (EtCO2), ECG and BP are being monitored.
- Give cyanide antidote as per clinical suspicion/blood results:
  Cyanokit = 2x2.5g of Hydroxycobalamin iv **OR** Dicobalt edetate 300mg/20ml slowly iv. The antidotes work quickly (return of normal skin colour and falling lactate) and can be repeated if necessary.
- Insert NG tube if intubated/larger burn as gastroparesis is common.

Pain Relief/Sedation

- Ensure adequate pain relief with opiates.
- If patient ventilated ensure adequately sedated (+/-paralysed).

Wound Care

- Cover the burn wounds with plastic cling film to limit heat loss and evaporation. NB Do not apply any topical ointments as this makes accurate assessment difficult by the Burns Team. (Cling Film is not a dressing – it is a temporary cover and has no clinical benefit)
- If possible elevate burnt limbs.

Documentation & Transfer Check List

- Ensure all documentation and results including CT scans and xrays go with patient.
- Inform Burns Unit and ITU of transfer
- Ensure adequate amounts of oxygen, Hartmann's, sedation and pain relief for transfer.
- Keep the patient warm with blankets/head wrapped for transfer.
- Keep an accurate record of the patient's care during transfer.

BURNS OF THE HANDS

Remove jewellery including watches and bracelets.

Burns of the hands are best treated with the use of handbags. A polythene bag is generously coated with liquid paraffin or an antibacterial cream, eg flamazine and the hand placed in the bag. Apply swabs to the wrist to absorb exudate and secure with a bandage around the forearm. If the wrists are burned apply jelonet, vaseline gauze or mepitel before applying the swabs.
The hands are kept elevated, except when in active use, and frequent passive and active exercises are carried out. – this should be done daily by nurses as well as physiotherapists.
Although an unpleasant looking exudate collects in the bag, and any undamaged skin within the bag becomes macerated, the patients ability to use his/her hands is a great advantage in the preservation of active hand function. Encourage use of hands
Hand burns should be washed daily with soap and water, eg baby bath or saline and a new handbag applied. If a leak occurs the handbag can be renewed. This can be required frequently initially
Although silver liquid paraffin is commonly used in handbags, if necessary other wound products can be applied, eg flamazine/betadine.
DO NOT use flamazine initially as it masks appearance – stick to liquid paraffin until condition alters.

BURNS OF THE FACE

Facial burns are best left exposed. Infection in this vascular region is rare and the exudate quickly forms a crust if it is exposed to a warm, dry atmosphere. Full thickness burns of the face do not exude so copiously and also may be left exposed prior to skin replacement by a plastic surgeon. Facial cleaning/toileting should be performed 2 hourly initially then at least 4 hourly and as required with saline.
The exudate dries and together with destroyed dermis and protein exudate forms a scab of eschar. This scab theoretically protects the underlying tissues from contamination. Partial thickness burns treated properly by exposure will usually start to shed the coagulum after about 12 days, Revealing healed, but tender skin beneath.
Over Aggressive debridement should be avoided. Attempts to remove the coagulum/eschar before it is loose will damage the developing epithelium.
Topical creams can be applied if prescribed by a senior plastic surgeon. Supporters of this treatment believe that a moist wound interface is beneficial and will enhance wound healing.

BURNS OF THE EYES

The goal of treatment for burn injury to the eyes is to prevent further damage and complications. Damage to the eyes can involve the eyelid, conjunctiva and cornea as well as the deeper tissues. Singed eyelashes and eyebrows often indicate more extensive occular burn damage. The injury can be severe enough to cause significant infections, eyelid contractures, corneal ulceration and even permanent loss of vision.
The major cause of corneal damage is rapid contracture and ectropion formation. The incomplete closure of the lids causes drying out of the cornea and possible ulcer formation.
Caring for burns of the eyes involves thorough cleansing with saline 4 hourly and prn.
Instillation of lacrilube or application of geliperm will prevent drying of the cornea .
A topical ophthalmic antibiotic ointment, eg, chloramphenicol should be instilled if prescribed.
Consider an ophthalmic review.

