REFERENCE: 16/4
ENQUIRIES: Dr EH Engelbrecht

To all Service Deputy Director Generals/ Chief Directors/ Directors/ Heads of Institutions/ Deans of Health Sciences Faculties/ General Specialist Heads Metro & Rural

CIRCULAR NO OF 2011

CLINICAL GUIDELINES FOR THE MANAGEMENT OF BURN WOUNDS

1. Aim of the policy:
   • A Provincial Policy guideline on the clinical management of burn wounds.

2. Implementation:
   • This guideline is for immediate implementation
   • Implementation support will happen from General Specialist Heads in Surgery and Prof H Rhode, an expert in the field.

3. Development of the Policy:
   • Inputs by Prof H Rhode, Dr Albie vd Merwe, General Specialist Heads and other experts such as Prof A Millar, spearheaded by Dr Stephan Fourie.

The Clinical Guideline was endorsed by Provincial Co-Ordinating Committee for Surgery and the Departmental Interdivisional Management Committee.

HEAD: HEALTH
DATE: 17 June 2011
Burn wounds - Determining the size and type degree

Determining surface area of burn

[ RULE OF 9’S ]

ANTERIOR

4.5%  9%  9%  9%  9%  9%  9%

INFANT

4.5%  9%  18%  9%  9%  9%  9%

POSTERIOR

4.5%  9%  9%  9%  9%  9%  9%

PALMAR METHOD
(Patient’s palm)

(Open hand only for small burns)
Burn depth

Most burns are a combination of superficial and deeper burns and the best assessment is made 3 to 4 days after the injury when wound evolution is complete.

1. **Superficial partial thickness: destruction of only superficial layers of the skin.** These wounds will re-epithelialise spontaneously within 3 weeks; excision is contraindicated and the wounds rarely cause functional or cosmetic defects or hypertrophic scars. They characteristically have an erythematous, moist, homogeneous surface with blister formation, are painful and hypersensitive to touch, blanch readily on pressure and have a normal to firm texture on palpation.

2. **Indeterminate depth (deep dermal burn): destruction of epidermis and varying amounts of dermis.** These wounds are difficult to assess during the first 3 to 4 days after injury due to the ongoing evolution within the burn wound, which can be modulated by infection and dehydration. These wounds present with a reticulated red, white, dry surface and may blister. Capillary circulation may be sluggish or absent when pressure is applied to the wound. Wound pain is perceived as discomfort and the wound is often less sensitive to pinprick than the surrounding normal skin. The healing time for these wounds may be variable and may require several weeks leading to severe hypertrophic scarring.

3. **Unequivocally full thickness: total irreversible destruction of all elements of the skin with or without extension into the deeper tissues and structures.** These wounds will not heal spontaneously within 3 weeks and have unsatisfactory functional and cosmetic results. There is general consensus that the best treatment entails early eschar excision and immediate grafting. These wounds may mimic the appearance of an indeterminate burn and are usually mottled, white, red or charred and dry in appearance, insensitive to pain and leathery to palpation. Blisters are unusual and if present are thin walled and do not enlarge. Clotted superficial vessels may be visible. The appearance of the burn remains static with little change over the ensuing days.
PROTOCOL for Emergency Treatment of a Burn:

1. **Assess airway/breathing**
   (a) Careful airway assessment of both flame and scald burns to face and neck. Intubation is generally only necessary for unconscious patients, hypoxic patients with severe smoke inhalation, or patients with flame or flash burns involving face and neck. Indications include: pharyngeal burns, air hunger, stridor, carbonaceous sputum with hoarseness and any of the above.
   (b) All major burns must receive high flow oxygen for 24 hours
   (c) Carbon monoxide may present as restlessness, headache, nausea, poor coordination, memory impairment, disorientation, or coma. Administer 100% O$_2$ via non-rebreathing face mask.
   **Useful lab:** Blood gases with carboxyhaemoglobin level.
   (d) If breathing seems to be compromised by tight circumferential trunk burns an escharotomy must be performed urgently.

