SUMMARY OF EVIDENCE

Statewide Burn Injury Service

Burn Patient Management

4th Edition

NSW GOVERNMENT

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Glossary

ACI	Agency for Clinical Innovation
hr(s)	Hour(s)
IV	intravenous
kg	kilograms
LPG	liquid petroleum gas
ml	millilitres
mm	millimetres
NSW	New South Wales
SBIS	Statewide Burn Injury Service
TBSA	total body surface area

Contents

Acknowledgements	i
Glossary	i
Introduction	1
Purpose	1
Burn injury definitions	1
Functions of the skin	2
Structure of the skin	2
Anatomy and physiology of the skin	2
Injury zones of the burn wound	4
Pathophysiology of burn injuries: local and systemic	4
First aid	5
Rule of Nines	6
Palmar method	6
Lund and Browder chart	6
Surface area assessment	6
Fluid management	7
Assessment	8
Acute management	8
Three classification – pain relief	8
Non-pharmacological	8
Outcomes	8
Special considerations	8
Pain management	8
Epidermal burn	9
Superficial dermal burn	9
Mid dermal burn	9
Deep dermal burn	9
Full thickness burn	9
Wound appearance	9
Initial assessment of the burn wound depth	9
Delivery of supplemental nutrition	10
Precautions	10
Nutrition for burn injuries	10
Cleansing	11
Debridement	11
Methods of debridement	11
Management of the burn wound	11
Considerations	12
Exudate management	12
Infection issues	12
Blister consensus	13
Management of blisters	13
Digital photograph of the burn wound	14
References	15
Websites	19

Introduction

Purpose

This document provides a summary of the available evidence to support the Burn Patient Management and the Minor Burn Management guidelines developed by the ACI Statewide Burn Injury Service (SBIS).

Burn injury definitions

A burn injury is defined as '…any injury to tissues of the body caused by hot liquids, flames, contact with hot objects, electricity, chemicals, radiation or friction from a fast moving object'.[1] The injuries sustained are generally classified as the following.

- **Chemical**
  direct contact with chemicals (acid or alkali)
- **Contact**
  direct contact with hot objects
- **Electrical**
  direct contact with an electrical current
- **Flame**
  direct contact with open flame or fire
- **Flash**
  exposure to the energy produced by explosive material
- **Friction**
  rapid movement of a surface against the skin e.g. treadmill, motorbike accident, etc.
- **Radiation**
  exposure to solar energy, radiotherapy, laser or intense pulse light
- **Radiant Heat**
  heat radiating from heaters, open fire places, etc.
- **Reverse Thermal**
  contact with liquid or solid of extreme cold i.e. LPG
- **Scald**
  direct contact with hot liquids such as hot water and steam, hot fats, oils and foods.

Anatomy and physiology of the skin

The skin, also referred to as the integument, is the largest organ of the body, with a surface area of 1–2 square metres.[1–4] It is also the heaviest organ of the body; average adults have 4–7kg of skin.[2]

Functions of the skin

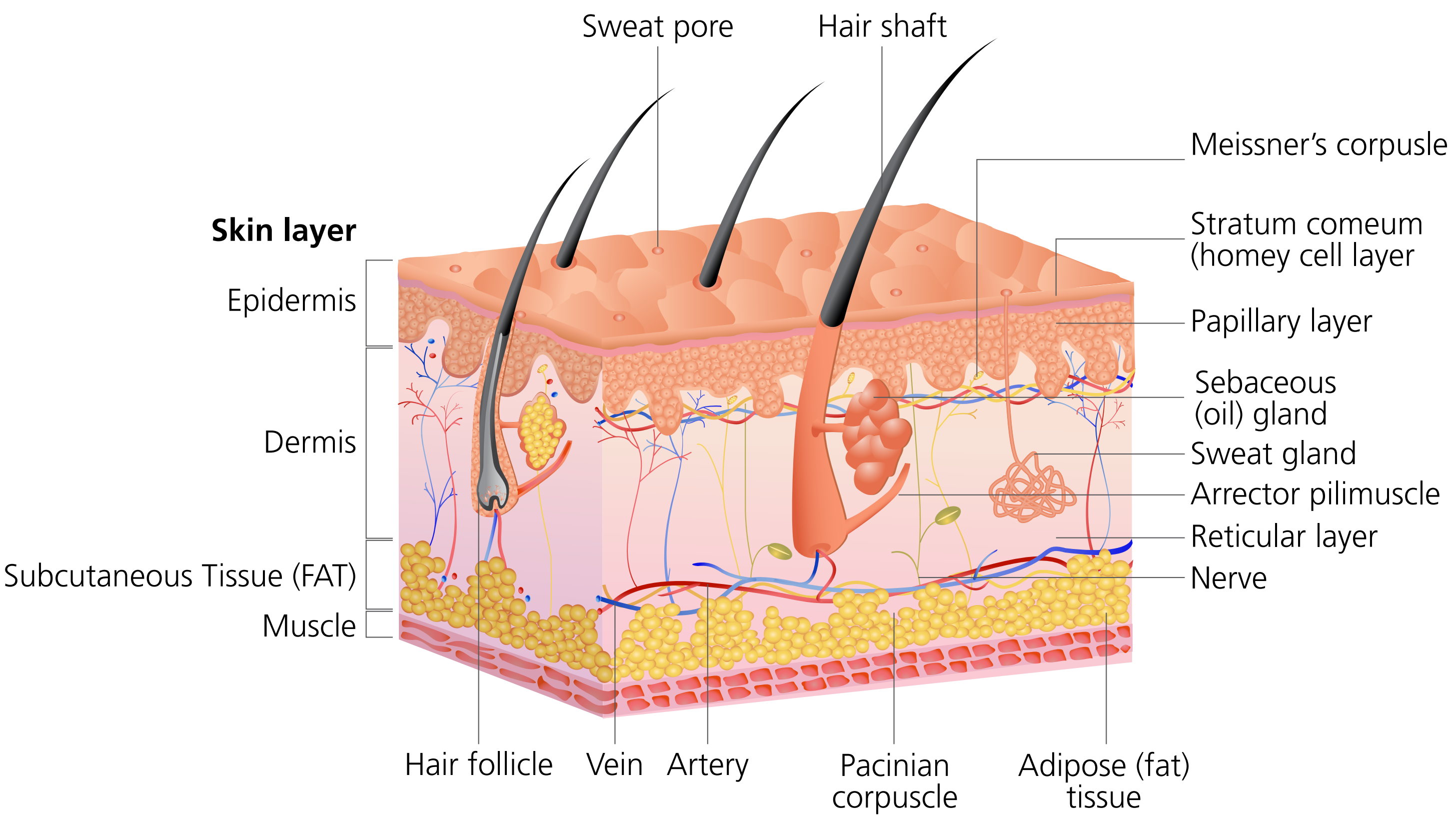
The skin has many functions including:

- temperature regulation
- sensory interface
- immune response
- protection from bacterial invasion
- control of fluid loss
- metabolic function
- psychosocial function.[5]

Structure of the skin

Skin structure consists of several layers, the epidermis and dermis, beneath which is the subcutaneous fat layer.[1, 6–8]

Diagram 1: Structure of skin



Epidermis

The epidermis is the first barrier for protection against foreign substance invasion. Keratinocytes are the principle cells of the epidermis, gradually migrating to the surface and sloughed off in desquamation.[1–3] In the epidermis keratin is flexible, but is thicker, stiffer and harder in the finger and toe nails. Hair is also made up of keratin.

The epidermis is comprised of four to five layers:

- stratum corneum
- stratum lucidium (generally not seen in thin epidermis)
- stratum granulosum
- stratum spinosum
- stratum germinativum (also known as stratum basale).[1–3, 8]

Skin pigment melanocytes are contained in the basale layer.[8] Epidermal cells mature and progress from the lower level of the basale, flattening and losing their nuclei, to be eventually shed from the corneum layer.[1, 8]

Dermis

The dermis controls thermoregulation and supports the vascular network. Hair follicles, nerve fibres, sweat glands and nails are located in the dermis layer and protrude through the epidermis.[8] The dermis contains mostly fibroblasts which secrete collagen and elastin. Immune cells are also present and defend against foreign substances that have come through the epidermis.

The dermis consists of two layers:

- papillary dermis
- reticular dermis.[1]

The papillary dermis is a thinner upper layer containing loosely ordered collagen fibres.[8] The reticular dermis is the thicker lower layer of the dermis containing more densely packed collagen fibres.[3, 8]

Other structures and functions

The subcutaneous fat cells insulate the body against the cold. When the body overheats the small blood vessels carry warm blood near the surface for cooling.[6]