BURNS OF THE EARS

Burn injury to the external ear is not an uncommon consequence of burns occurring on the face and neck. Because of its exposed anatomical position, poor vascularity and lack of subcutaneous tissue, burns of the ear are often deeper than other areas of the body.
The goal of treatment of burn injury to the ears is to minimise cartilage damage, ear deformity and loss of the ear.
Caring for the patient who has sustained burns of the ears involves thorough cleansing of the entire ear with soap and water, eg baby bath or normal saline, 4 hourly and prn. Cotton buds are helpful in getting into the small areas of the ear. This helps to remove products previously applied so that they do not cake onto the ear. Ensure exudates is removed from the ear canal – anything which leaks into this area can set hard like concrete
Then apply a generous amount of a topical antimicrobial agent, eg flamazine to the external meatus.
The eschar should not be debrided but allowed to separate spontaneously
Burns to the ears are best left exposed.

BURNS OF THE BUTTOCKS AND PERINEUM

In perineal burns, oedema formation of the genitals may cause obstruction of the urethra. A catheter should be inserted as soon as possible.
A conservative approach is necessary when debriding burns of the genitalia. The skin on these areas is very loose and wrinkled. Spontaneous healing of these wounds often occurs because tiny areas of epithelial tissue remain viable in skin folds despite deep injury.
Attention to cleanliness is necessary because of the risk of contamination and infection with faeces.
Treatment of perineal burns consists of local wound care, using an open technique if possible, ie exposure and the application of a topical antimicrobial, eg flamazine.
For burns to the buttocks a sacral pad – flamazine, jelonet and gamgee – can be applied. Change sacral pad as required ensuring that the area is washed before the new sacral pad is inserted. Flamazine impregnated jelonet can be applied to skin folds but must be washed off before a new application is applied as the old flamazine will build up on the skin. Position legs spread apart.
Wounds should be washed daily with soap and water, eg baby bath, after each bowel movement and prn. Perform regular catheter care prn to remove exudates/crusting.

NO INCONTINENCE PADS SHOULD BE PLACED ANYWHERE UNDER THE PATIENT – ONLY GAMGEE ROLLS, HALF OR QUARTER LENGTHS SHOULD BE USED AS AN EXTRA LAYER TO ABSORB ANY EXCESS EXUDATE. GAMGEE SHOULD NOT BE PLACED DIRECTLY ON TO THE BURN/WOUND AREA

CARE OF THE PATIENT WITH SKIN GRAFTS

Graft take can be affected by –

- surgical technique e.g if the recipient area is not excised deeply enough
- bleeding, the blood can push the graft off.
- Infection, exudates can push the graft off or cause cell lysis.
- Movement/shear, the graft can slide off, which is why the patient does not have physiotherapy to the grafted area.

DRESSING CHANGES

1st change of dressing depends on the surgeon's preference and will be documented in the post-operative instructions, either the 3rd, 5th or 7th day post-op.
Careful removal of the dressings is necessary: in case some of the graft edges lift off, and some fragile graft is removed with the dressings.
The healed graft should be washed daily with soap and water and gently dried.
Because the graft has lost its emollient properties, moisturise it twice daily with oily cream or E45.

CARE OF DONOR SITE

The donor area should heal within 14 days in the absence of infection. If the donor area has been shaved too deeply it will take longer. The healed donor area is treated in the same way as a healed graft. If strike through occurs the wet dressings should be replaced.

ASSESSMENT OF BURN DEPTH

Burns may be classified into two main groups.
- partial thickness
- full thickness

Partial Thickness

Partial thickness burns can be subdivided into those involving the epidermis and superficial layers of the dermis – superficial dermal – and those reaching down into the deeper layers of the dermis – deep dermal. In both cases spontaneous healing can occur from undamaged epidermal appendages – hair follicles, sweat and sebaceous glands – epithelium will regenerate and resurface the remaining dermis.

