NHS England

Guidelines for referral and management of adult burn patients

Northern Burn Care Network January 2026

Contents

Introduction

This guideline has been developed by the Northern Burn Care Network and is designed to give information on the appropriate assessment and management of burn patients alongside the referral criteria and process. Whilst Burns Services provide specialist multi-disciplinary care, there are many burns that can be managed by clinicians outside of the Burn Services.

Referral Criteria

Aim

To understand when a burn is complex or non-complex.

Complexity of a burn can be determined by a number of clinical issues:

Age

Extremities of age, <1 year old and >75 years old, **should be referred to the Burn Service** for assessment because:

- Elderly patients have less physiological reserve and have thinner skin, thus presenting the potential for deeper burns. These injuries are likely to become more complicated, as the elderly are more prone to pre-existing co-morbidities.
- Paediatric patients have immature immune systems thus increasing the risk of infection. Children under 5 also have thinner skin, thus presenting the potential to sustain deeper burns and have smaller airways and difficult vascular access.

Depth

Deeper burns may not heal spontaneously or may take longer to heal with the potential complications of infection, scarring and contracture.

Size

The greater the surface area of the body injured, the greater the mortality rate.

Pre-existing Conditions

A number of pre-existing conditions can influence the outcome of a burn injury, for example, patients with renal or liver disease or metastatic cancer have a higher mortality and morbidity risk, patients with diabetes generally sustain deeper wounds and are more at risk of infection and pregnancy can inhibit a woman's ability to respond to the injury and the safety to the woman and foetus can be compromised.

Site

The following significant injury sites must be referred to a Burn Service because:

Facial/Neck

Facial/neck burns are often associated with significant swelling which can compromise the patient's airway. Post-acute facial burns also have the potential for aesthetic and functional complications.

Hands

Extensive burns to the hands have the potential to lead to functional complications and impairments depending on the depth of the injury.

Perineum/genitalia

Perineum/genitalia burns are more prone to infection and are difficult to manage in the community.

Feet

Burns to the feet have a high complication rate of delayed healing, infection and hypertrophic scarring and therefore require more aggressive acute management.

Flexure Creases

Flexure creases have increased potential for functional complications. Areas such as the axillae, groins, antecubital fossa and behind the knee are more at risk of developing scar contractures.

Circumferential Burns

Circumferential burns have the potential for respiratory or circulatory compromise depending on the site of the burn.

Mechanism of Injury

Burns sustained from the following mechanisms of injury should be referred to the Burn Service:

Chemical

Chemical burns are predominantly deep injuries due to the progressively destructive nature of the chemical's penetration into tissues. Chemicals with systemic effects comprise:

Hydrofluoric Acid

Hydrofluoric acid causes the systemic effect of hypocalcaemia as a result of fluoride ions depleting the body's calcium reserves. Burns >2% body surface area can be fatal.

Phenol

Phenol burns lead to rapid systemic absorption which is directly proportional to the

surface area of exposure which can cause liver and kidney damage.

Petrol (Immersion)

The complex hydrocarbon properties of petrol cause injury to the lungs, liver, spleen and kidneys. There is also the possibility of increased fluid loss due to an increase in cell membrane permeability.

Electrical

Low voltage injuries from domestic electrical supply, often cause small full thickness injuries to hands and underlying damage to structures e.g. nerves, tendons, are not always visible. High tension electrical injury can cause extensive tissue and muscle damage.

Inhalation

Inhalation injuries can cause injury to various parts of the respiratory tract and can increase the likelihood of mortality in all burns.

Steam

High pressure steam injury has the potential to cause pulmonary injury as steam has a heat carrying capacity 4000 times higher than hot dry air.

Non-Accidental Injury

Detecting and managing non-accidental injury is crucial as repeated abuse is associated with significant morbidity and mortality.

Patients Who Require Immediate Referral to A Burns Service

The suggested minimum threshold for referral into specialised burn care services can be summarised as:

- All burns ≥3% in adults
- All full thickness burns
- All circumferential burns
- Any burn not healed in 2 weeks
- Any burn with suspicion of non-accidental injury should be referred to a Burn Unit/Centre for expert assessment within 24 hours

Patients Who Require Discussion with A Burns Service

In addition, the following factors should prompt a discussion with a consultant in a specialised burn care service and consideration given to referral:

- All burns to hands, feet, face, perineum or genitalia. Only extensive hand burns (full palm or full dorsum, deep burns) will be admitted.
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- Any chemical, electrical or friction burn
- Any cold injury
- Any concerns regarding burn injuries and co-morbidities that may affect treatment or healing of the burn

- If the above criteria/threshold is not met, then continue with local care and dressings as required
- If burn wound changes in appearance / signs of infection or there are concerns regarding healing, then discuss with a specialised burn service
- If there is any suspicion of Toxic shock syndrome (TSS) then refer early

Many non-complex burn injuries can be safely managed outside of specialist burn services. However, some may need support for specific treatment factors or post-acute complications.

Dressings

Even on minor burn injuries dressings can be complex if on difficult to dress areas. Dressings may be large and/or time consuming. Patients can be referred if these factors inhibit their burn management.

Physiotherapy

Individuals with minor burns over joints should be referred for physiotherapy for

assessment. Patients with any other restrictions to normal movement can also be referred to Physiotherapy.

Occupational Therapy

Patients unable to achieve a good functional position or with significant oedema should be referred for assessment regarding splinting.

Psychology

Psychological distress can be experienced regardless of burn size, site and mechanism of injury. Patients can be referred for psychological support.

Pain Management

Pain experience is highly subjective and not exclusive to complex injuries alone. Minor burns have the potential to be extremely painful. Therefore, patients with minor injuries can be referred for pain management.

Social factors

Ability to carry out basic needs (washing, cooking, and toileting) may be compromised due to burn injury. For example, minor burns affecting both hands and feet can limit self-care and/or mobility. Inability to self-care may indicate need for referral.

How to Refer

The previous section has given you an understanding of complex, non-complex and complex non-burns.

For the majority of Specialised Burns Services in the Northern Burn Care Network, Referrals should be made using the MDSAS system and also calling the doctor on call for burns: http://referrals.mdsas.nhs.uk/. (Wythenshawe Hospital, Royal Preston Hospital, Mid Yorks Hospital, Northern General Hospital)

Patient Pass is used at Whiston Hospital - Patient Pass, communication, care and clarity
Connect NENC is used at James Cook Hospital, and Royal Victoria Hospital - Www.nenc-connect.nhs.uk

Accessing the Referral website Users can only access the website on a computer that is connected to the NHS N3 network. Open your web browser on the computer and enter the following URL address: http://referrals.mdsas.nhs.uk	 (We recommend Chrome, although Internet Explorer 8.0 or newer is supported)
MDSAS Homepage The Referral System is utilized by a growing number of different clinical specialties. The process to refer to different specialties will be similar. To make a Burns referral, click on the **Burn Referrals** button.	
Burns Homepage You can also access this page directly by entering: https://www.mdsas.nhs.uk/burns/ To create a referral, click on **New Referral** on the left side of the screen. There is no need to register.	
Introduction Please select the Burns Service that you require from the list.	
Your (Referrer's) Details Enter information about yourself and select your location from the list, or enter into the box. Please use a NHS email address. You must telephone the service to confirm that your patient requires Burns specialist advice. This also lets the Burns Service know that an online referral will be arriving. Alternatively, you should call the burn service immediately after submitting the referral.	 Red asterisks * signify that this information is required and you will not be allowed to proceed without filling in this field

To make a burns referral, click on Burn Referrals button. To create a new referral, click on the New Referrals button. Select the burns service you require from the list e.g. Manchester Adults. Enter your details and location and complete the patient details.

You must telephone the Burns Service to let them know there is a referral waiting. (Appendix 5 gives the services and their contact numbers)

If the closest Specialised Burns Service does not have a bed, then you should call the **National Burn Bed Bureau (NBBB) on 01384 679036**. The National Burns Bed Bureau (NBBB) is a nationally available resource to aid and support specialised burns services and professionals to identify burns bed capacity and capability in England and Wales. It is their role to find an appropriate bed for you at the level required by the complexity of the patient. This will save you time ringing around burns services. Once they have found you a bed it is your responsibility to contact that service and arrange transfer as usual.

First Aid

(See Appendix 1 for care plan)

Aim

- Stop the burning process.
- Cool the burn wound.

Stop the burning process

There is much discussion around cooling of the burn wound. The burn wound should be cooled with running cool/tepid water for at least 20 minutes. This is said to decrease pain from damaged nerve endings, decrease immediate cell death due to hot temperatures, decrease the inflammatory response, prevent vasoconstriction and decrease or prevent oedema formation. The suggested temperature is 15 ^{0}C to prevent possible hypothermia and ice should never be used as this will promote vasoconstriction and potentially deepen the burn. Chemical burns should always be irrigated with copious amounts of water for 1-2 hours or more.

Even if there is a delay in applying appropriate first aid, then application of water even up to 3 hours post injury will have a beneficial effect on re-epithelialisation and scar tissue production.
Diphoterine is available in some areas, Diphoterine solution contains an amphoteric, chelating molecule: a substance which is capable of reacting with both acids and alkalis when applied to either type of chemical spill, stopping the aggressive action of a corrosive or irritant chemical, halting the reaction with the body.