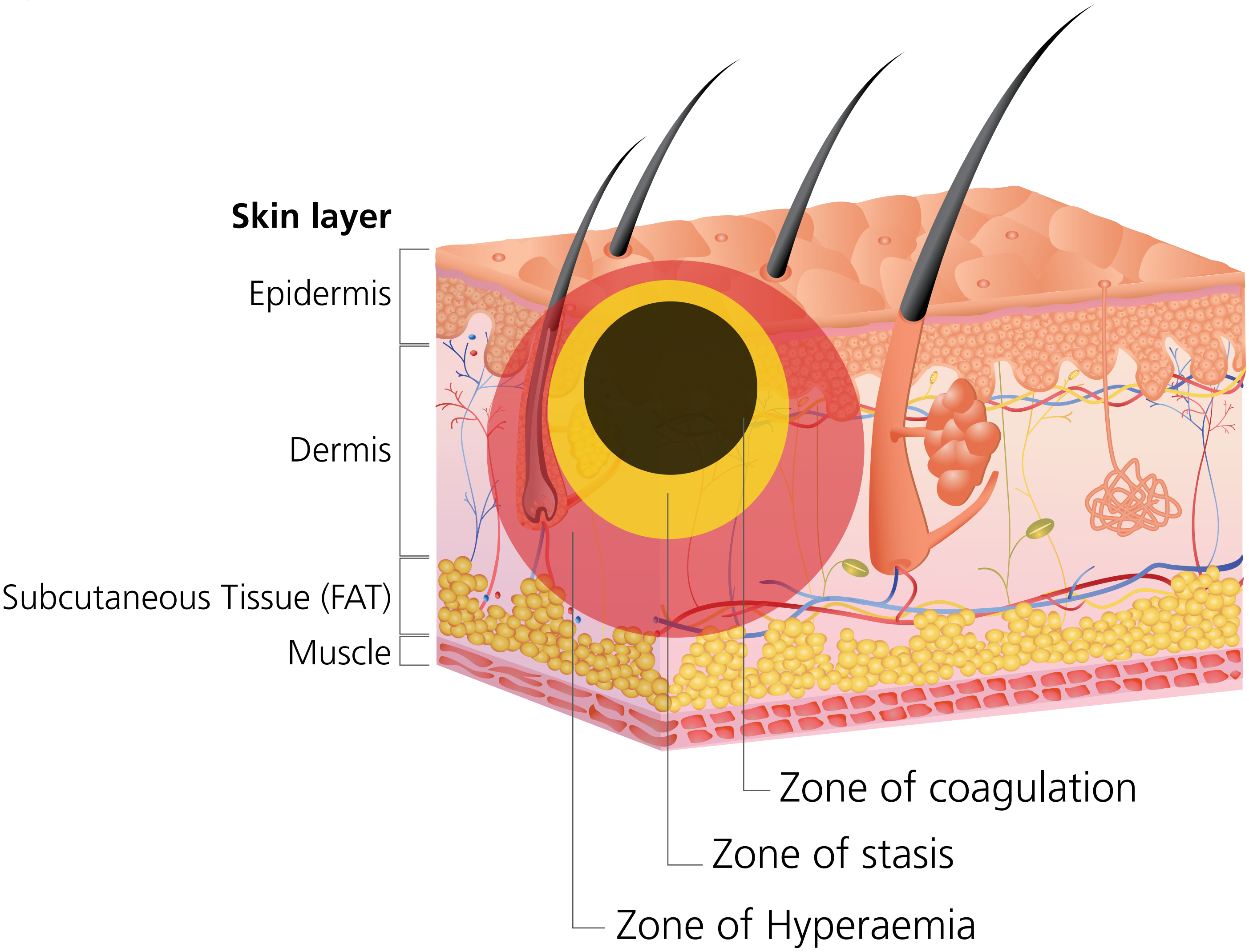
Skin thickness depends on a number of variables including age and gender. The location on the body is also important as eyelids have very thin layers of skin whereas the sole of the foot is very thick, up to 1mm.[2]

Alterations to the skin including loss of the epidermal layer can lead to issues such as fluid loss and susceptibility to infection.[2]

Injury zones of the burn wound

Burn injuries consist of three zones of damage: the zone of coagulation, the zone of stasis and the zone of hyperaemia. These zones were first described by Jackson in 1953 and have been referred to in many articles.[5, 9–11]

Diagram 2: Representation of Jackson Burn Wound Model.[5]



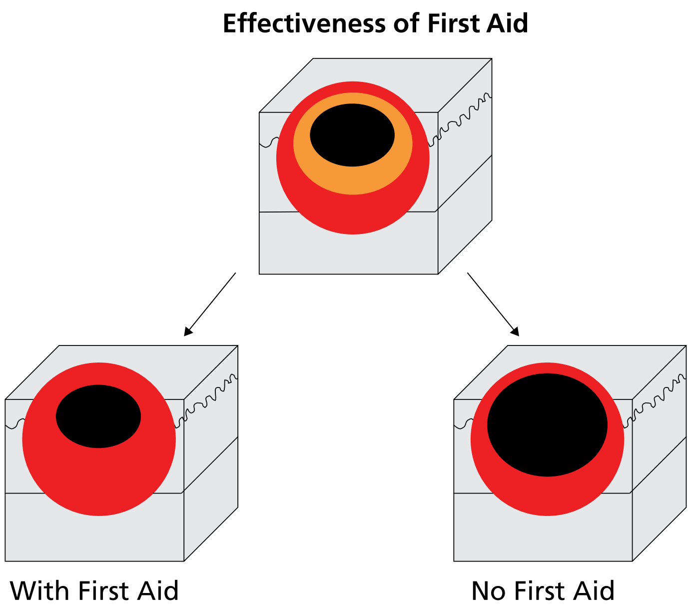
- The zone of coagulation, or necrosis, is the central area of a burn injury where there is the greatest amount of damage. Necrosis in this zone is irreversible.[10] First aid measures do not alter the extent of injury in this area.
- The zone of stasis, also referred to as the zone of ischaemia or damage, lies outside the zone of coagulation. Adequate first aid measures can have a beneficial effect on this zone. Changes in this zone can continue to progress up to two weeks following injury.[10] Changes in this central zone can have a significant influence on the assessment of body surface area and depth of burn wounds.[10, 12]
- The outer layer is the zone of hyperaemia, or survival. In burns greater than 20% total body surface area (TBSA) the whole body becomes the zone of hyperaemia. Cells in this zone do not generally suffer from any long term effects, usually resolving after seven to ten days.[13]

First aid

First aid following a burn injury is an important facet of patient care.[14–16] The main aims for first aid are to stop the burning process and cool the wound.[5] The Australian & New Zealand Burn Association (ANZBA) recommend effective burn first aid as 20 minutes cool running water within three hours following injury.[5, 14, 15, 17–19] Effective first aid can have a positive effect on the progression of the wound, particularly in decreasing inflammation and oedema.[14–16, 19]

The application of timely and effective first aid measures such as cool running water for 20 minutes given within the first three hours after injury can have a beneficial effect on the zone of stasis by stopping the burning process and assisting in cell survival (see Diagram 3).[14–16, 20] It can also have a beneficial analgesic outcome for the patient.[14, 15, 18] Conversely the lack of effective first aid can lead to an increased chance of further tissue necrosis as the zone of stasis can progress to coagulation.[19]

Diagram 3. Representation of Jackson Burn Wound Model depicting effectiveness of first aid application on burn wound progression.