2. **Circulation**
   (a) Stop any external bleeding.
   (b) Identify potential sources of internal bleeding.
   (c) Establish large bore IV lines and provide resuscitation bolus fluid if required in all compromised patients. Perfusion of potentially viable burn wounds is critical.

3. **Remove any sources of heat**
   (a) Remove any clothing that may be burned, covered with chemicals or are constricting.
   (b) Cool any burns less than 3 hours old with cold tap water for at least 30 min and then dry the patient.
   (c) Cover patient with clean dry sheet or blanket to prevent hypothermia.
   (d) Use of Burnshield® is a very effective means for cooling and dressing for the first 24 hrs.
   (e) Rings and constricting garments must be removed.

4. **Estimate percent total body surface area burned (%TBSA)**
   (a) Initially, use Rule of Nines; for all pediatric patients and for a more accurate assessment, use attached Berkow diagram or patients outstretched open hand representing 1%

**Reminder:** Accurate estimation of burn size is critical to ongoing fluid replacement and management
5. Ongoing losses (once the patient has been stabilised). Resuscitation must be commenced within two hours of injury
   (a) Burns <10% can be resuscitated orally, unless the patient has an electrical injury or associated trauma. This needs ongoing evaluation and still may require an IV line.
   (b) For 10 to 40% burns, secure a large bore IV line; add a second if the transport will be longer than 45 minutes.
   (c) Burns >40% require two large bore IV lines.
   (d) If the transfer will be less than 30 min. from the time of call, don’t delay transfer for an IV line.

**Reminder:** IVs may be placed through a burnt area if necessary (suture to secure). Avoid saphenous vein if at all possible; avoid cut-downs through unburned skin if possible. Intravenous is an excellent alternative in the hypovolaemic child.

(e) Initiate fluids for ongoing resuscitation and fluid losses:

**Parkland formula:**

\[3-4\text{ml Ringers lactate} \times \text{kg body weight} \times \text{% burn} = \text{mls in first 24 hours}\]

with half of this total given in the first 8 hours post injury. Children must have their daily maintenance fluids added to the volume of fluids calculated by the Parkland formula (including dextrose). Glucose must be added to Ringer’s lactate in children weighing less than 20kg.

**Example:** Patient weighing 70kg with a 50% burn: \((4 \times 70 \times 50) = 14,000\text{ml needed in first 24 hours.} \) \(7000\text{mls are needed in the first 8 hours (calculated from the time of burn injury) so IVs are initially started at 900mls/hour.}\)

**Reminders:**
- Do not give dextrose solutions (except for maintenance fluids in children) – they may cause an osmotic diuresis and confuse adequacy of resuscitation assessment. Ideally use Ringers Lactate or Plasmalyte B for ongoing fluid losses and a 5% dextrose balanced salt solution for the child’s maintenance.
- This is only a guide and ongoing evaluation is essential, patients may need more fluids than calculated.

6. Assess urine output (this is the best guide to resuscitation)
   (a) Insert Foley catheter in patients with burns >15% TBSA. Adequate urine output is \(0.5\text{ml} - 1/\text{kg/hr}\) in adults and \(1\text{ml/kg/hr}\) in children.

**Reminder:** Lasix and other diuretics are never given to improve urine output; fluid rates are adjusted to increase urine output.
(b) Observe urine for burgundy colour (seen with massive injuries or electrical burns). There is a high incidence of renal failure associated with these injuries, requiring prompt and aggressive intervention.

**Reminder:** If the urine is red or brown **CONSULT BURN CENTRE.**

7. Insert nasogastric tube
   (a) Insert nasogastric tube in any patient who is unresponsive, shocked or with burns >20% if preparing for air or long distance transport.

8. Decompression incisions (Escharotomy)
   Assess for circumferential full-thickness burns of extremities or trunk. Elevate burned extremities on pillows above level of the heart. If transfer will be delayed, discuss with a burn surgeon indications and methods for decompression incisions (escharotomies). If an escharotomy is required, do not delay the procedure.

9. Medications
   (a) Give tetanus immunization.
   (b) After fluid resuscitation has been started, pain medication may be titrated in small intravenous doses (not intramuscular). Blood pressure, pulse, respiratory rate and state of consciousness should be assessed after each increment of IV morphine.