Covering the burn

Once the wound is cooled then it should be wrapped in a clean covering. Cling film (Plasticised Polyvinyl Chloride) is the covering of choice as it excludes air and bacteria and will help alleviate pain. It also allows the wound to be viewed for assessment without having to remove it does not shed fibres into the wound and is easily removed without causing further trauma. It is important to lay the film on the patient not wrap the area as swelling may lead to constriction, in addition to not use for facial burns. Hand burns can be covered with a clear plastic bag so not to restrict mobility. Remember to keep the patient warm during transfer to hospital. Generally, Burn Services prefer any form of topical antimicrobial cream to the wound prior to transfer as this can mask the depth of the burn, but check with your local service.

The British Burn Association (BBA) have published a Position Statement on First Aid (BBA 2014).

Mechanism of Injury

Aim

An understanding of how a burn injury has been sustained can give important clues as to the potential severity/complexity of the injury. A burn injury can be from thermal, radiation, chemical or electrical sources:

Thermal injuries

Thermal injuries occur when skin is exposed to temperature extremes. These injuries can be Hypothermic or Hyperthermic.

Hypothermic Thermal Injuries

Examples of hypothermic injuries include frostbite and cryogenic aerosol burns.

Frostbite

Frostbite occurs by the formation of ice crystals in the intracellular and extracellular space which precludes an osmotic process that can ultimately lead to cell death. Severity of frostbite is related to duration of exposure and to the temperature gradient of the skin surface.

Cryogenic Aerosol Burns

The use of aerosols to self- harm is an emerging phenomenon. Aerosol sprays contain a chemical and propellant stored in a liquid form under pressure. Such substances have an evaporation point at sub-zero temperatures which can cause a hypothermal injury similar to frostbite. They are usually deep injuries due to:

- Analgesic effect of cooling allows for a longer exposure time than that of high temperature thermal agents.
- The particular cohort of patients with this injury is unlikely to administer first aid.
- Possible poor concordance with treatment.

Hyperthermic Thermal Injuries

Hyperthermic injuries comprise, contact, flame, flash and scalds.

Contact

- Sources include radiators, fire surrounds, irons, hair straighteners, motorbike exhaust pipes.
- Depth of tissue damage is dependent upon the temperature of the injuring agent and the amount of time the individual is in contact with it.
- Can cause full thickness injury in those unable to remove themselves from the heat source i.e. those who have lost consciousness, those who are incapacitated through drugs and/or alcohol or disability and those at either end of the age spectrum, the very young and the very old.

Flame

- Common form of burn injury from various sources i.e. house fire, candles, lighters.
- High association with self-inflicted injury.
- Tend to cause deep dermal or full thickness injuries especially if clothing catches fire.
- Associated with inhalation injury in enclosed spaces.

Flash (Flame)

- Often caused by ignition of a volatile substance i.e. putting petrol onto a bonfire/BBQ.
- Commonly results in superficial injury to face, neck, hands or other exposed areas.
- Common cause of ocular injury.

Scald

- Common form of burn injury from various sources i.e. bath water, kettles, hot drinks and hot fat.
- Commonly cause superficial to superficial dermal injuries but can deepen without appropriate first aid and treatment.
- Hot fat scalds are becoming more prevalent and typically cause injury at the deeper end of the tissue spectrum.

Radiation Injuries

Sunburn/ Sun beds

- Injury to the skin from over exposure to ultraviolet rays.
- Erythema and inflammation are typical responses to overexposure however deeper burns can result from prolonged exposure.
- Characterised by erythema, pain, tenderness, swelling, itching and blisters.

Chemical Injuries

Chemical injuries are those which can be acidic or alkaline in origin. The extent of tissue damage caused by these injuries is dependent on the strength/concentration of the agent, the quantity, length of contact with the skin and the agent's mechanism of action. Acids cause coagulative necrosis, so the wound appear dry and discoloured or necrotic and alkali's cause liquefactive necrosis, so the wound appears wet and sloughy.

These are complex injuries and should be referred directly to the burn service.

While there is residual chemical on the skin, burning continues. Therefore, contaminated clothing should be removed, and the burn washed with tepid water for a long time with close monitoring of body temperature to prevent hypothermia.

Chemical burns to the eye require continuous flushing with water. Swelling of the eyelids and eyelid muscle spasm due to pain may make adequate washing difficult. Careful retraction of the eyelids will facilitate correct irrigation. An early ophthalmological opinion is necessary in these cases.

There are very few antidotes for chemical burns, but it is worth checking with Toxbase on tel:03448920111. Or at https://www.toxbase.org/

For Hydrofluoric Acid only, Calcium Gluconate Gel can be added topically.

Electrical injuries

Electrical injuries can be low voltage, high voltage or flash. Any electrical injury results from heat generation which leads to a thermal burn. Tissue damage is dependent on the resistance of the tissue, the type and duration of contact and the concentration of the current. Again, these are complex injuries and should be referred directly to the burn service.

Flash (Electrical)

- Can occur with high tension discharge.
- The current does not pass through the individual.
- Results in cutaneous tissue damage. Not usually deep unless clothing catches fire.

Emergency Assessment and Management of Severe Burns

Aim

Immediate life-threatening conditions are identified and emergency management commenced.

Primary Survey

Airway

The main threat to upper airway is the development of laryngeal oedema following direct thermal injury caused by the inhalation of flame, hot gases or steam. Occasionally aspiration of hot liquids during scalding of the face produces similar damage. One must consider the need for intubation whenever there are facial burns. In general, the more severe the thermal injury the earlier the laryngeal obstruction will occur. It may happen without warning.

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.

There is always risk of associated injury, so consider the potential for cervical spine injury and manage accordingly.

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.

Mechanical restriction of breathing: Deep dermal or full thickness circumferential burns of the chest can limit chest excursion and prevent adequate ventilation. This may necessitate escharotomies.

Blast injury: If there has been an explosion, blast lung can complicate ventilation. Penetrating injuries can cause tension pneumothoraxes, 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 bronchorrhea. 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.

Circulation

Any obvious haemorrhage should be controlled by simple means such as direct pressure. Peripheral circulation must be checked, by measuring and recording the pulse, and blood pressure and checking the speed of capillary refill in all four limbs (normal <2 seconds). If the circulation is inadequate, 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. 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.

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

Disability

The neurological status of the patient should be assessed quickly. The level of consciousness should be recorded according to the Glasgow Coma Scale. The sizes of the pupils should be compared and their reaction to light noted. If there is any suspicion of a major neurological dysfunction (e.g. head injury), treatment for this takes priority.

Exposure

Remove all clothing and jewellery but keep the patient warm. Hypothermia can have detrimental effects on the patient. It is important to ensure that the patient is kept warm, especially during first aid cooling periods. Log roll patient, remove wet sheets and examine posterior surfaces for burns and other injuries. Estimate total body surface area (TBSA) burn size using Rule of Nines or Paediatric Rule of Nines. For smaller burns the palmar surface of the patient's hand (including fingers) represents 1% TBSA and can be used to calculate the %TBSA burnt.

Fluid Resuscitation

Aim

To replace circulating volume of fluid lost through the burn.

The greatest amount of fluid loss in burn patients is in the first 24 hours after injury. For the first eight to 12 hours, there is a general shift of fluid from the intravascular to interstitial fluid compartments. This means that any fluid given during this time will rapidly leave the intravascular compartment. There is no ideal resuscitation regimen, and many are in use. All the fluid formulas are only guidelines, and their success relies on adjusting the amount of resuscitation fluid against monitored physiological parameters.

The main aim of resuscitation is to maintain tissue perfusion to the zone of stasis and so prevent the burn deepening. This is not easy, as too little fluid will cause hypoperfusion whereas too much will lead to oedema that will cause tissue hypoxia. Colloids have no advantage over crystalloids in maintaining circulatory volume in the first 8 hours. Fast fluid boluses probably have little benefit and may be detrimental, as a rapid rise in intravascular hydrostatic pressure will just drive more fluid out of the circulation.

Burns covering more than 15% of total body surface area in adults warrant formal resuscitation. Again, these are guidelines, and experienced staff can exercise some discretion either way. The formula is the Parkland formula, a pure crystalloid formula. It has the advantage of being easy to calculate and the rate is titrated against urine output. This calculates the amount of fluid required in the first 24 hours. The starting point for resuscitation is the time of injury, not the time of admission. Any fluid already given should be deducted from the calculated requirement.

Modified Parkland Formula
Total fluid requirement in 24 hours = 3 ml x (total burn surface area ((%) x (body weight (kg)) 50% given in first 8 hours 50% given in next 16 hours

Worked Example of Fluid Resuscitation - Adult

Fluid resuscitation regimen for an adult
A 25-year-old man weighing 70 kg with a 30% flame burn was admitted at 4 pm. His burn occurred at 3 pm. **1) Total fluid requirement for first 24 hours** 3 ml x (30% total burn surface area) x (70 kg) = 6300 ml in 24 hours **2) Half to be given in first 8 hours, half over the next 16 hours** Will receive 3150 ml for 0-8 hours and 3150 ml for 8-24 hours **3) Subtract any fluid already received from amount required for first 8 hours** Has already received 1000 ml from emergency services, and so needs further 2150 ml in first 8 hours after injury **4) Calculate hourly infusion rate for first 8 hours** Divide amount of fluid calculated in (3) by time left until it is 8 hours after burn Burn occurred at 3 pm, so 8-hour point is 11 pm. It is now 4 pm, so need 2150 ml over next 7 hours: 2150/7 = 307 ml/hour from 4 pm to 11 pm **5) Calculate hourly infusion rate for next 16 hours** Divide figure in (2) by 16 to give fluid infusion rate Needs 3150 ml over 16 hours: 3150/16 = 197 ml/hour from 11 pm to 3 pm next day

Urine Output
The infusion rate is guided by the urine output, not by formula. The urine output should be maintained at a rate 1ml / kg / hr

High-tension electrical injuries require substantially more fluid (up to 9 ml x (burn area) x (body weight) in the first 24 hours) and a higher urine output (1.5-2 ml/kg/hour). Inhalational injuries also require more fluid. The following may also need higher fluid amounts:

- When haemochromogenuria (dark red/black urine) is evident. Haemochromogenuria occurs when the person has endured thermal damage to muscle e.g. electrical injury. For haemochromogenuria aim for a urine output of 2ml/kg/hr.
- After delayed resuscitation.
- If there is fluid loss prior to burn e.g. fire fighter, diuretics, alcohol etc.