- There have been several porcine studies which evaluate different first aid modalities.[14, 15, 17–19] The porcine studies are used as pig skin is similar to human skin and can thus produce a comparable reaction.[18, 20]
- One of these studies evaluated the effective time frame for cool running water.[18] The study compared cooling a burn with cool running water for 5, 10, 20 and 30 minutes by use of intradermal temperatures and histological examinations. Results indicated that 20 minutes cool running water is optimal first aid following a burn injury.[18]
- Ideal water temperature for cooling is 15°C, range 8°C to 25°C.[15] In a porcine study by Cuttle et al it was discovered that water at 15°C is optimal.[15] Ice should not be used as it causes vasoconstriction and hypothermia.[5] Ice can also cause burning when placed directly against the skin.
- Wet towels or pads, sprayed water or hydrogel tea tree dressings (e.g. BurnAid®, Waterjel® etc.) are not efficient at cooling the burn as they do not cool the wound adequately.[19] They should not be used unless there is no water readily available i.e. in transit to medical care.
- Duration of running water should be 20 minutes unless other factors prevent this (e.g. large burn causing rapid heat loss; hypothermia; multiple traumas).[21]
- It is important to keep the remaining areas dry and warm to avoid hypothermia. Hypothermia can increase morbidity and mortality in burn patients.[20] If patient's body temperature falls below 35°C – stop cooling.
- The usual recommendation for burn first aid (20 minutes of cool running water) is contraindicated for reverse thermal burns i.e. LPG gas cold burns. **Rapid re-warming in a bath of water between 40 and 42°C for 15–30 minutes** – aims to minimise tissue loss and reduce chemical irritation. Active motion whilst re-warming is recommended. Avoid massaging affected area during re-warming.[22, 23]

Surface area assessment

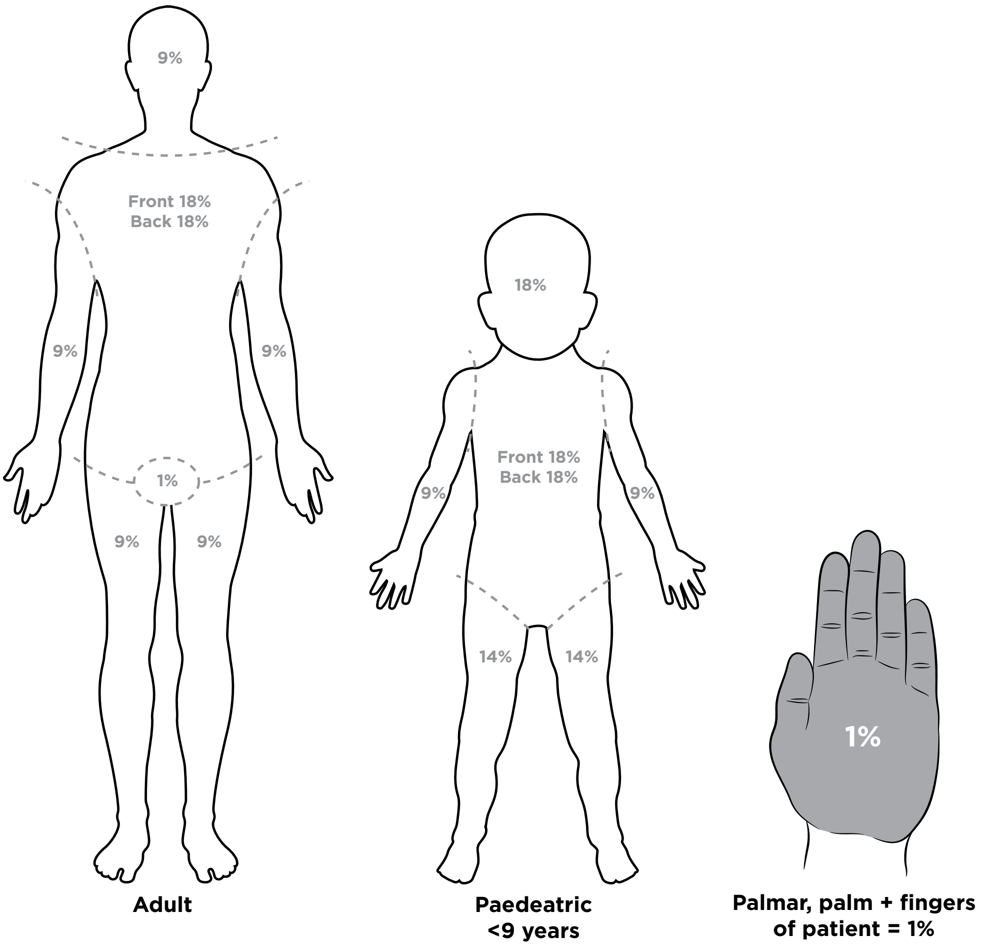
The assessment of burn extent is expressed as a percentage of the TBSA.[24] Inaccurate calculation of %TBSA can have significant effect on accurate calculation of fluid resuscitation and possibly other complications such as airway compromise.[25–27] In most cases the burn size is over estimated in regards to TBSA and the patients receive more fluid than is necessary (with subsequent effects of excess oedema) (see Fluid Management, page 12).

