
CLINICAL PRACTICE STANDARD — Aeromedical Operations
AO.CLI.08 – Major Burns

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| Contents | Clinical Practice Standard AO.CLI.08 - Major Burns |
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1. Introduction

Major burns, whilst uncommon injuries, pose significant clinical challenges in the pre-hospital environment, as well as during inter-hospital retrievals. The NSW Burn Transfer Guidelines give specific criteria for consideration of medical inter-hospital retrieval following major burns.¹ The NSW Institute of Trauma and Injury Management (ITIM) App collates this current consensus practice and includes sanctioned algorithms, calculators, guidelines and other useful resources.²

2. Purpose

The purpose of this procedure is to outline the pre-hospital and inter-hospital assessment and management of patients with major burns.

3. Procedure

3.1 Scene Safety

- In pre-hospital missions, **ensure the scene is safe before you access the patient**. If possible identify and directly communicate with the scene Fire Commander.
- If immediate first aid has not been applied, then the burnt area should be immersed in cool running water. The ideal temperature is 15°C.¹ Apply for 20 minutes, within the first three hours of injury.¹ Most patients with large areas of major burns have already had vigorous first aid applied when we arrive and are shivering and at risk of hypothermia which must be prevented- **Cool the burn and Warm the patient**.
- Such patients should have wet dressings (including Hydrogel) removed and their injured skin protected from air currents and further injury. Polyethylene film, eg. GladWrap™ is the preferred dressing.^{1,3}
- Keep the patient warm with active warming blanket and environmental heating where possible with all fluids warmed using the MEQU fluid warmer.

3.2 Assessment

Percentage of Burnt Surface Area (BSA) can be calculated using the “Wallace Rule of 9’s”, a Lund and Browder Chart, or using “palm of patient’s hand (including fingers) = 1%”.^{1,3} The NSW ITIM App has approved burn calculators to assist with injury assessment.² Remember that superficial burns with erythema only are not included in these calculations.^{1,3} It is essential to log roll the patient to assess the entire body surface for burns.

3.3 Airway Burns

- Airway burns can rapidly progress to airway obstruction and airways at risk after thermal injury should be anticipated and treated early.³
- Inhalational injury is a serious consequence of major burns and is much more common when combustion or explosion occurs in enclosed spaces.⁵
- Clinical indicators suggesting upper airway thermal burn include:^{1,5,6}
 - Head, facial and neck burns (especially full thickness) with increased swelling
 - Intraoral burns
 - dysphonia or stridor
- Indicators suggestive of inhalational injury:^{1,5}
 - Mechanism- confined area explosion/combustion
 - carbonaceous sputum
 - respiratory distress
 - hypoxia.
- Always consider concomitant trauma particularly following explosions, electrical injuries or falls from height.
- Consider inhalational asphyxiants such as carbon monoxide or cyanide poisoning in patients with unexplained coma or shock, especially with normal SpO₂.

3.4 Indications for Intubation

- Signs or symptoms suggesting thermal burn to airway.
- Signs or symptoms suggesting inhalational injury.
- Agitated, combative or patients with decreased level of consciousness.
- Major burns (40%) on humanitarian grounds.
- Decision making should take into account the time/distance required for transfer as well as the volume of intravenous fluids administered prior to the arrival of the team.

3.5 Management

3.5.1 Dressings:

- Polyethylene film is the ideal out-of-hospital burns dressing for major burns involving large areas as it protects the skin, reduces pain due to air currents, reduces fluid loss and allows repeated wound inspection.^{1,4} Avoid circumferential dressing.¹
- Hydrogel dressings are appropriate for small areas only and should be avoided in major burn patients.
- Soft paraffin is an alternative dressing for facial burns.¹ For practical purposes apply paraffin after airway interventions are completed.

3.6 Analgesia

- Intravenous (IV) access through burnt skin can be difficult. Consider early intra-osseous (IO) access.
- Despite severe and life-threatening injuries most patients with major burns are fully alert and conscious. Adequate analgesia and/or sedation is mandatory.
- Intranasal fentanyl and intramuscular/intranasal ketamine may be useful adjuncts before obtaining intravascular or intrasosseous access.
- Once IV/IO access is obtained, analgesia is best facilitated by a combination of IV opioids (fentanyl/morphine) with ketamine⁷ in small titrated boluses.
- Large doses of these agents may be needed, and an infusion is usually the best way to provide a steady level of analgesia. The intubated, paralysed patient must be carefully and serially examined for signs of pain and awareness (lacrimation, pupillary mydriasis, tachycardia or hypertension).⁷

3.7 RSI

- If signs of an airway thermal injury or inhalation injury suggest the need for rapid sequence intubation then this should be done early, before anatomical distortion makes orotracheal intubation difficult or impossible.⁴
- Provided that there is no mechanism of injury to suggest trauma, consider pre-oxygenation with the patient sitting up and using a pillow or folded towel to raise the occiput.
- The largest tracheal tube possible should be inserted to facilitate pulmonary toileting in ICU.⁴ (Smaller ETT's however should be readily available in case of difficulty with RSI).
- Preparation for a difficult airway should be thorough and include preparation for a surgical airway. In full thickness burns, limiting neck movement or mouth opening then a primary surgical airway may be considered as the primary means of securing the airway.