Hartmann's solution is the international standard for fluid resuscitation. The above regimens are merely guidelines to the probable amount of fluid required. This should be continuously adjusted according to urine output and other physiological parameters (pulse, blood pressure, and respiratory rate). Investigations at intervals of four to six hours are mandatory for monitoring a patient's resuscitation status. These include packed cell volume, plasma sodium, base excess, and lactate.

Secondary Survey

Aim

To gain an understanding of the history and mechanism of the injury and assess for other injuries.

Perform a comprehensive secondary survey.

History

A – Allergies
M – Medications
P – Past illnesses
L – Last meal
E – Events or Environment related to injury

Mechanism of injury

Gather information from the patient or others about the following:

• Date and time of burn injury, date and time of first presentation.
• Source of injury and length of contact time.
• Clothing worn.
• Activities at time of burn injury.
• Adequacy of first aid.
Head to toe assessment – re-assess A, B, C, D, E, and F.

Pain relief

Give morphine (or other appropriate analgesia) slowly, intravenously and in small increments according to pain score and sedation scale (see pain chapter).

Record and Document

Circumferential burns: if the patient has a circumferential deep dermal to full thickness burn it may impede circulation and/or ventilation (if burn around chest).
• Contact the Burns Surgical Trainee at the Burns Service.
• Elevate the affected limb above the heart line.
• Start a circulation chart and monitor capillary refill in affected limb hourly.
• Escharotomy may be necessary to relieve pressure if circulation is compromised.

Psychosocial care

• Document next of kin and telephone number.
• Inform and provide support to family.
• Obtain relevant psychosocial information during assessment and document.

Re-evaluate

• Give tetanus prophylaxis if required.
• Note urine colour for haemochromogenuria.
• Laboratory investigations:
− Haemoglobin/haematocrit
− Urea/creatinine
− Electrolytes
− Urine microscopy
− Arterial blood gases, carboxyhaemoglobin

History and Documentation

History Taking

The history of a burn injury can give valuable information about the nature and extent of the burn, the likelihood of any complications/complexities, and probability of other injuries. The exact mechanism of injury and any initial treatment must be established, along with a medical history which outlines any previous medical problems, medications, allergies, vaccinations and social circumstances.

Note: taking a medical history should not be subject to any delay as these variables are crucial to any subsequent diagnosis and treatment.

Factors to be considered

- Cause of the injury (Consider Non-Accidental Injury (NAI))
- Type
- Depth
- Location
- Any first aid carried out at the time of injury, with what and for how long
- Patient's general condition
- Medical/mental health issues
- Social considerations
- If hands are involved, ascertain which is the patient's dominant hand and whether this will mean the patient is unable to carry out Activities of Daily Living (ADL) for themselves

Non-Accidental Injury (NAI).

Suspect NAI where thermal injuries are in locations you would not expect to come into contact with a hot object:

- Soles of the feet
- Buttocks/back
- Backs of hands

Shape of the burn/scald

- Suspect NAI where an injury is in the shape of a conceivable implement such as a cigarette or iron
- Scalds with sharply delineated borders should arouse suspicion (consider immersion injury)

If there is any suspicion of NAI must be referred to the Burn Service immediately for assessment and referred locally to safeguarding.

Importance of Accurate Medical Documentation

The importance of effective documentation cannot be stressed enough especially in our current world of litigation and questionable motives behind actions. Accurate documentation is required to record pertinent facts, findings, and observations about an individual's health history including the past and present illnesses, examinations, tests, treatments, and outcome. The medical record chronologically documents the care of the patient and is an important element contributing to high quality care. Documentation is extremely important as without its facts can be forgotten, misinterpreted or even omitted entirely.

Documentation of Burn Wounds:

The documentation of burn wound status and progress should inform action:

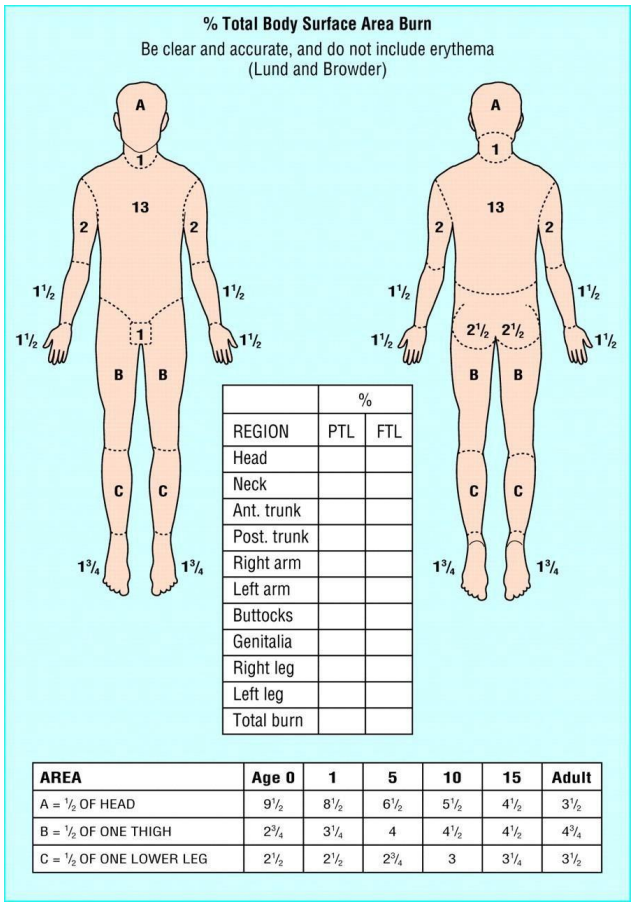
- Use burns wound assessment/evaluation chart to document wound status and progress.
- This should be available to all health care professionals involved in the management of the patient so that they are fully informed as to treatment plans and histories.
- Treatment objectives should be evident on the plan of care and evidence of ongoing reassessment documented.
- Changes to planned wound care should be documented including rationale for any change.

Assessment of Burn Injury – Total Body Surface Area (TBSA)

Aim

Burn size is classified in terms of the percentage of Total Body Surface Area (TBSA) burned. It is essential to establish an accurate TBSA percentage which can be measured using the following methods:

Lund and Browder chart



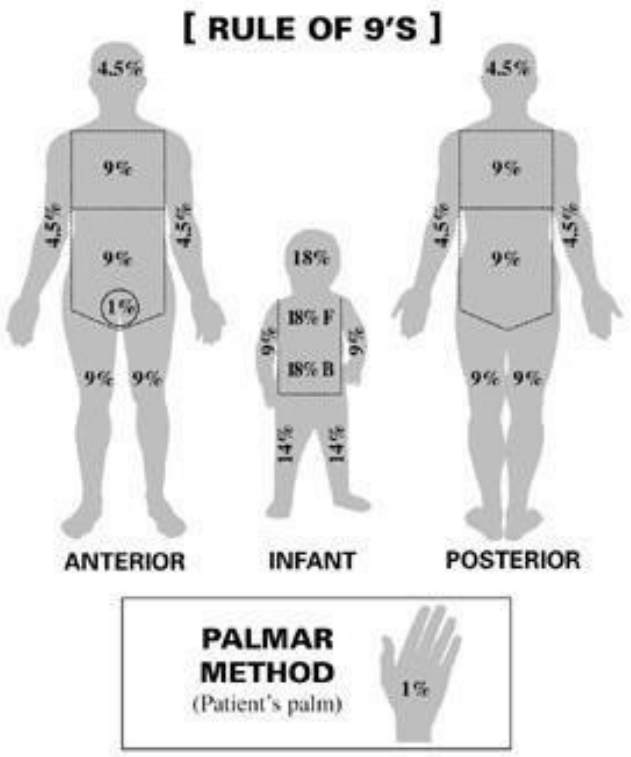
	%	
REGION	PTL	FTL
Head		
Neck		
Ant. trunk		
Post. trunk		
Right arm		
Left arm		
Buttocks		
Genitalia		
Right leg		
Left leg		
Total burn		

AREA	Age 0	1	5	10	15	Adult
A = ½ OF HEAD	9½	8½	6½	5½	4½	3½
B = ½ OF ONE THIGH	2¾	3¼	4	4½	4½	4¾
C = ½ OF ONE LOWER LEG	2½	2½	2¾	3	3¼	3½

- Body chart broken down in percentages according to age and TBSA.
- Suitable for both adults and children as the chart allows for the differing body surface area proportions of children.
- Produces the most accurate measurement of TBSA in children.

Rule of Nines

- This chart breaks the body down into percentages of nine.
- It is taught on the Emergency Management of Severe Burns (EMSB) course and can be used as an assessment method for adults, usually prehospital.