To assess the extent of TBSA there are a number of methods which can be used. These include the Rule of Nines, Palmar method and the Lund and Browder chart.[24, 28, 29] Whichever method is used it is important to note that erythema is not included in a TBSA calculation.

Rule of Nines

This method is often used as it is quick and simple.[24, 29] The body is broken into areas allocated 9%, with 1% allocated to the groin, totalling 100%.[30] As infants and young children are proportionally different to adults there is the Paediatric Rule of Nines.[24] This method is the same for upper limbs and torso but allocates 18% to the head and 14% to each leg. For every year of life take 1% from the head and add ½% to each leg. Once the child is 9 years old the body has the same proportions to an adult and thus uses the adult Rule of Nines.[5]

Diagram 4. Rule of Nines and Palmar methods



Palmar method

This method uses the palmar surface of the patient's palm and fingers to represent 1% of the TBSA.[29] It can be useful for small scattered areas, or to deduct small spared areas from large burns.[24]

Lund and Browder chart

This is often reported to be a more accurate method of assessment of burn extent as it calculates TBSA using more specific areas.[24] However it can be complicated to use and therefore often not as useful as the Rule of Nines for a quick evaluation.[29]

Fluid management

- Hypovolaemia is a common problem for large TBSA burn injured patients (>10%TBSA in children; >20%TBSA in adults) due to the systemic inflammatory response causing increased vascular permeability.[5, 28, 31–34]
- Fluid resuscitation using the Parkland formula is recommended by many burn units worldwide.[25, 34–37] This formula was originally described by Baxter in 1968 and is used to compensate for the loss of circulating volume following a burn injury.[25, 38] ANZBA recommends a modified version of this original formula.[5] It recommends:
  - 3ml x weight (kg) x %TBSA.[5]
- The calculated amount of fluid is divided in two. Half is given in the first eight hrs from the time of injury. The other half is given in the following 16hrs, making up the first 24 hrs.[5, 25, 34, 35]
- The calculated amount of fluid (according to the Parkland formula) is used as a guide. Close monitoring is necessary as ongoing fluid resuscitation should be titrated against urine output.[31, 32, 34, 36, 38] The urine output should be maintained at a rate of 0.5ml / kg / hr for adults and 1ml / kg / hr for children.[28, 39–43]
- The type of fluid has been widely debated, particularly crystalloid vs colloid.[42, 44–46] There has also recently been discussion regarding the usage of hypertonic solution.[45] In NSW Hartman's (a crystalloid) solution is recommended as this is readily available in most settings and useful at replacing the large fluid loss.[5]
- In addition to fluid resuscitation, children less than 16 years of age require maintenance fluids due to their lack of physiological reserve. The fluid of choice for this is a 5% dextrose in 0.9% sodium chloride.[34] Rate is calculated as per local maintenance fluid guidelines.
- Care must be taken not to under or over resuscitate patients as this may lead to secondary complications such as oliguria, renal failure, pulmonary oedema, increased peripheral oedema, abdominal compartment syndrome and raised intraocular pressure.[25, 28, 34, 47–49] Over-hydrating is often referred to as 'fluid creep'.[40, 44, 50]
- Some patients may need more fluid than expected such as those with electrical burns, multi-trauma, inhalation injuries, very large %TBSA and those with delayed resuscitation.[25, 34, 49]

All patients that have a burn experience pain at some stage and this pain can be difficult to manage for patients and staff.[51, 52] Optimal pain management for burn pain involves accurate assessment and combines both pharmacological and non-pharmacological methods to achieve minimal pain for the burn patient.[51, 52]

It is widely recognised that there are three types of acute pain for the burn patient, background, breakthrough and procedural pain. Procedural pain, or pain at wound dressings, has the most effect both physically and psychologically.[53–59]

Assessment

- Burn pain is complex and can be both nociceptive and neuropathic and can occur in many phases of burn treatment, from the acute initial injury, through treatment, wound healing and onto rehabilitation.[57–59]

Acute burn pain can be classified into three main types.

Background pain

- Pain experienced when at rest, in burned areas and treatment areas, e.g. donor site.
- Constant and dull in nature.

Breakthrough pain

- Rapid onset of pain and often short in duration.
- Occurs while attending to simple activities such as walking or changing position in bed.

Procedural pain

- High levels of intense pain for duration of procedure, e.g. wound dressing changes and therapy.
- Requires higher more potent doses of opioid administration.
- It is important to assess and document the pain level of the patient using an appropriate scale such as the Visual Analogue Scale.[58, 59] During procedures and painful periods this should be done at regular intervals, i.e. every 3–5 minutes.
- When considering pain relief it is important to consider the patient's history and provide analgesia over and above existing medications.