10. Wound care during transport
    (a) Debridement and application of topical antimicrobials is usually unnecessary; transport patient wrapped in dry sheet, blanket or cling wrap and keep the patient warm.
    (b) Apply a thin layer of Silver Sulfadiazine to open areas if transport will be delayed longer than 12 hours.
    (c) Use of Burnshield® is a very effective means for cooling and dressing for the first 24 hr.

11. General items
    (a) A history, including details of the accident and pre-existing diseases/allergies, should be recorded and sent with the patient.
    (b) Annotate the burn wound in TBSA and depth.
    (c) Copies of all medical records, including all fluids (calculations of fluids) and medications given, urine outputs and vital signs must accompany the patient. These specific details may be recorded on the back of the burn size assessment sheet.
    (d) The Burn Centre will arrange transport if appropriate.
    (e) In case of paediatric patients not accompanied by a parent get consent in consultation with your burn centre.
12. **Special considerations with chemical burns – Consult Burn Centre!**  
   (a) Remove ALL clothing.  
   (b) Brush powdered chemicals off wound; then flush chemical burns for a minimum of 30 minutes or until all pain has disappeared, with copious volumes of running water. Be careful to protect yourself.  
   
   **Reminder:** *Never neutralize an acid with a base or vice versa.*  
   (c) Irrigate burned eyes with a gentle stream of saline. Follow with an ophthalmology consult if transport is not imminent.  
   (d) Determine what chemical (and what concentration) caused the injury.  

13. **Special considerations with electrical injuries – Consult Burn Centre!**  
   (a) Differentiate between low voltage (below 1000v) and high voltage (>1000v)  
   (b) Attach cardiac monitor; treat life-threatening dysrythmias as needed.  
   (c) Assess for associated trauma; assess central and peripheral neurologic function.  
   (d) Administer Ringer’s lactate; titrate fluids to maintain adequate urine output or to flush pigments through the urinary tract (see urine output above).  
      **Useful lab:** ABG with acid/base balance.  
   (e) Elevate burned extremities above the level of the heart on pillows. Monitor distal pulses.  

14. **Local Care**  
   The burn wound is carefully assessed for extent and depth and then treated topically with an antiseptic/antibacterial agent as a prophylactic or therapeutic measure against burn wound colonisation and burn wound infection.  
   (a) The burn wound is washed with water and soap or with chlorhexidine solution and then covered with the selected topical agent. Grease and road contamination can be removed by the application of petroleum jelly. A closed burn wound technique is used and the topical agents chosen according to burn unit protocol.  
   (b) Frequently used topical agents include silver sulphudiazine (changed daily), povidine iodine (changed daily), Mupirison with or without Chlorhexidine (changed daily) and a nanocrystalline dressing (Acticoat) changed every 3 days.  

15. **Wound Cleansing – Hydrotherapy and Versajet**  
   The initial burn wounds can be washed with soap and water or Chlorhexidine or can be debrided under anaesthesia.
Transportation of the burned patient

- Ensure airway is safe.
- Transport as soon as possible to reach destination within 4 to 6 hours.
- Intravenous (IV) fluid therapy should be commenced.
- Ensure IV lines are reliable, especially if long journey. Secure lines with sutures if necessary.
- Transfer children only after fluid resuscitation has commenced, measures to maintain temperature have been instituted and the wound protected.
- Transfer with dry dressings or cling film, not wet towels.
- Arrange appropriate escort.
- Oxygen should be administered to all major burns or when carbon monoxide poisoning is suspected.
- Administer adequate analgesia.
- Infection prophylaxis: tetanus immunisation. Defer antibiotics if for burns only.
- Provide a full and complete record to the receiving service/clinician:
  - Medication given: dosage and route
  - Dressings
  - Fluids administered: type, volume and time of commencement
  - Urine output: catheterisation for accuracy
  - Procedures performed, if any
  - Contact details of relatives
  - Name and contact details of referring person

Special Considerations:

Circumferential Burns: assess distal circulation, remove jewellery. Evaluate for escharotomies as necessary. Contact the regional burn centre for further instructions.