Palmar Surface Method

- Palmar surface of patients own hand, (closed fingers and palm).
- Suitable for small and/or patchy burns and accurate up to approximately 7%.
- Equates to 1% of TBSA.
- Burns of less than 1% TBSA, can be measured in cm_2.

When calculating TBSA ignore simple erythema

Assessment Of Burn Injury - Burn Wound Depth

Aim

To determine the depth of the burn wound

Burn wounds are traumatic thermal, chemical or electrical injuries that are defined in terms of severity and complexity by mechanism of injury, size, depth and involved anatomical structures. Appropriate management of any burn injury is dependent upon accurate assessment of the above variables. Assessment can be somewhat complicated by the 'burn wound conversion' phenomenon, in that the depth of tissue damage may either improve or extend quite significantly within the first few days.

Health care professionals can positively influence this outcome by adhering to principles of wound debridement, moist wound healing and infection control, plus by arranging for follow-up review within 48-72 hours. This will aid management goals which are to restore optimum physical, functional, psychological and sensory potential. A crucial component of this process is to facilitate timely wound healing. Timely wound healing will lessen the possibility of complications such as infection, contracture and abnormal scarring and will require the consideration of excision and grafting for deep dermal and full thickness burns, and consideration of the 'Burn Wound Conversion' phenomenon.

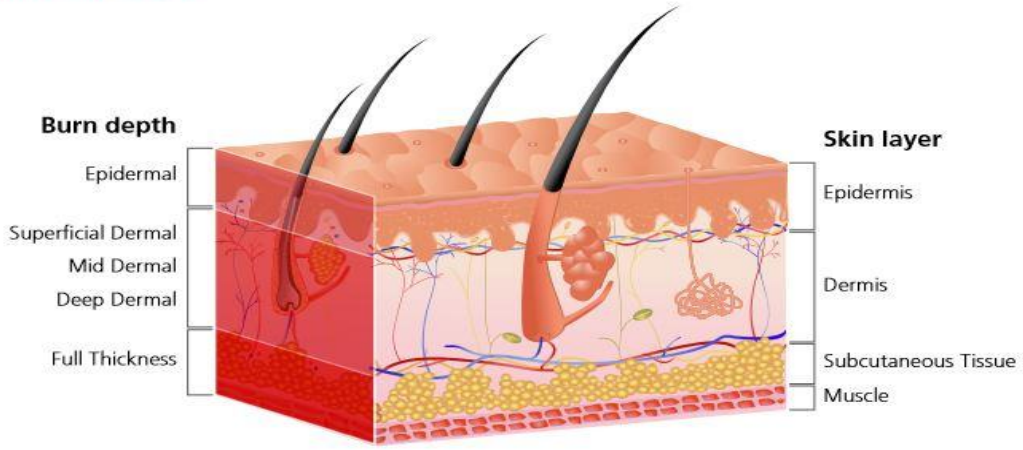
The pathophysiology of burn injury is dynamic and changing. Burns have the potential to convert to deeper injuries depending upon how badly the vasculature within the injury is compromised. Dead tissue/vessels in full thickness injury cannot be salvaged however compromised tissue/vessels in superficial dermal, and some deep dermal injuries are potentially salvageable with appropriate management. This includes use of the most appropriate dressings that will provide a clean, moist environment to allow adequate tissue perfusion and preventing the potential for infection.

Burns may be classified as either superficial or deep. Classification is dependent on depth of tissue damage. The depth of a burn is proportional to the amount of heat applied and the duration of application. Influencing factors include mechanism of injury, age and existing co-morbidities. The depth of injured tissue is classified as follows:

- Erythema
- Epidermal/Superficial
- Superficial Dermal
- Deep Dermal
- Full Thickness.

Note: The terms 1st, 2nd and 3rd degree are often used in the media and some other countries to describe burn depth. However, these terms offer no description of tissue injury and therefore can be misleading.

Burn skin depth



There are visual and sensory indicators of tissue injury that can give clues as to depth and will aid assessment:

Indicator of Tissue Depth	Indication	Rationale
Colour	Patency of blood vessels within the injury site	An even pink colour indicates good vessel patency and thus a less deep burn, while a fixed red/mottled staining or pale white colour can indicate vessel destruction and thus, a deeper burn
Capillary Refill Time	Testing Capillary refill time can indicate the efficiency of blood flow through the skin	The spectrum of brisk refill to no refill indicates superficial to full thickness tissue damage respectively
Pain level at burn site	Depth of tissue damage	Pain receptors lie in the epidermal to mid dermal layers of the skin. The deeper the burn, the greater the extent of damage to these receptors with a corresponding reduction of pain at the burn site.
Sensation level at burn site	Depth of tissue damage	Nerve endings lie in the epidermal and mid dermal layers of the skin. The deeper the burn the less feeling at the burn site
Presence/absence of hair/hair follicles at burn site	Depth of tissue damage	Hair follicles lie in the mid to deep dermis. The absence of hair (or if they pull out easily) denotes deeper tissue injury damage
Presence/ absence of blisters at burn site	Depth of tissue damage	Blisters can be present in all depths apart from erythema

Incorporating these indicators into your clinical assessment of the wound, (as well as taking a full medical history and mechanism of injury), will aid depth assessment. Performing a holistic assessment is the key to establishing an accurate depth of tissue injury.

Superficial/Epidermal

- Injury only to the epidermis.
- Characterised by red (unbroken) skin with mild oedema.
- Brisk capillary refill.
- Often very painful.
- Careful assessment of skin viability is necessary as skin may look intact but may not be viable.
- Push firmly upwards on affected area to assess whether skin is intact.
- Skin may also blister at a later date thus dressing the area and review in 48 hours is advisable.

Superficial Dermal/Partial Thickness

Mid Dermal

- Injury to the epidermis and the upper portion of the dermis.
- Characterised by uniform pink colour to wound bed.
- Brisk capillary refill.
- Painful.
- Blisters often present.
- Heal spontaneously within 7 days.

- Injury to the epidermis extending to the upper and middle portion of the dermis.
- Characterised by pink colour but may have some white mottling.
- Less brisk capillary refill.
- Painful.
- Blisters often present.
- Under suitable conditions (keeping the injury warm, moist and free from infection) the wound will heal outwards from the adnexal structures (hair follicles, sebaceous glands and sweat glands).
- Should heal spontaneously within10 - 14 days.

Deep Dermal/ Partial Thickness

- Injury to the epidermis and lower portion of the dermis.
- Characterised by a fixed red capillary staining and/or pale white mottling.
- Sluggish capillary refill.
- Reduced pain and sensitivity.
- Blisters may sometimes be present.
- Ability to heal spontaneously often depends on the number of adnexal structures remaining. In some cases, a deep dermal wound will heal spontaneously if the wound environment is optimised by being kept warm, moist and infection free. This may be after a prolonged period with the possibility of significant contracture and scarring.

Full Thickness

- Injury to epidermis and all of dermis. May extend beyond dermis into subcutaneous layer, muscle and bone.
- Characterised by white to charred colour.
- Do not blanch (no capillary refill).
- Dry leathery appearance.
- Insensate (but may be painful around edges).
- Does not bleed on pinprick.
- Absence of blisters in most cases (but may be some blistering).
- No regenerative elements remain in full thickness burn injury. Epithelialisation from the wound cannot occur. Wound can heal from the edges, but prolonged length of time associated with significant contracture and scarring.

It is important to note that burns are rarely uniform in depth therefore there may be a range of different depths in any particular burn.

Emergency Surgery - Escharotomies

Aim

Understand how to monitor for need of escharotomies.

Escharotomy

An escharotomy should be performed as soon as it becomes apparent that the distal circulation might become impaired. If surgery is delayed too long, permanent ischaemic damage to the tissues, especially the muscles, will occur. However, escharotomies are best done in an operating theatre by experienced staff. They should be discussed with the Manchester Burns Centre and performed under instruction only when transfer is delayed by several hours. Initially, at risk limbs should be elevated and observed.

A circumferential deep dermal or full thickness burn is inelastic and, on an extremity, will not stretch. Fluid resuscitation leads to the development of burn wound oedema and swelling of the tissue beneath this inelastic burnt tissue. Tissue pressures rise and can impair peripheral circulation. Circumferential chest burns can also cause problems by limiting chest excursion and impairing ventilation. Both of these situations require escharotomy, division of the burn eschar. Only the burnt tissue is divided, not any underlying fascia, differentiating this procedure from a fasciotomy.

The signs and symptoms of impending circulatory obstruction are:

- Deep pain at rest
- Pain on passive movement of distal joints
- Pallor
- Loss of capillary return (especially in the nail beds)
- Coolness
- Decrease in pulse pressure as detected by Doppler ultrasound

Loss of palpable pulses

- Numbness

Decreased oxygen saturation as detected by pulse

The interpretation of these signs may be made difficult by the presence of burned skin (which makes feeling the pulses difficult), by cold (which gives the appearance of decreased capillary return) and by hypovolaemia. The most accurate method of assessment is the use of Doppler ultrasound. The earliest changes will be loss of

Doppler signals from the digital vessels. Escharotomies should be performed before pulses are lost but when there is evidence of decreasing circulation.

Trunk

When the trunk is extensively burned, rigidity of the chest wall decreases compliance and this may reduce ventilation. In adults this problem is seen with circumferential burns of the chest with or without involvement of the abdomen. In children whose breathing is principally diaphragmatic, the problem can be seen when the anterior aspect of the chest and abdomen are burned without the injury extending to the posterior.