Acute management

- Follow local hospital or institutional pain management guidelines.
- Antihistamines can be useful in patients where there is excessive itch, but should not be used in conjunction with midazolam.
- Inhaled nitrous oxide mixture or methoxyflurane can be useful during dressing removal and reapplication in some cases.
- Provision of diversion or distraction therapy can help decrease pain and anxiety for both adults and children (see Non-pharmacological below).
- Anti-emetics may be necessary when narcotics are given.
- Aperients may be required to be administered when narcotics are given to avoid constipation.
- Oral analgesia may be administered to patients with minor burns.

Three classification – pain relief[55, 60]

Background

Best treated with constant serum opioid levels, e.g. acute phase, continuous narcotic infusion or slow released oral opioid as pain levels decrease.[56, 61]

Breakthrough

Relieved by quick release oral opioids and for patients with IV access, patient controlled analgesia or bolus doses.[61]

Procedural

- Generally recommended to provide analgesia beforehand, allowing time for it to take effect. The drug of choice is determined on an individual basis and may include an opiate such as morphine or oxycodone, with paracetamol. Oral midazolam may also be used for its dissociative, anxiolytic and sedative qualities.
- Inhaled analgesics during the procedure such as nitrous oxide or methoxyflurane can also assist with pain management.
- Sedative hypnotics such as propofol and ketamine may also be used if appropriate personnel are available to administer and monitor post-procedure.[58]
- Adjuncts such as diversion or distraction can also be used (see below).[51–53, 55, 56, 58, 61, 62]

Non-pharmacological

Non-pharmacological methods are often used effectively to compliment pharmacological relief. These include diversion therapy, massage, and feeding in the young.[58] These methods are used to help with anxiety associated with burn pain and in particular pain at wound dressing change.[54, 59, 61]

Outcomes

Optimal outcomes of pain management include:

- rapid onset of analgesia
- little post procedure sedation
- able to be administered on unit with patient and staff control
- no need to fast or nil by mouth
- non-toxic for repeated use.

Special considerations

In the acute resuscitation period, narcotic intramuscular injections should not be administered as peripheral shut down occurs in burns >10% TBSA. Absorption of the drug will be delayed so pain relief will not be achieved.[63] As circulation improves an overdose of the opiate may occur.

Initial assessment of the burn wound depth

Burn depth is dependent on the mechanism of injury and length of exposure to the heat source or agent.[2, 24] In the past depths were expressed in 'degrees' as first, second, third and fourth degree. In current practice, the use of anatomical descriptors is preferred when classifying burn depths.[64] Using these anatomical descriptors burns are now classified as epidermal, superficial dermal, mid dermal, deep dermal and full thickness injuries. Even experienced clinicians are often only correct in assessing burn depths in 67% of patients.[64–67] The usage of a diagnostic tool such as laser Doppler imaging can provide a more accurate depth assessment.[2, 34, 37, 65, 66, 68–71]

Epidermal burn[1]

- Not included in %TBSA assessment
- Damage to epidermis only.[71] Skin intact, no blisters present
- Erythema. Red
- Brisk capillary refill
- Heal spontaneously within 3–7 days with moisturiser or protective dressing

Superficial dermal burn[1, 24]

- Damage to upper layer of dermis[71]
- Pink. Blisters present or absent
- Brisk capillary refill (under blister)
- Should heal within 7–10 days with minimal dressing requirements

Mid dermal burn[1]

- Damage into mid dermis
- Dark pink
- Sluggish capillary refill
- Should heal within 14 days
- Deeper areas may need surgical intervention and referral

Deep dermal burn

- Burn extends into the deeper layers of the dermis, but not through the entire dermis[71]
- Blotchy red/white
- Sluggish to absent capillary refill
- Generally need surgical intervention
- Refer to specialist unit

Full thickness burn[1, 24]

- Entire destruction of dermis, sometimes underlying tissue involved[71]
- White, waxy, cherry red, brown, black
- No capillary refill
- Surgical intervention and long–term scar management required[24, 71]
- Refer to specialist unit

Wound appearance

Aside from the obvious epidermal or full thickness burn, initial determinations of burn depth can be somewhat difficult.[2] The appearance of a burn wound can change over a period of time. Discernible differences in burn depth may not be apparent until 7–10 days after the burn injury.[2] It is rare that a burn wound will be uniform in depth. Mixed or heterogeneous burn wounds are common.[71]

- Resting energy expenditure can increase by 1.2 to 1.4 times the usual resting basal metabolic rate following a large burn injury.[72]
- Close attention to nutritional needs both acutely and in the longer term is vital to reduce protein breakdown, prolonged wound healing, immune suppression and the increased risk of infective complications.[73]
- Malnutrition has also been shown to impair tissue healing and contribute to an increase in length of hospital stay.[74, 75]
- The start of early enteral nutrition has been seen to have metabolic and clinical benefits for the burn injured patient, as well as assist in preventing gastroparesis and/or ileus.[72, 73]
- Consultation with a dietitian is essential to guide prescription, implementation and ongoing monitoring of supplemental nutrition.

Delivery of supplemental nutrition

Oral

High energy oral supplement drinks can be encouraged if tolerated.

Enteral

If a patient cannot meet their nutritional requirements orally, timely supplemental enteral feeding via a nasogastric tube should occur. Patients with burns 20% TBSA or more should be assessed for enteral feeds.[76] In the acute phase of management if a base of skull fracture is suspected, an orogastric tube should be passed.[77] Enteral nutrition is the preferred method for patients who are intubated.