High Voltage Electrical Injuries: suspect myoglobinuria or haemoglobinuria. Keep urine output at 100ml/hr and urine alkaline. Place on cardiac monitor. Record ECG. Suspect compartmental syndrome, consider fasciotomies. Contact the regional burn centre for further instructions.
REFERRAL CRITERIA/GUIDELINES FOR TRANSFER TO BURNS CENTRE/HIGHER FACILITY

- Partial thickness (2°) and full thickness burns (3°) > 10% total body surface area (TBSA) in patients under 10 and over 50 years of age
- Partial thickness (2°) and full thickness (3°) burns >20% TBSA in other age groups
- Full thickness (3°) burns >5% (TBSA) in any age group
- Burns to the face, hands, feet, genitalia or major joints
- Electrical (including lightning), Chemical or Inhalation burns
- Patients with pre-existing medical disorders compromising outcome
- Patients with burns and concomitant trauma
- Patients requiring extensive social, emotional or long-term rehabilitation support
- Paediatric burns without qualified personnel or equipment

Associated co-morbidity and injuries may complicate any burn and the patient needs to be carefully considered and the injuries be treated according to clinical needs. Before any transfer please consult with the receiving hospital unit.

1. Entry criteria for Level 3 burns centre:

These are complex burns.

a. Age under 2 and over 60 years.

b. TBSA:

- All partial thickness burns >15% TBSA in children.
- All partial thickness burns >25% TBSA in adults.
- All full thickness burns >15% TBSA.

c. Anatomical site:

- Face, Hands, Feet, Genitalia, Perineum, major joints, circumferential burns. These burns could also be dealt with at level 1 or 2 but discretion must be used.

d. Inhalational injury requiring ventilation for more than 48 hours.

e. Mechanism of injury

- Exposure to ionizing radiation injury
• High pressure steam injury
• High tension electrical injury (>1000 Volts)
• Hydrofluoric acid injury >1% TBSA
• Suspicion of non-accidental burn injury: paediatrics and adults

f. Existing Co-morbidity:
• Cardiac limitation and/or MI within 5 years
• Respiratory limitation of exercise
• Uncontrolled type 1 diabetes
• Pregnancy
• Medically or disease induced immune-suppression for any reason
• Existing psychiatric or suicidal tendencies
• Suspected drug/alcohol abuse

g. Severe associated injuries e.g. polytrauma and crush syndrome

Burns that may qualify for Level 2 care:
  a. Partial thickness burns of up to 25% TBSA in adults and up to 15% in
  b. Children older than 2 years
  c. Full thickness burns less than 10-15% TBSA in both adults and children excluding critical areas.
  d. Burns that require debridement, skin grafting and dressing changes.
  e. Inhalational burns requiring ventilation support for less than 48 hours.

16. Burns that may qualify for Level 1 care:

These are non-complex injuries.

  a. A uncomplicated minor burn is:

    Partial thickness burn < 15% TBSA
    Full thickness burn <5% TBSA
b. Depending on the expertise of the available staff, additional criteria may include:

- Minor inhalational injury
- Electrical burns <400 Volts
- Minor burns in anatomically important sites
- Manageable and stabilised co-morbidities
- Surgery: debridement, skin grafting, dressing changes

The quality of care at this level can be substantially improved by the development of clinical guidelines and educational programmes (e.g. EMSB Course). These programmes should also be made available to the Emergency and Ambulance Services to standardized burn care at pre-hospital and HPC levels. There is unfortunately no published information available on the outcome of burns treated at community level.