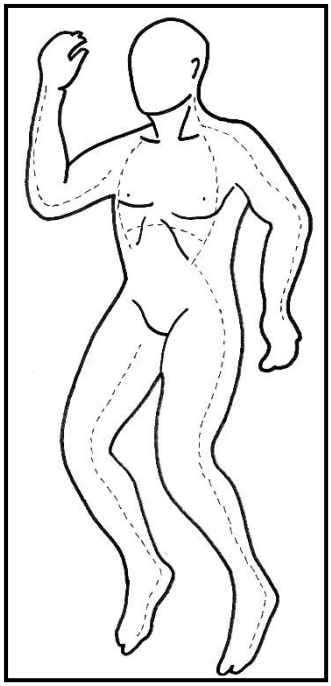
The incisions to be made run longitudinally along the anterior axillary lines to the costal margin or to the upper abdomen if this is burnt and are connected by two cross incisions which may be convex upwards across the upper chest below the clavicles and across the upper part of the abdomen.

Extremities

When a limb is burned circumferentially the increase in pressure due to the accumulation of oedema under the rigid burned skin may interfere with circulation and cause death of tissue in the distal part of the extremity.

The incisions should extend by a few millimetres onto normal skin above and below. The incisions are in the mid-axial lines between flexor and extensor surfaces. Avoid incisions across the flexural creases of joints. They should be carried down to the fat sufficiently to see obvious separation of the wound edges.

Running a finger along the incision will detect residual restrictive areas. Sometimes one incision is enough but often incisions on both sides are necessary to restore circulation. The palpable softness of the limb is a useful guide.



The danger of escharotomy is to structures under the skin. In particular at the elbow the ulnar nerve is vulnerable and at the knee the common peroneal nerve is at risk. Transverse incisions in the limbs should not be made.

The distal extent of escharotomy is sometimes difficult to assess. In the upper limb the medial incision can pass along the medial border of the hand to the base of the little finger. On the lateral aspect the incision can come down to the proximal phalanx of the thumb. Occasionally further hand incisions may be necessary but before embarking on this the burn referral unit should be contacted.

The first step is to define the lines of incision. If the operator is not familiar with the procedure, they can be usually drawn in with coloured pen with the limb held in its anatomical position and then inspected before a final decision is made. When the arm is burnt, the forearm lies in pronation so needs to be supinated before marking and incising. In the upper limb the incision should go in front of the medial epicondyle to avoid damage to the ulnar nerve.

In the lower limb the medial incision passes behind the medial malleolus avoiding the long saphenous vein and saphenous nerve. If a second incision is required laterally, care should be taken to avoid the common peroneal nerve where it crosses the neck of the fibula. This incision is in the midlateral line (see diagram).

Anaesthesia is usually not necessary. Sometimes local anaesthetic is necessary at the edge of the burn to extend up into normal tissue adequately. Many of these patients may already be intubated and therefore sedated under which circumstance a little extra sedation can be given.

An Escharotomies are best done with electrocautery, as they tend to bleed. They are then packed with a calcium alginate dressing (KALTOSTAT) and dressed with the burn. However, as the patient is further resuscitated and the peripheries warm up, bleeding may increase. It may be necessary to take the dressing down to secure haemostasis.

escharotomy should be performed as soon as it becomes apparent that the distal circulation might become impaired. If surgery is delayed too long, permanent ischaemic damage to the tissues, especially the muscles, will occur. However, escharotomies are best done in an operating theatre by experienced staff. They should be discussed with the local burns' unit and performed under instruction only when transfer is delayed by several hours. Initially, at risk limbs should be elevated and observed.

Restoration of the distal pulses or chest expansion indicates the escharotomy has been successful. However, it should be borne in mind, that the tissues continue to swell and so the incision should be adequate to allow for further oedema formation.

Burn Wound Management for Major Burns

If possible, wash the burn with warm saline. Fluid needs to be warm to help prevent temperature loss. Ideally patient should be in a cubicle with additional heating. Cleaning the wound will allow you to see the extent of the injury.

Once clean, wrap the burn in cling film, single layer, not tightly wrapped to allow for oedema and keep the patient warm, ideally with a bear hugger. Do not wrap around the face and hands and feet are better in clear plastic bags. This keeps the burn moist and warm. Allowing the burn to dry out will make it go deeper as any epidermal remnants will die away.

Elevate affected limbs as much as possible, this will help prevent the need for escharotomies

Organise transfer to a specialised burn service.

Pain and Pruritus – Assessment & Management

(See Appendix 2 for care plan)

Aim

- To reduce pain levels that are unacceptable to the patient.
- To minimise the risk of excessive or inadequate analgesia.

Pain Assessment

Frequent and continued pain assessment is needed to ascertain pain type/severity and to guide pain management. Simple, patient friendly scales can be used to form a structured pain assessment. Generally numerical scales are useful to gauge pain severity in adults, but in patients with cognitive issues pictorial pain scales may be useful.

There are a wide range of pharmacological and non-pharmacological interventions used to treat burn pain. These can be used separately, or as a combined approach to pain management. The decision of which pain relief to use will be dependent on pain type, intensity and the individual characteristics of the person requiring the pain relief. All pharmacological methods of pain control must be prescribed and their effects monitored and documented.

Pain Relief

Burns are very painful injuries. Even though sensory nerve endings may be destroyed in deep burns, patients will require large quantities of strong analgesics to relieve their pain, fear, anxiety and distress. In small burns, simple measures such as cooling, elevation and covering the burn with an occlusive dressing will help to alleviate the intense pain. Analgesics such as oral paracetamol and/or codeine may be sufficient. Non-steroidal anti-inflammatory drugs are also useful, and some can be administered by the rectal route if the patient is unable to tolerate oral medication.

For major burns, opiate analgesia such as morphine will be required. This should always be given intravenously during the resuscitation phase to ensure that it is effective. Intra-muscular injections should be avoided because in the shocked patient muscle blood flow is impaired. Thus, the opiate may not be absorbed into the circulation and so the injection is ineffective initially. If subsequent doses are given intravenously and the patient is resuscitated with fluids, the circulation to the muscles will be restored. The initial dose will then be absorbed, and this may lead to over dosage.

Intravenous opiate should be given in small, incremental doses until the patient's pain and distress is relived, whilst monitoring their conscious level and respiratory rate. A dose of 0.2mg of morphine per kg of body weight is usually sufficient but it must be borne in mind that some patients are very sensitive even to small quantities of opiates.

Pruritus (Itch)

Pruritus can replace pain as a source of discomfort, anxiety and distress (depending

on its intensity) when burn wounds have healed. Affected individuals may attempt to relieve itch by rubbing or scratching the affected area and this may cause trauma/blistering/breakdown to newly healed and fragile skin. Prevalence of itch post burn injury is high with reported intermittent to persistent itch at 60% to 87%. For this reason, antihistamines should be considered early first line management and be administered alongside analgesia.

Burn Wound Management

Burn wound cleansing

(See Appendix 3 for care plan)

The aim of burn wound cleansing is to help create the optimum local conditions for wound healing by removal of debris, exudates, foreign and/or necrotic material and other micro- organisms. This will also assist in assessment of burn size and depth. These solutions are currently used:

NaCl 0.9%

Physiologically balanced solution that has a similar osmotic pressure to that already present in living cells and thus compatible to human tissue.

Tap water and Soap

Evidence from various research studies suggests that there is no increased risk of infection in acute wounds when using tap water.

Soap and water are used by most Burns Units and is cited by the European Working Party of Burns Specialists as a solution of choice for burn wound cleansing, (Alsbjorn et al 2007). Soap should be non-perfumed to avoid potential skin/tissue irritation.

Conservative Sharp Debridement

Burn injuries are subject to certain degrees of dead and devitalised tissue, slough and other debris. This is dependent on age and depth of the wound. Acute burn wounds commonly have dead tissue and blisters present which need to be removed. The removal of devitalised tissue or foreign material from and around a wound is essential to optimise healing. If not removed, it can increase the risk of wound infection and prevent epithelial tissue from migrating across the wound bed which will inhibit timely wound healing. Debridement is also necessary to assist in assessment of burn size and depth.

Blister Management

There is conflicting evidence within international burns literature concerning best practice for the management of blisters. However, consensus leans towards the conclusion that blisters should be debrided as their presence will impede wound depth assessment, limit function and increase the potential for infection.

Guidelines for Blister Management: BBA (2018)

Blister size

< 6mm: can be left intact as unlikely to rupture spontaneously or impede healing.
> 6mm: should be debrided or deroofed as more likely to rupture spontaneously.

Blister type:

- Thin-walled blisters: should be debrided because a) they are prone to rupture and b)

they occur on hair lined skin surfaces which are of increased infection risk.

- Thick-walled blisters: Thicker skin occurs on hands and feet. If 1cm or below and not limiting function and/or mobility they can be left intact. If larger they are more likely to limit these actions and thus should be debrided.

Infection Prevention

A blister is non-viable tissue that is a potential source of wound infection if not removed.

Wound assessment

Blisters should be debrided to facilitate proper inspection of the wound bed which will aid depth assessment.

Functional outcome

Blisters should be debrided when their presence impedes the movement, function and/or mobility of the burn injured individual.

Aesthetic outcome

Blisters should be debrided to facilitate more timely wound healing which will limit the potential for abnormal scarring.

To debride you need: a) adequate pain relief b) sterile forceps and scissors c) a competent practitioner to carry out the procedure. If these are not available, please refer to the burn service.

Managing non-complex burns that don't need referral.

Dressings for Burns

Wound dressings can have a profound influence on healing, thus making them an essential part of wound management. The outcome of the burn can be significantly influenced by the choice of dressing.