Parenteral

In rare cases when the gastrointestinal tract becomes non-functional, feeding via the intravenous route may be necessary.

Precautions

Overfeeding is a potential risk that may occur when supplemental nutrition takes place. Major complications associated with overfeeding include an increased carbon dioxide production, fatty liver and azotemia (raised nitrogen compounds indicative of renal insufficiency).[72] Careful monitoring of metabolic rate, liver enzymes, fluid intake, urine output and blood chemistry must occur to prevent this.[78]

Cleansing and debriding the wound bed, either allows for the wound healing to be accelerated, or prepares the wound bed for a skin grafting or skin coverage procedure.

Cleansing

- Wound cleansing removes devitalised tissue and debris from previous dressings and excessive exudate. These act as a substrate for bacterial multiplication, prolonging the inflammatory stage and thus retarding wound healing.[3]
- Prior to dressing procedure, to determine if the wound requires cleaning, ensure pain levels are controlled. Explain procedure to the patient. Minimise chemical irritation by using an appropriate cleaning solution such as saline, potable water or chlorhexidine.[3]
- While carrying out wound cleansing be aware of fragile new cells and reduce pain and trauma to the patient and the wound bed.[79]
- Maintain a stable body temperature throughout the procedure especially over prolonged intervals.[80]
- Follow standard infection control principles to prevent the transmission of pathogens.

Debridement

Healing of the burn injury may require debridement of devitalised tissue to allow spontaneous re-epithelialisation (healing by secondary intention), or by grafting with an autograft (healing by primary intention).[81] Appropriate analgesia should be given before debridement. The ideal method of debridement should be early, safe, effective, and selective to the tissue type and harmless to non-injured tissue. [82, 83]

Wound debridement is the removal of devitalised tissue, biofilm, particulate matter and foreign bodies that are incompatible with healing.[83–85]

Methods of debridement[86, 87]

There are many different types of debridement for a wound, some of which are outlined below.[83]

Autolytic debridement

The use of rehydrating or moisture retention dressings or agents to assist with autolysis of necrotic or devitalised tissue. Uses the body's own healing process or defence mechanism.[87]

Advantages

- Selective debridement
- Not harmful to granulating or epithelialising tissue
- Inexpensive.

Disadvantages

- Results may be slow
- Maceration to the surrounding intact skin
- May increase wound exudate
- Occlusive dressings are not recommended on infected wounds.

Enzymatic debridement

Uses chemical enzymes to assist in wound healing.[85, 87, 88] Enzymes that help slough off the dead tissue must be carefully applied to only the currently dead tissue not healthy tissue.

Advantages

- Non-invasive
- Shorter healing time.

Disadvantages

- May be expensive
- May cause inflammation during debridement.

Mechanical debridement

The removal of necrotic or devitalised tissue by mechanical means such as irrigation, wet-to-dry dressings, hydrotherapy or pulsation therapy.[87]

Advantages

May soften eschar and devitalised tissue to aid sharp debridement.

Disadvantages

- May be expensive if hydrotherapy, mechanical irrigation system
- Wet-to-dry dressings can cause excess bleeding [87]
- Can be painful.[88]

Conservative sharp wound debridement

Conservative removal of loose, tissue in a wound using sharp sterile scissors or scalpel.[89, 90]

Advantages

- Fast and effective
- Can be used when appropriate with other methods of debridement
- Inexpensive.

Disadvantages

- Requires specialised and skilled clinician
- Increased pain for the patient [90]
- Requires access to sterile, sharp instruments.[89]

Surgical debridement

A definitive procedure performed by a medical practitioner under anaesthetic and aseptic conditions, in a designated treatment facility using sterile sharp instrument including Braithwaite Knife™, dermatome or Versajet™.[28, 91]

Advantages

- Maximises debridement with asepsis when performed in sterile working environment (i.e. operating theatre)
- Appropriate when burns are deep and extensive.

Disadvantages

- Often results in loss of some viable tissue surrounding excised eschar, and excess blood loss [92]
- Potential associated risks of a general anaesthetic for the patient
- Potential for increased pain for the patient post-operative.

Other clinical indications for wound debridement

- Wound bed preparation prior to application of a temporary skin substitutes (e.g. Biobrane™); biosynthetic or synthetic dressings that require minimal dressing change and provide a moist wound environment.[93, 94]
- The presence of necrotic, devitalised, biofilms or infected tissue that is inhibiting healing.[3, 93, 95]

Considerations

Caution is required for some patients.[86] Check with the medical team when patients have:

- diabetes
- peripheral vascular disease
- immunosuppression
- thrombocytopenia
- risk of bleeding due to impaired clotting disorders.