Superficial dermal

Superficial dermal burns blister exposing the pink coloured surface layers of the dermis which is sensitive to pain. There is considerable loss of protein rich tissue fluid from the wound, which when left to dry for 2 or 3 days will form an adherent scab. Spontaneous healing will occur within 10 to 14 days.

Deep dermal

Deep dermal burns also blister but the base is creamy – white and not as sensitive to pain as nerve endings have been damaged. Spontaneous healing may be delayed for 3 to 4 weeks and may scar. Large areas of deep dermal burn will benefit from excision and grafting to speed wound healing.

Full Thickness

Full thickness burns do not blister as there are no patent capillaries remaining in the bed and coagulation destroys the entire dermis together with all epidermal cells. The surface of the burn is initially grey- white and leathery and is painless. If allowed to dry a transparent brown eschar forms, revealing thrombosed vessels beneath. With very deep burns, damage can extend to muscle and bone. Only very small, deep burns will heal spontaneously. Excision and skin grafting is normally required.

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ADMISSION OF A PATIENT WITH SEVERE BURNS

Patients with burns require an accurate and rapid assessment, looking for life-threatening problems first.
It is very easy to be overwhelmed by the appearance of the wound. However the effects of respiratory burns and hypovolaemia are more likely to kill a patient in the first few hours rather than the burn itself.

The initial priorities are:-

1. **Check the airway and breathing – check the nostrils and mouth for soot.**
2. **Make a quick initial assessment of the burn.**
3. **Set up a reliable drip and start a fluid regimen.**
4. **Provide adequate analgesia.**
5. **Catheterise the bladder.**
6. **Obtain blood samples.**
7. **Obtain details of accident –**
   - **the nature of flammable substances or corrosive chemicals involved**
   - **most importantly the time of the accident should be established.**
8. **The patient's age and relevant pre-injury medical history should be recorded.**
9. **Measure/estimate the patient's weight and record it.**

Knowing the time of the accident, the weight of the patient and the percentage size of the burn, the doctor is now able to estimate the likely fluid requirement for the next few hours.

Where these priorities have been addressed, the clinician should make a complete examination of the burn wound and make his own assessment of burn extent and depth using a Lund and Browder chart which allows for variations in relative body surface areas according to age.

Assessing the depth of burn can be difficult. Try to distinguish between partial thickness and full thickness skin loss.

Assessment may be made on the presence or absence of blister formation, on the colour of the wound and the presence or absence of pain. However these are not necessarily definitive.

Blistering implies that fluid is formed through damage to capillaries. Absence of blistering suggests that the underlying capillaries have been thrombosed and that the damage is more severe.

In reality a burn wound is rarely entirely one depth and is normally a mixture of varying tissue destruction and can be described as mixed depth.

Particular attention should be paid to areas of full thickness burn that are circumferential around the chest, a limb or a finger. The inability of the damaged skin to stretch causes a tourniquet effect as the burn oedema develops. Escharotomy is advisable to release the tension not later than 3 hours post burn. With relief of the tension, the wound will gape open and some bleeding may occur.

In the first 48 hours the burn wound is in a dynamic state. A burn initially assessed as superficial may progress to a deeper wound. This is due to a combination of lethally injured cells, desiccation of surface cells, local ischaemia, bacterial growth and a lack of first aid at the time of injury.

NB. Do not apply any topical agents before the wound has been assessed by the plastic surgeon, eg after applying flamazine cream, the burn wound acquires a white appearance. This makes even a superficial burn look deep.

GENERAL BURN WOUND CARE

The aim of treatment of the first few days to reduce the risk of infection

Wound Inspection
After adequate sedation of the patient, the wound should be carefully inspected in a clean and warm atmosphere.
Using an aseptic technique-
- take bacteriology swabs from the wound surface. One swab wiped over a large surface area in a zigzag pattern while rotating the tip will yield the best results.
- Any loose skin and debris is gently removed and blisters emptied or debrided.
- Intact blisters may be left unless they are very large, painful or limiting joint movement.
- The area is cleansed with a mild detergent antiseptic ie betadine surgical scrub and saline 1:1 (then rinse with saline) or baby bath and water or normal saline.