### Dosing schedule of simple analgesics

<table>
<thead>
<tr>
<th>Drug</th>
<th>Route of administration</th>
<th>Dose</th>
<th>Time to peak effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paracetamol</td>
<td>Oral</td>
<td>20 mg/kg</td>
<td>100–120 minutes</td>
</tr>
<tr>
<td></td>
<td>Rectal</td>
<td>40 mg/kg</td>
<td>60–240 minutes</td>
</tr>
<tr>
<td></td>
<td>Intravenous</td>
<td>15 mg/kg</td>
<td>50 – 60 minutes</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>Oral</td>
<td>10 mg/kg</td>
<td>120–240 minutes</td>
</tr>
<tr>
<td>Diclofenac</td>
<td>Rectal</td>
<td>1–1.5 mg/kg</td>
<td>30–45 minutes</td>
</tr>
<tr>
<td>Ketorolac</td>
<td>Intravenous</td>
<td>0.5 mg/kg</td>
<td>60–120 minutes</td>
</tr>
</tbody>
</table>

### Dosing schedule of Tilidine

<table>
<thead>
<tr>
<th>Dose</th>
<th>Time to peak effect</th>
<th>Duration of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mg/kg*</td>
<td>45 minutes</td>
<td>4–6 hours</td>
</tr>
</tbody>
</table>

### Dosing schedule of Clonidine

<table>
<thead>
<tr>
<th>Dose</th>
<th>Onset of action</th>
<th>Time to peak effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 5 μg/kg</td>
<td>20 – 40 minutes</td>
<td>60 minutes</td>
</tr>
</tbody>
</table>
Dosing schedule of Ketamine

<table>
<thead>
<tr>
<th>Route of administration</th>
<th>Dose</th>
<th>Onset of action</th>
<th>Time to peak effect</th>
<th>Duration of action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sedation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral</td>
<td>6–10 mg/kg</td>
<td>&gt; 5 minutes</td>
<td>30 minutes*</td>
<td>4–6 hours</td>
</tr>
<tr>
<td>Intravenous (bolus)</td>
<td>0.25–1 mg/kg**</td>
<td>&lt; 1 minute</td>
<td>3–5 minutes</td>
<td>10–15 minutes</td>
</tr>
<tr>
<td>Intravenous (infusion)</td>
<td>0.5–1 mg/kg/ hour***</td>
<td>&lt; 1 minute</td>
<td>3–5 minutes</td>
<td>10–15 minutes</td>
</tr>
<tr>
<td>Intramuscular</td>
<td>2–4 mg/kg</td>
<td>2–5 minutes</td>
<td>20 minutes</td>
<td>30–120 minutes*</td>
</tr>
<tr>
<td>Rectal</td>
<td>4–6 mg/kg</td>
<td>&gt; 5 minutes</td>
<td>30 minutes*</td>
<td>30–120 minutes*</td>
</tr>
<tr>
<td><strong>Analgesia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral</td>
<td>4–6 mg/kg</td>
<td>&gt; 5 minutes</td>
<td>30 minutes*</td>
<td>4–6 hours</td>
</tr>
<tr>
<td>Intravenous (infusion)</td>
<td>0.15–0.3 mg/ kg/hr</td>
<td>&lt; 1 minute</td>
<td>3–5 minutes</td>
<td>15 minutes</td>
</tr>
</tbody>
</table>

Profile of Topical Antimicrobials

<table>
<thead>
<tr>
<th>Agent</th>
<th>Application</th>
<th>Eschar Penetration</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hypochlorite</td>
<td>20–30 min</td>
<td>Surface action</td>
<td>Bacteriocidal</td>
</tr>
<tr>
<td>Silver sulphadiazine</td>
<td>12 hourly</td>
<td>Limited</td>
<td>Bacteriocidal</td>
</tr>
<tr>
<td>Povidone Iodine</td>
<td>6 hourly</td>
<td>Limited</td>
<td>Bacteriocidal</td>
</tr>
<tr>
<td>Mupirocin</td>
<td>Daily</td>
<td>Excellent</td>
<td>Bacteriocidal</td>
</tr>
<tr>
<td>Chlorhexidine</td>
<td>Daily</td>
<td>Surface action</td>
<td>Bacteriocidal</td>
</tr>
<tr>
<td>Nano-silver</td>
<td>3–4 days</td>
<td>Excellent</td>
<td>Bacteriocidal</td>
</tr>
<tr>
<td>Bactigras</td>
<td>48 hours</td>
<td>Limited</td>
<td>Bacteriocidal</td>
</tr>
</tbody>
</table>