3.8 Escharotomy

- Escharotomy involves incision of inelastic burned tissue (eschar) that can impair perfusion of the extremities, as well as restrict chest wall movement and ventilation.
- Escharotomies may be necessary on patients with circumferential full thickness (or near circumferential full thickness) burns to the chest, neck, limbs or digits.⁸
- As to whether escharotomies should be performed by the HEMS physician, in the prehospital setting, the Duty Retrieval Consultant (DRC) should be contacted to assist in decision-making. On interhospital missions, a discussion with the Statewide Burns Injury Service or receiving Burns Centre should be requested via ACC. Other aspects of the critical care of these patients can also be discussed during this call.
- **Limb escharotomy** is rarely necessary within four (4) to six (6) hours following a burn injury regardless of the severity of burn injury.⁸ They should be performed when distal perfusion is impaired or threatened due to circumferential full thickness (or near

circumferential full thickness) burns unresponsive to simple elevation. If needed, incisions should be made laterally avoiding neurovascular bundles and be deep enough to release the tissues (Appendix 1).

- **Chest Escharotomy** is more time critical and should be performed when there is difficulty ventilating the patient with full thickness chest or upper abdominal wall burns. It should be performed in the midclavicular or anterior axillary line as well as midline longitudinally and joined with horizontal incisions to allow adequate chest excursion (Appendix 1).
- The incisions must be deep enough to “release” burnt tissue – this usually means a deep enough incision to reach fat. Bleeding is a common consequence of effective escharotomy.
- There is no role for prophylactic antibiotics or steroids.⁹

3.9 Performing Escharotomy¹⁰

3.9.1 Preparation and planning

- Assess patient thoroughly to ensure indications are met.
- Prehospital mission: call DRC to share decision-making.
- Interhospital mission: call receiving Burns Centre via ACC.
- Ensure suitable PPE and plan ahead for fluid containment and dressings eg Kaltostat.

3.9.2 Procedure:

- Ensure limb is in anatomical position (forearm supinated).
- Draw a line where the incision will be made as per diagram in Appendix 1.¹⁰.
- Prepare area with chlorhexadine or non-alcoholic Betadine™.
- Cut using scalpel (or diathermy) along lines as above
- For limbs release both medial and lateral sides.
- For chest release bilateral mid axillary lines and inferior transverse elliptical below costal margin joining vertical incisions.
- Re-assess post procedure: ventilation for chest distal perfusion for limb escharotomy.

3.9.3 Cautions:

- Identify and avoid important structures, ie. ulnar nerve and common peroneal nerve; and neurovascular bundle of the digits (which run both ulnar and radial side of fingers on the palmar surface side upper third of finger when palm up).
- Ensure incision is skin deep seeing only fat in the base of wound (not muscle, it is *not* a fasciotomy).

- Ensure adequacy of release by running finger along wound and determine that there are no residual tight bands of tissue.
- Extend the escharotomy above and below the burn into healthy unburnt skin where possible. Use local anaesthetic for the unburned skin
- If available, dress the wound with an alginate type dressing eg Algisite™ or Kaltostat™.

3.10 Fluid Resuscitation

3.10.1 Pre-hospital:

If burn >20% BSA (adults) or 10% BSA (children), then initiate fluid therapy pre-hospital¹. Shock (due to a combination of fluid shifts, systemic inflammatory response and impaired cardiac output) peaks at about 12 hours. Over-resuscitation should be avoided until definitive airway management but thereafter the Modified Parkland Formula provides good estimate of fluid needs¹¹

3.10.2 Inter-hospital:

If burn >20% BSA (adults) or 10% BSA (children), then initiate fluid therapy using the Modified Parkland Formula (3mL/kg X %BSA burned, over 24 hours with half given in first eight (8) hours using Ringer's Lactate/Hartman's solution). This is in addition to normal maintenance requirements.¹

Individual patient's fluid needs can vary greatly and a useful end point to aim for is a stabilization of deteriorating vital signs and an hourly urine output of >0.5mL/kg/hr in adults (> 1.0mL/kg/hr in paediatric patients).^{1 4 11}

4. Disposition

- As noted in HELI.CLI.13 - Pre-Hospital Trauma Triage, patients with major burns should be triaged to one of the two adult burns centres – Royal North Shore Hospital (RNSH) or Concord Hospital. If the patient has a mechanism of injury suggestive of any trauma, then they should be primarily transported to RNSH.
- Paediatric (<16yo) major burns should be transported to The Children's Hospital at Westmead.