When selecting the most appropriate dressing many factors should be taken into account:

- Burn depth
- Burn site
- Burn TBSA
- Type of first aid (use of unclean water may increase infection risk)
- Cause of burn
- Any co-morbidities that may influence dressing choice
- Patients' ability to manage/tolerate dressing
- Health professional's ability to manage dressings
- Functional impact of dressing
- Associated pain (and control of pain)
- Cost

Dressing Principles

(See appendix 4 for Burn Wound Care Formulary)

A dressing consists of two parts; the primary wound contact layer and the secondary dressing whose purpose is to ensure primary wound contact layer remains in contact with the wound.

Provision of a moist wound environment

This has been shown to accelerate healing by as much as 50% as opposed to a dry environment caused by air exposure. A moist environment not only promotes autolytic debridement of devitalised tissue but also provides a surface over which migration of epithelial cells can move more easily.

Note: Burn wounds are initially wet in the first 24-48 hours of injury. This is the normal 'hyperaemic' phase of injury. After this point (excluding the incidence of infection) they will generally be quite dry wounds that require moisture to assist with timely healing.

Absorbency

Dressings should have the right level of absorbency for status of the burn wound/ stage of healing. A dressing that does not have the correct capacity for absorbency for any particular burn wound will engender 'strike through' of exudates which will increase the potential for infection.

The provision of a moist environment does not remove the need to prevent the build-up of excessive moisture/exudates that can lead to skin maceration, delayed wound healing and infection. Balancing the need for moisture with the level of exudates of

any given burn wound is crucial to aid timely healing and prevent complications.

Protect the wound from micro-organisms

Dressings should be impermeable to micro-organisms. Strike through of exudates allows passage of bacteria in and out of its field. Consider dressing absorbency in this context.

Antimicrobial properties

Burns have the potential to become colonised or infected. Potential increases with:

- Method of first aid – (using unclean water to extinguish flame/rolling on unclean surfaces)
- depth of wound – (deeper burns will have more necrotic tissue)
- Site of wound – (feet, axilla, groin, perineum)
- Co-morbidities – (e.g. diabetes)

Non-adherence

Dressings need to be applied and removed without causing trauma. Any dressing that adheres to the wound (and that is not its intended mechanism of action) may damage any healthy tissue on removal.

Conformable to wound surface

Dressings/topical creams and ointments should be in contact with the burn wound surface in order for them to be effective.

Keep the burn patient warm and avoid any unnecessary exposure

A drop in wound temperature below 37 °C delays mitotic activity for up to 4 hours.

Allow adequate movement

Joints should always be dressed in a range that maximises movement. Concerning the hands, fingers should be dressed individually, or if there is no alternative the thumb should be dressed separately from the other digits, with the dressing in contact with the wound in between each digit.

Be comfortable for the patient

Dressings should be comfortable and manageable for the patient otherwise they are less likely to comply/cope with treatment which in turn may be detrimental to the healing process.

Cost effectiveness

Choosing the most appropriate dressing for the characteristics of any particular wound/ patient will reduce waste, facilitate timely wound healing and promote cost effectiveness.

Note: Inclusion of categories of products does in any way endorse specific products; users should select products that meet the principles of managing burn wounds outlined above.

Types of Dressings

Antimicrobials

Topical antimicrobial dressings are impregnated or coated with various agents which provide sustained antimicrobial effects. Their aim is to manage wound bioburden and reduce the risk of invasive infection through minimisation of bacterial colonisation. Current antimicrobials include dressings containing; iodine, Polyhexamethylene Biguanide (PHMB), Dialkyl Carbamoyl Chloride, (DACC), honey and silver, in relation to burns the latter two are most commonly utilised.

Silver Containing Products

Silver sulphadiazine (SSD) cream is the primary form of silver, which has an established use in the topical management of burns. SSD cream is effective against a wide array of gram positive and gram-negative organisms. There is also evidence to suggest antifungal and antiviral benefits. Many other silver dressings now exist, and these are now largely preferred over SSD cream. Silver products work by either donating silver to the wound (nanocrystalline products) or absorbing the exudate into the dressing containing silver.

Honey Products

The use of honey within dressing products has been found to provide a multitude of antimicrobial and anti-inflammatory benefits. These include promoting wound debridement, stimulating healing, maintaining a wound moist environment and assists in deodorising wounds. It has proven to be effective against a wide range of wound pathogens. Discomfort has been reported occasionally with the use of honey products, particularly in more superficial burns or when deeper burns are granulating.

Alginate Gel

Alginate gels are hydrated alginate polymers, with antimicrobial enzymatic complex; glucose oxidase and lactoperoxidase. They have 3 clinical benefits: moisture, debridement and anti-bacterial action.

Foam Dressings

The majority of foam dressings are made out of polyurethane foam. They provide patient comfort, are extremely conformable and highly effective for the absorption of exudate, whilst providing a bacterial barrier to prevent contamination. Their primary use is for light to moderate exuding, clean, granulating wounds, and care needs to be taken when using them with burn wounds unless a suitable moisture agent has been added.

Low Adherent Products

These dressings usually consist of polyamide net coated with soft silicone and their

meshed composition allows exudate to drain away from the wound bed. Their primary benefit lies with their ability to reduce tissue trauma and pain, during dressing procedures. They are very useful in painful areas like hands or newly debrided burn wounds.

Hydrogels

Hydrogel dressings have high water content and contain insoluble polymers. These products are usually used to donate fluid to dry and/or sloughy wounds and aid wound autolytic debridement, but some have the capacity to manage low levels of exudate. They are suitable for use throughout all stages of the wound healing process. They are used to debride full thickness burn wounds or to manage pain in superficial wounds in their sheet versions.

Hydrocolloids

Hydrocolloid dressings form a gel once in contact with wound exudate; this promotes autolytic debridement. These dressing products are suitable for use throughout the wound healing process and may provide pain relief by ensuring the nerve endings remain moist. They are able to absorb low to medium levels of exudate and do not require secondary dressings. However, care should be taken when using these in burns that there is no contamination of the wound prior to application as they create an anaerobic environment in which bacteria can thrive.

Secondary Dressings

The key purpose of a secondary dressing is to keep the primary dressing in contact with the wound and absorb exudate. Although some dressings contain both layers in a single unit, others require the selection of an appropriate, separate secondary layer. In either instance it is essential that the amount of exudate is considered prior to selecting a suitable dressing product.

Managing Burn Wound Infection

Infection

Burns wounds by nature are prone to infection from a variety of different micro-organisms. Skin usually provides a barrier to prevent bodily invasion of micro-organisms however when this barrier is breached by a burn injury, microbes gain access into the tissues and increase the potential for infection. The presence of any necrotic tissue will compound this potential. Infection can occur at any stage of the wound healing process. It is important to be proactive in the prevention of infection and assess the wound at every dressing change for signs of clinical infection.

Clinical infection follows a cellulitis profile of:

Heat

Local to and surrounding the wound site.

Discolouration

Most wound bed tissue and even newly healed tissue has a red/pink appearance. This is normal. Discolouration originating from infection will track outside the margins of the wound/healed areas and often be accompanied by one or all of the other signs of infection.

Swelling

Local to and surrounding the wound site.

Pain

Local to and surrounding the wound site.

Where a burn has the above characteristics and is on a functional area e.g. the hand then the patient may protect this area, leading to loss of function

Colonisation

Colonisation occurs when bacteria are present on the wound surface yet there are no clinical signs of infection. The circumstances surrounding the burn injury, extent and depth of injury, health status and lifestyle of the injured individual, along with the type and number of micro-organisms colonising the wound can all influence the potential future risk of clinical infection.

*For these reasons all burn wounds should be swabbed on initial presentation to ascertain a baseline status and check with the burn service for information about protocols for the use of antibiotics.

Management of locally infected burn wounds

An infected or critically colonised burn wound can lead to further tissue damage, delay healing and increase the potential for complication such as scarring and contracture. It is important that we use the appropriate measures to prevent and treat infections.

Dress wound with antimicrobial dressings such as silver

Antimicrobial dressings alone may be sufficient to control/ limit/ eradicate microorganisms on colonised wounds without the need for antibiotics. This will be dependent on the individual circumstances of the injured individual, the level of colonisation present and whether the colonisation is inhibiting normal wound healing. Clinically infected wounds should be treated with both antibiotics and antimicrobial dressings.

Dress and assess wound regularly 48hrs after initial injury then every 72 hours

Colonised or infected wounds should be reviewed on a regular basis to assess the effectiveness of treatment and prevent any wound/systemic deterioration.

Antibiotic treatment according to assessment and wound swab results

Note: individuals with burn wounds should not be given antibiotics for prophylaxis. Only when clinical signs of infection are apparent and/or confirmed by swab results, or delayed wound healing is apparent due to heavy colonisation, should antibiotics be considered.

Always adhere to good hygiene and aseptic techniques

This rule should apply to all wound management whether colonisation/infection is indicated or not.

Burn wounds that are healing in a timely manner for injury depth, and show no clinical signs of infection only need to be swabbed if any changes in the status of the wound i.e.