Have the wounds photographed. Medical photography are open 0900-1700 (SJH) Monday – Friday.

The burn wound can be treated by these methods:-
- dressings
- exposure
- prompt excision and skin grafting

On admission it is often difficult to be certain of the depth of skin damage: treatment should therefore be conservative for the first 48 hours, then the wound reassessment.

DRESSINGS
By dressing the wound, contamination is minimised whilst providing an environment which will encourage epithelialisation. The choice of dressing depends on the size, site and depth of the burn Initially simple dressings are preferred, ie a traditional burn dressing – jelonet, mepitil or vaseline gauze, layers of gauze, gamgee and crepe bandages to hold the dressing in place and avoid slippage.
Jelonet, mepitil or vaseline gauze acts as a non-adherent layer in heavily exuding wounds. Jelonet has the advantages of being supplied in larger sizes and is more compliable and easier to apply than vaseline gauze. Several layers of cotton gauze (burns swabs) help to absorb the exudate. A thick layer of gamgee acts as a further barrier.
Bacterial colonisation of the wound cannot be prevented but frequent dressing changes will keep the number of organisms down, thus preventing invasive sepsis. An antimicrobial can be applied to inhibit bacterial colonisation but check with the plastic surgeon before applying any topical agent in the first 48 hours.

If infection does occur, the dressing should be changed daily as it is the physical cleaning of the wound which is important. In the absence of infection frequency of dressing changes will depend on the size, site, depth of burn and products used.
Strike-through is a problem because burns produce copious amounts of exudate. If visible strike-through occurs, the dressing becomes damp ad bacterial integrity is lost, therefore a prompt change of dressings or re-padding is desirable.

EXPOSURE
This is based on the principle that drying the burn inhibits bacterial growth. Exposure is more appropriate for partial thickness or mixed depth burns where a decision has been made to avoid early surgery..
The exudate dries, and, together with destroyed dermis and protein exudate, forms a scab or eschar. The scab theoretically protects the underlying tissues from contamination. This method depends on dryness and exposure to light at the burn surface, and is thus a precise form of treatment in which nothing touches the burn wound except air, it does not mean “doing nothing”. Partial thickness burns treated properly by exposure will usually start to shed the coagulum after about twelve days, revealing

healed, but tender skin beneath. Aggressive debridement should be avoided. Attempts to remove the coagulum/eschar before it is loose will damage the developing epithelium.
An eschar should develop within 2 to 3 days, beneath which the wound will start to heal. The eschar forms a close fitting cover consisting of protein exudate and dead desiccated burned tissue which is lifted off as the burn heals.
To encourage drying of the wound the patient should be nursed in a warm, dry atmosphere with free circulation of air.
Limbs are elevated and the wound washed with a topical antiseptic, eg betadine once or twice a day.
Measures must be taken to avoid contamination by implementing stringent barrier nursing techniques.

DEBRIDEMENT
Debridement is the removal of devitalised tissue and foreign matter from a wound to speed healing and prevent/reduce infection. Several methods can be used.

Surgically with a scalpel or scissors
Only qualified or experienced practitioners should perform surgical debridement because of the risk of an untrained person damaging viable tissue, eg blood vessels, tendons or nerves.
Autolytic debridement
Autolysis relies on the body to use its own enzymes to break down necrotic tissue by applying a product which provides a warm, moist and clean environment, eg hydrocolloids.
Hydrocolloids keep the wound surface bathed in exudate. When rehydrated, necrotic tissue softens and separates from viable tissue on the wound bed. However, hydrocolloids are suitable only for small burns and can take some time to debride.
Biosurgery
Larvae of the green-bottle fly secrete enzymes and inject necrotic tissue and bacteria while avoiding viable tissue. This results in rapid cleansing and sloughing of the wound. Other benefits can include a reduction in odour and prevention of infection.