5. References

- ¹ NSW Burn Transfer Guidelines - Statewide Burn Injury Service – 4th Edition. Version: 2. Trim: ACI/D17/4419. Date Amended: May 2022. Next Review: 2025. ACI_5875 [05/22].
- ² NSW Institute of Trauma and Injury Management (ITIM) App
- ³ Hettiaratchy H. Initial management of a major burn: I—overview. BMJ 2004;328:1555- 1557.
- ⁴ Hettiaratchy H. Initial management of a major burn: II—assessment and resuscitation. BMJ 2004; 329(7457): 101–103.
- ⁵ Endorf, F, Gamelli R. Inhalation Injury, Pulmonary Perturbations, and Fluid Resuscitation. J Burn Care Res 2007;28:80–83.
- ⁶ Haponik EF, Meyers DA, Munster AM, Smith PL, Britt EJ, Wise RA, Bleecker ER. Acute upper airway injury in burn patients. Serial changes of flow-volume curves and nasopharyngoscopy. Am Rev Respir Dis. Am 1987 Feb;135(2):360-6.
- ⁷ Mehmet C. Ketamine May Be the First Choice for Anesthesia in Burn Patients J Burn Care Res 2006 27 (5): 760-2.
- ⁸ Orgill D, Piccolo N. Escharotomy and Decompressive Therapies in Burns. J Burn Care Res 2009;30:759–768.
- ⁹ Tomer A, Levcovich A, D Ad-EI D,Leibovici L, Paul M. Prophylactic antibiotics for burns patients: systematic review and meta-analysis. BMJ 2010 340: c241.
- ¹⁰ Escharotomy for Burns Patients – Statewide Burn Injury Service – 2nd Edition. Version: V2.0. Date Amended: June 2019. Next review: 2024. Trim: ACI/D19/1969 ACI_0265 [07/19].
- ¹¹ Saffle J. The Phenomenon of “Fluid Creep” in Acute Burn Resuscitation. J Burn Care Res 2007;28:382–395.

APPENDICES

1. Appendix 1 - Recommended Incision Sites For Escharotomy.

REVISION HISTORY

| Version (Document #) | Amendment notes |
|---|---|
| Version 6.0 | <ul style="list-style-type: none"> More explicit instruction around who to call for escharotomies: prehospital call the DRC, interhospital call the receiving Burns Centre or SBIS. Re-emphasised the more emergent nature of chest escharotomy compared to limb escharotomy that can often be deferred A reminder to re-assess for end points post procedure Reviewed by NSW StateWide Burn Injury Service |
| Version 5.0 | <ul style="list-style-type: none"> Added references to ITIM App Calculators Addition of clarification of first aid from NSW Burns Transfer Guideline Minor changes to indicators of airway and inhalational injury to align with NSW Burns Transfer Guideline Dressings amendment to align with NSW Burns Transfer Guideline and additionally to avoid practical problems with hydrogel and paraffin application prior to patient stabilisation Minor contextual changes to escharotomy explanation MRU changed to ACC Fluid resuscitation guidance altered to align with NSW Burns Transfer Guideline Urine output guidance altered to align with NSW Burns Transfer Guideline |
| Version 4.0 Issued 16 October 2019 | <ul style="list-style-type: none"> Modified Parkland Formula updated to latest NSW Health Burns Guideline (3ml/Kg x %TBSA) Need for increased fluid requirements in inhalational injury removed as latest NSW Health Burns Guideline omits it. |
| Version 3.0 Issued 16 September 2016 | <ul style="list-style-type: none"> Minor amendments, including reference to Senior Retrieval Consultant (SRC) changed to Duty Retrieval Consultant (DRC). Transition to new format. <p>Approved by Executive Director, Health Emergency & Aeromedical Services.</p> |
| Version 1.0 Issued May 2013 | <p>Approved by Executive Director, Health Emergency & Aeromedical Services</p> |

**APPENDIX 1 - RECOMMENDED INCISION SITES FOR ESCHAROTOMY
WITH STRUCTURES TO AVOID HIGHLIGHTED**