- Wound develops clinical signs of infection
- No clinical signs of infection but wound shows signs of delayed healing which may indicate colonisation

Toxic Shock Syndrome

This is a life-threatening infection that can happen in any percentage burn. It is usually more common in minor burns and originates from toxins released by the Staphylococcus aureus pathogen which can colonise in the wound. Toxic Shock Syndrome (TSS) is more prevalent in children as they generally have a weaker immune system. The onset of this syndrome happens very rapidly, and accurate assessment and treatment is vital. It is imperative to commence treatment from the first signs of:

- Rash
- Diarrhoea
- Vomiting

- Circulatory shutdown

Treatment

This is a medical emergency and rapid transfer to the nearest emergency department is vital. It may also be appropriate to initiate discussions with the Burns Service as the affected individual will most likely continue their care at a burn facility once the acute episode has been stabilised.

Tetanus

Patients have the potential to develop Tetanus as a complication of burn injury. This is a disease caused by the pathogen Clostridium Tetani. The condition presents as a pattern of muscle stiffness starting in the jaw (lockjaw), followed by neck stiffness, swallowing difficulties and rigidity of the abdominal muscles. Laryngospasm can also occur. Therefore, a Tetanus protocol should be followed when managing a burn injury (Alsbjorn et al 2007).

Rehabilitation and Aftercare

Rehabilitation from burn injury should begin on the date of injury itself. This will optimise the potential to restore the patient to an optimum form, function, sensory and psychological post burn state. Rehabilitation begins with appropriate assessment and management of the burn injury to facilitate timely healing and thus reduce the risk of abnormal scarring, contracture and function.

Promotion of movement and function:

- Encourage patient to move injured area
- Balance any need for elevation due to swelling with the need for movement
- Ensure adequate pain relief to help patient undertake functional exercises

Note:
Burns over flexure surfaces may have increased risk of functional problems and would benefit from referral to the Burns Service.

Acute or recovering full thickness injuries may also have the complication of tendon damage and should not be mobilised without proper assessment of the injury. Referral to the Burns Service is then necessary.

First line scar management techniques for healed burns:

Once healed, all burns should commence a scar management regime of moisturising, massage and UV protection. This is aimed at reducing the potential for abnormal scarring, contracture and altered pigmentation of newly formed tissue:

Moisturising

Moisturising with non-perfumed cream helps to return moisture to skin that has lost varying degrees of secretory function due to burn injury. It helps to reduce/stop newly healed skin from drying out, cracking and/or contracting. For best effects this is performed in combination with massage, 2 or 3 times a day depending on how dry the patient's skin is.

Massage

Massage provides pressure which helps to prevent/minimise restrictive bands of scar tissue and/or raised hypertrophic scarring. It can also make scar tissue more pliable and reduce risk of contracture.

UV (sun) protection

Healed skin generally has some degree of hyper-pigmentation and this should fade with time, however exposure to UV light (daylight) can render this hyper pigmentation permanent and can give the healed tissue a 'stained' appearance. This phenomenon can be avoided/limited by daily use of sunscreen. Factor 50 is recommended.

Patient education

Patients must be made aware of the need to undertake and continue with these skin care techniques for up to two years post injury as scar tissue can continue to be active within this time period.

Post-Acute Complications

Infection

Infection can occur at any stage post burn injury. This can delay healing and increase potential for additional complications such as scarring and contracture. Clinically infected burn wounds indicate the need for referral to the Burns Service for management.

Unhealed after 7 days (Paediatrics) 14 days (adult) post injury

Delayed wound healing indicates that there has been a complication with the normal wound healing process. This increases the potential for infection, contracture and scarring, and referral for wound management is indicated. However, if the wound is significantly older > 6 months this is a chronic non-healing wound and should be managed by the local Tissue Viability service and not referred to the Burns Service.

Scarring

As a general rule, wounds that heal in a timely manner without complication are less likely to scar. However, this may not always be the case. Individuals who develop abnormal scarring and/or altered pigmentation post healing can be referred for to the Burns Service for specialist support and scar management.

Delayed psychological trauma

Psychological distress is not always immediate or apparent post injury. Individuals who develop psychological problems post injury can be referred for psycho/social support.

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Glossary

Adnexal

Adnexa refers to the appendages of an organ.

Background Pain

Background pain is pain which is present while the patient is at rest. This type of pain is usually less intense but is protracted.

Breakthrough Pain

Breakthrough pain is unpredictable surges of pain at various time intervals.

Coagulative Necrosis

Necrotic tissue caused by acids as they denature proteins

Colonisation

Development of bacterial infection in an individual, as demonstrated by a positive culture. The infected person may have no signs or symptoms of infection while still having the potential to infect others.

Co-morbidities

Co-morbidities are other co-existing illness(es) in addition to the particular illness which is currently most significant.

Conservative Sharp Debridement

Conservative Sharp debridement is the removal of dead and devitalised tissue from healthy tissue either using scissors and forceps or a scalpel. This does not mean making the wound bleed.

Contracture

Contracture refers to the tightening of the skin after a deep dermal or full thickness burn. When skin is burned, as it heals, the wound and surrounding skin begins to pull together, resulting in a contracture. It needs to be treated as soon as possible because the scar can result in restriction of movement of and around the injured area.

Cutaneous

Pertaining to the skin.

Debridement

Debridement is the process of removing non-living tissue from burns and wounds.

Deep Dermal

Deep dermal burns are injuries to the epidermis and lower portion of the dermis. These burns are characterised by a fixed red capillary staining and/or a pale white mottling.

Dermis

The dermis is a layer of skin between the epidermis (with which it makes up the cutis) and subcutaneous tissues, that consists of connective tissue and cushions the body from stress and strain.

Devitalised Tissue

Devitalised tissue is tissue that has been starved of oxygen and nutrients over a period of time. It can have a range of presentations from hard black and fixed dead tissue to soft, stringy yellow or green slough or loose tissue/blistering as a result of thermal or chemical injury.

Epidermis

The epidermis is composed of the outermost layers of cells in the skin. It is composed of 4 or 5 layers depending on the region of skin.

Epithelialisation

Epithelialisation is the re-growth of skin over a wound.

Erythema

Erythema is redness of the skin caused by hyperaemia of the capillaries of the lower layers of the skin.

Eschar

A piece of dead tissue that is cast off from the surface of the skin, particularly after a burn injury. Eschar may be allowed to slough off naturally or it may require surgical removal.

Escharotomy

Escharotomy is a surgical incision made to release pressure and improve circulation in a part of the body that has a deep burn and is experiencing excessive swelling. Burn injuries that encircle a body part, such as an arm or the chest, can cause swelling and tightness in the affected area, resulting in reduced circulation or difficulties breathing.

Exudate

Exudate is any fluid that filters from the circulatory system into wounds or areas of inflammation.

Flexure

Bend or fold.

Full Thickness

Full thickness burns are injuries to the epidermis and all of the dermis. Injury may extend beyond the dermis into subcutaneous layer, muscle and bone. These burns are often characterised by white to charred colour.

Hyperaemic

Describes the increase of blood flow to different tissues in the body. Clinically, hyperaemia in tissues manifests as erythema.

Hyperthermic

Elevated body temperature due to failed thermoregulation >40^{o}C.

Hypothermic

Decrease in body temperature below that required for normal metabolism and body function <35^{o}C.

Hypertrophic Scar

Hypertrophic scar is a red, raised and firm scar resembling a fibroma or collagen nevus.

Immediate Pain

Immediate pain is the initial exposure of nerve endings during acute injury coupled with inflammatory stimulation of fibres that can cause intense pain.

Laryngospasm

Laryngospasm is the spasmodic closure of the larynx.

Larval Debridement

Larval debridement is the use of Larvae of the Green Bottle Fly to remove necrotic and devitalised tissue from fixed burn eschar and slough that is not dry and hard.

Larvae

Is a distinct juvenile form many animals undergo before metamorphosis into adults. Often termed maggots.

Liquefactive Necrosis

Necrosis caused by alkali chemicals as they denature proteins and saponification of fats

Maceration

Softening and breaking down of skin resulting from prolonged exposure to moisture.

Mitotic

Process by which a cell divide.

Non-pharmacological

Therapy or treatment which does not involve drugs.

Necrosis

Premature death of cells in living tissue.

Neuropathic Pain

Neuropathic pain is pain that can originate from disordered re-growth of nerves or neuroma.

Ocular Injury

Ocular injuries are those pertaining to or affecting the eye.

Oedema

Excessive amount of water fluid accumulated in the intracellular spaces, most commonly present in subcutaneous tissue.

Osmotic Pressure

The pressure required to stop osmosis through a semi-permeable membrane between a solution and pure solvent.

Patency

A state of being open or exposed.

Pathophysiology

The functional changes associated with or resulting from injury.

Pharmacological

Therapy or treatment which involves drugs.

Procedural Pain

Procedural pain is pain that is generated by therapeutic interventions such as dressing changes and physiotherapy. This type of pain is intense but short in duration.

Pruritus

An itching sensation or feeling.

Rehabilitation

Rehabilitation is a programme of therapy designed to restore independence and reduce disability.

Safeguarding

Promoting the welfare of children and young people that reflect the needs of the children they deal with; or to protect vulnerable adults from abuse or the risk of abuse.

Scar Management

Scar management is the physical and aesthetic components as well as the emotional and psychosocial implications of scarring.

Slough

A layer or mass of dead tissue separated from surrounding living tissue, as in a wound, a sore, or an inflammation.

Stasis

Stoppage or diminution of flow as of flow of blood or other body fluid.

Subcutaneous

A layer of tissue immediately below the dermis.

Superficial Dermal

Superficial Dermal burns are injuries to the epidermis which extend to the upper and middle portion of the dermis. These burns are characterised by a pink colouring, however, there may be some white mottling.