For burns to the scalp and excessively hairy areas the area should be shaved.[24]

Exudate management

- Burn wound exudate is dependent on a number of factors present in the burn wound at various stages of healing.[2]
- Ongoing exudate management varies depending on the stage of wound healing, the depth of burn, and the wound management plan. The aim of exudate management is to create an optimal moist wound environment to promote burn wound healing.[3, 28, 96]
- There are several phases of burn wound exudate. Initially, exudate provides moisture that is essential for wound healing and wound re-modelling. Ongoing wound exudate is responsible for removing damaged cells (metabolites) from the wound interface. Prolonged unmanaged exudate can extend the inflammatory period and delayed wound healing.[2]
- In the first 24hrs, exudate from the wound will be high due to capillary leakage, inflammation and large molecule transport across the interstitium.[2]
- Management of exudate is based on a balance between maceration and desiccation.[2, 96]
- Wound product selection to manage exudate should have qualities of absorption, leakage prevention, maceration reduction at the wound interface, and have the ability to hold exudate under compression.[79, 96]

Infection issues

- Burn wounds are an excellent medium for bacterial contamination, colonisation and localised infection which may spread, resulting in systemic infection.[97]
- Prophylactic antibiotics are not routinely given to burn patients as they do not reduce the risk of infection and may lead to multi resistant organisms.[98]
- **Antibiotics are only given to patients with known infections and are prescribed to sensitivities. Consultation with the infectious diseases team is strongly recommended.**
- In the initial post-burn stage the patient may experience febrile periods. These do not necessarily indicate infection, although they should be monitored. Febrile episodes are often related to the release of large amounts of pyrogens resulting from the initial injury.[99]

Management of blisters

Blisters may be observed in dermal thickness burns, from superficial to deep dermal.[71] Blisters are a result of inflammatory changes that increase capillary permeability allowing oedema formation between the epidermis and the dermis.[94] Blisters are formed when there is separation of the epidermal and dermal layers, often, but not always, with fluid present.

If blisters are present in the burn wound decisions on how to manage must be considered. The management of blisters is generally guided by specialist clinician or institutional preference and has historically included three main options; debride completely, leave intact or incise and drain the fluid leaving the blister skin intact.[28] To date there has been no universal standard among burn clinicians to debride or not to debride blisters. Arguments for preserving the blister is that it creates its own biological protection thus leaving it will reduce the risk of infection and cause less pain. The arguments in favour of debridement or aspiration of blister fluid focus on the components of the fluid being detrimental to healing and that there is an infection risk with leaving the devitalised blister roof on. Also included in the argument for debriding is the ability to visualise the wound bed, and remove necrotic tissue that may cause infection.[71] Some practitioners prefer to debride blisters that are broken, fragile, are on flexor surfaces or incise the blister due to the fluid causing pressure and pain.[24, 28, 94]

Blister consensus

In NSW it has been noted that for the non-burn clinician there may be conflicting recommendations which can lead to confusion on the best management plan. Thus the ACI Statewide Burn Injury Service (SBIS) developed a Minor Burn Blister Consensus document. This document states that the recommended management for minor burn blisters is 'de-roofing' (removal of skin and fluid) if the clinician has the skill and resources such as adequate pain relief and appropriate dressing. This option allows the assessment of the burn wound bed.[71] If skills and or resources are not available, or blisters cover large areas of the body it is recommended to contact the burn unit for advice.

Rationale for de-roofing

- Remove non-viable tissue.
- Prevent uncontrolled rupture of blister.
- Avoid risk of blister infection.
- Relieve pain in tense blisters.
- Reduce restriction of movement of joints.

Procedure for de-roofing blisters

- Obtain consent from the patient/family.
- Administer appropriate analgesia and allow time to take effect prior to procedure.
- Take digital image before and after de-roofing procedure if possible.
- Burn blisters ≤5mm can be left intact.
- Burn blisters >6mm should be:
  - **de-roofed** either with moist gauze (for thin-walled) or forceps and scissors (for thick–walled)
  - **dressed** appropriately with a non or low–adherent dressing (see Clinical Practice Guidelines: Burn Wound Management for specific dressing information)
  - **referred** to local emergency department or burns service if your facility does not have the resources to de-roof blisters.

Considerations

Consideration should be given to:

- the risk or benefit of removing blister skin when infection may occur (i.e. in remote area)
- the risk or benefit of 'de-roofing' blisters on the palmar surface of the hand and the plantar aspect of the foot
- patient compliance with the procedure and on-going care when considering the management of small, non-tense blisters i.e. patients with dementia, learning difficulties, etc.

Optimise patient comfort, safety and privacy

- Provide adequate pain relief before, during and after debridement (procedural pain relief, back ground pain relief).
- Obtain consent.
- Provide patient education.

Use infection control strategies

Maintain asepsis and universal precautions; safely dispose of sharps and wastes.[94, 100]

Digital photograph of the burn wound

Digital photography is now used throughout NSW to gain information about the burn wound sustained. This helps recognise the need for transfer, admission or just consultation. Digital photography helps to enhance communication between the burns team and the referral centre and allows for more effective communication.[65]

- The patient should be given adequate explanation of the procedure and sign a consent prior to any photographs being taken.[101–103]
- Take numerous pictures, with and without flash if necessary, extras can be deleted when downloading.[102, 104, 105]
- It is possible to email digital photographs of burn wound to burn units. Contact must be made between referring and accepting medical or nursing staff. Photographs must be taken in accordance with appropriate guidelines and must be accompanied by injury history and consent. [101, 102, 106]

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- **Australian New Zealand Burn Association**
  www.anzba.org.au
- **Journal of Burn Care & Research**
  www.burncareresearch.com
- **International Society for Burn Injuries**
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