Surgical Debridement

Surgical debridement is the excision or wider resection of dead and devitalised tissue, including the removal of healthy tissue from the wound margins where the eschar needs to be removed quickly due to size/status/anatomical position of the burn injury that would otherwise present complications of infection, contracture and scarring. This process should only be undertaken by surgeons or practitioners with surgical training.

Systemic

Affecting the whole body, or at least multiple organ systems.

Tetanus

Tetanus is a rare but often fatal disease that affects the central nervous system by causing painful muscular contractions. It begins when tetanus bacteria enter the body, usually through a wound or cut exposed to contaminated soil.

Thermal Injuries

Thermal injuries are injuries that occur with skin exposure to extreme temperature.

Toxic Shock Syndrome

Toxic Shock Syndrome (TSS) occurs where poisonous substances produced by bacteria enter the bloodstream.

Vasculature

Arrangement of blood vessels in the body or in an organ or body part.

Appendix 1 First Aid Care Plan

Goal	Action	Rationale
STOP the burning process	**Flame** • Extinguish **Scald/flame** • Remove clothing **Chemical** * While there is residual chemical on the skin it will continue to burn (EMSB 2012) • Remove contaminated clothing • Prompt and copious irrigation with water • Ocular chemical injuries require continuous flushing with water • Hydrofluoric acid burns require the application of Topical Calcium Gluconate Gel (10%)	Removes heat source Removes residual heat source Dilutes solution
COOL the burn wound	• Cool with running water up to 3 hours post injury • Water application for 20 minutes if possible Note: water temperature should be about 15 degrees Celsius. Very cold or icy water can cause vasoconstriction which can contribute to tissue ischemia and thus deepen the burn (Sawadal et al 1997). Ice/ice packs should not be used.	Reduces inflammatory reaction which can stop wound progression Clinical and experimental evidence shows beneficial effect from immediate and active cooling: • Stabilises skin mast cells • Decreases oedema in wound • Helps to control pain (Herndon 2007)
PROTECT the burn wound	• Cover the burn wound with cling film (polyvinyl chloride film), except faces.	Prevents (further) contamination of the wound Provides pain relief by covering the exposed nerve endings. (Huspith and Ryatt 2004) Note: do not use constrictive circumferential material as may compromise circulation (Huspith and Ryatt 2004). Only one layer of cling film is necessary.

Appendix 2: Pain Management Care Plan

Goal	Action	Rationale
To alleviate/minimise all types of pain at all stages of burn recovery	• Use a structured pain assessment tool to ascertain the type and severity of pain the patient is experiencing. • Question the patient about the immediate, background, breakthrough and neuropathic pain as appropriate for stage of healing/recovery and any burn management procedures that are occurring. • Use numerical scores/pictorial representation to assess pain severity. • Ask where and when the pain is felt and what makes it better or worse. • Ask the patient to describe the pain they are feeling and the duration of which it is felt • Document all pain assessment scores/information (Richardson and Mustard 2009).	Knowing what type and severity of pain the patient is experiencing will assist in appropriate pain management.
	Immediate pain Cool and cover the injury. **Procedural pain** Refrain from any unnecessary procedures that can cause pain and give prescribed procedural pain medication 30 minutes prior to starting any procedure. Re-assess pain experience at intervals throughout the procedure. Note: Entonox (Nitrous Oxide) is a supervised self-administered medication which is sometimes used as it provides rapid pain relief and is effective in relieving short- term pain. Because of its immediate action, administration can occur at the time of the procedure instead of prior to the procedure. **Background Pain** Give modified release medication as prescribed. Reassess effectiveness at regular intervals. **Breakthrough Pain** Give 'as required' medication as needed and monitor and evaluate the frequency and dosage.	Cooling and covering the exposed nerve endings will help to reduce the pain (Hudspith and Ryatt 2004). Limit unnecessary occurrence of pain and allow analgesia the time to act before a procedure has begun. Provide and maintain constant background analgesia and allow for dose adjustments to be made if necessary. Alleviate breakthrough pain for procedures such as dressing changes, wound debridement and therapy.

Appendix 3: Burn Wound Cleansing Care Plan

Goal	Action	Rationale
To remove any debris/foreign material (that can't be removed by cleansing alone) which may otherwise hinder wound assessment and prevent timely wound healing	• Use most appropriate method of debridement in accordance with burn wound status, type of dead and devitalised tissue and required speed of removal	To facilitate timely wound healing with minimal complication of infection, scarring and contracture
	• Use of sterile forceps and scissors to debride loose skin and blisters	To prevent infection To prepare the wound bed for timely healing To aid assessment of burn wound depth and TBSA
	• Perform any debridement procedure in an environment that is equipped to deal with any complications that may arise and by a practitioner that is competent to deal with them. (Gray et al 2010)	To maintain patient safety

Appendix 4: Burn Wound Care Formulary

Classification of	Tissue Injury	Appearance	Management Aims	Other Considerations	Infection Potential	Treatment Options
Superficial/ Epidermal		Skin intact No blistering Red or pink Painful Capillary refill normal (<2 seconds)	Alleviate pain/promote comfort. Protect against any potential delayed blistering / skin loss	Analgesia. Erythema must be assessed for potential to develop blisters which can occur up to 48 hours post injury. If in doubt dress the area.	None	Un-perfumed moisturising cream Low adherent Hydrocolloids Thin foam dressings Hydrogels
Superficial Dermal		Blistering present Wet Pink Very painful Capillary refill normal (<2 seconds)	Alleviate pain/promote comfort Be fully healed within: 7 days (adults), 5 days (paediatrics) Prevent infection Maintain function	A moist wound healing environment and protecting against infection will limit the possibility of burn wound conversion - re assess in 48 hours.	Low	Low adherents Silicone dressings Hydrogels Foam dressings Hydrocolloids
Mid Dermal		Pink/red infrequent patchy white areas Painful Capillary refill normal	Alleviate pain/promote comfort Prevent deterioration of burn depth Prevent infection Promote function Promote wound healing Adults - (10-14 days) Paediatrics - (7-10 days) and minimise scarring	Reassess for burn wound conversion in 48 hours. The deeper the burn the greater the amount of devitalised tissue and the increased risk of infection. If using a dressing product with no anti-microbial properties more frequent inspection is required.	Low/Medium	Low adherent Silicone dressings Hydrogels Foam dressings Anti-microbial Silver dressings
Deep Dermal		Mottle red with abundant fixed white areas. May be painful but diminished Capillary refill slow or absent	Prevent infection Prevent deterioration of burn depth Promote function Promote wound healing and minimise scarring	Reassess for burn wound conversion in 48 hours. Deep dermal burns may require excision and grafting depending on size and site of injury and patient history. Refer to local burns service for assessment.	High	Low adherent Silicone dressings Foam dressings Honey based dressings Antimicrobial Silver dressings

ull Thickness		Dry leathery white Charred black/brown Insensate Capillary refill absent	Prevent infection Prepare wound for surgical closure Promote function	Generally, all but the smallest of full thickness burns require excision and grafting. Decisions are made in accordance with burn size, site and patient history. Refer to local burns service for assessment	Low	Foam Hydrogels Hydrocolloids Honey based dressings Silver dressings
Donor Site		Painful Readily bleeds	Promote comfort Be fully healed within 10-14 days Prevent infection Manage leakage Prevent slippage of dressing	For non-acute donor site - seek advice from the Burns Unit. Leave intact for at least 14 days	Low	Low adherents Silicone dressings Silver dressings
Face		Varies depending on mechanism of injury and depth	Alleviate pain/promote comfort Prevent infection Limit oedema/swelling Maintain flexibility which allows essential functionality Control exudate Promote timely healing	Refer new burn injuries to local burns service as per referral guidelines.	Low	Antimicrobial ointment Arachis oil/olive oil Silver dressings Yellow soft paraffin
Hands and Feet		Varies depending on mechanism of injury and depth	Alleviate pain/promote comfort Maintain function Manage exudate Promote timely healing Limit oedema/swelling Prevent infection	Refer new burn injuries to local burns services as per referral guidelines. Dressing choice should be geared towards preventing infection, encourage healing and promote function.	High	Low Adherents Silicone Dressings Thin Foams Hydrocolloids Antimicrobials Silver dressings
Hypertrophic Scars		Scar is raised above level of surrounding skin. Reddening is present as well as itching and sometimes pain	Prevent scar formation Treat symptoms Reduce scar	All patients must be taught to massage and cream at the point of healing. For problematic scarring refer to local burns service for review	None	Emollients Silicone Gels Silicone Sheets

Appendix 5 Specialised Burn Care Services

Trust	Hospital	Telephone Number	Level of Care
The Newcastle upon Tyne Hospitals NHS Foundation Trust	Royal Victoria Infirmary, Newcastle-Upon-Tyne	0191 282 5637/0271	Centre
Manchester University NHS Foundation Trust	Wythenshawe Hospital, South Manchester	0161 2916314	Centre
St Helens & Knowsley Teaching Hospitals NHS Foundation Trust	Whiston Hospital, Liverpool	0151 430 1540/2349	Centre
The Mid Yorkshire Hospitals NHS Trust	Pinderfields Hospital, Wakefield, West Yorkshire	01924 541700	Centre
Sheffield Teaching Hospitals NHS Foundation Trust	Northern General Hospital, Sheffield, South Yorkshire	01142 714 129/126	Unit
Lancashire Teaching Hospitals NHS Foundation Trust	Royal Preston Hospital, Lancashire	01772 52 2550/2244	Facility
South Tees Hospital NHS Foundation Trust	James Cook University Hospital, South Tees	01642 854535	Facility