

## Burns - Paediatric Full Clinical Guideline - Joint Derby & Burton

Reference no.: CH CLIN C05

### 1. Introduction

Many burns presenting to the children's emergency department are appropriate to be managed without referral to a specialist burns unit or for admission to hospital.

### 2. Aim and Purpose

This guideline is designed to help the emergency clinician with the initial assessment and management of the child presenting to the emergency department with a burn.

### 3. Definitions, Keywords

Burns are thermal injuries associated with extremes of temperature, contact with chemicals or electricity. Severity of burn is determined by the temperature of the burning agent and the duration of the exposure. Simple erythema is not included in the calculation of the size of the burn area.

Keywords: Burns, scalds, partial thickness, full thickness, Parkland

### 4. Emergency management

- APLS approach. ABC. 100% oxygen via non rebreathing mask.
- Remember the potential risk to the airway. If in doubt, early intubation should be considered. If any indicators for air way burns contact the on call anaesthetist. Consider smoke inhalation, cyanide and carbon monoxide poisoning and check a blood gas for carboxyhaemoglobin and acidosis.
- Shock should be treated with 10ml/kg + 10ml/kg boluses of warm Plasma-Lyte 148 or 0.9% sodium chloride. Then calculate any fluid replacement requirements using the modified Parkland formula that should be administered alongside usual maintenance requirements. If the child is shocked at presentation examine carefully for its underlying cause as the burns are unlikely to cause early shock.
- Analgesia should be given alongside cooling and covering the burn. Keep the child warm to prevent hypothermia.
- Treat shock before giving intravenous morphine. Intranasal fentanyl can be a very useful adjunct.
- Remember to check tetanus status.

### 5. Assessment of burns

The burn should be assessed by noting the depth of the burn, the area involved, any associated injuries and/or smoke inhalation. Beware that erythema shortly after injury may disappear later or go onto blister and therefore the initial assessment of the burn area may

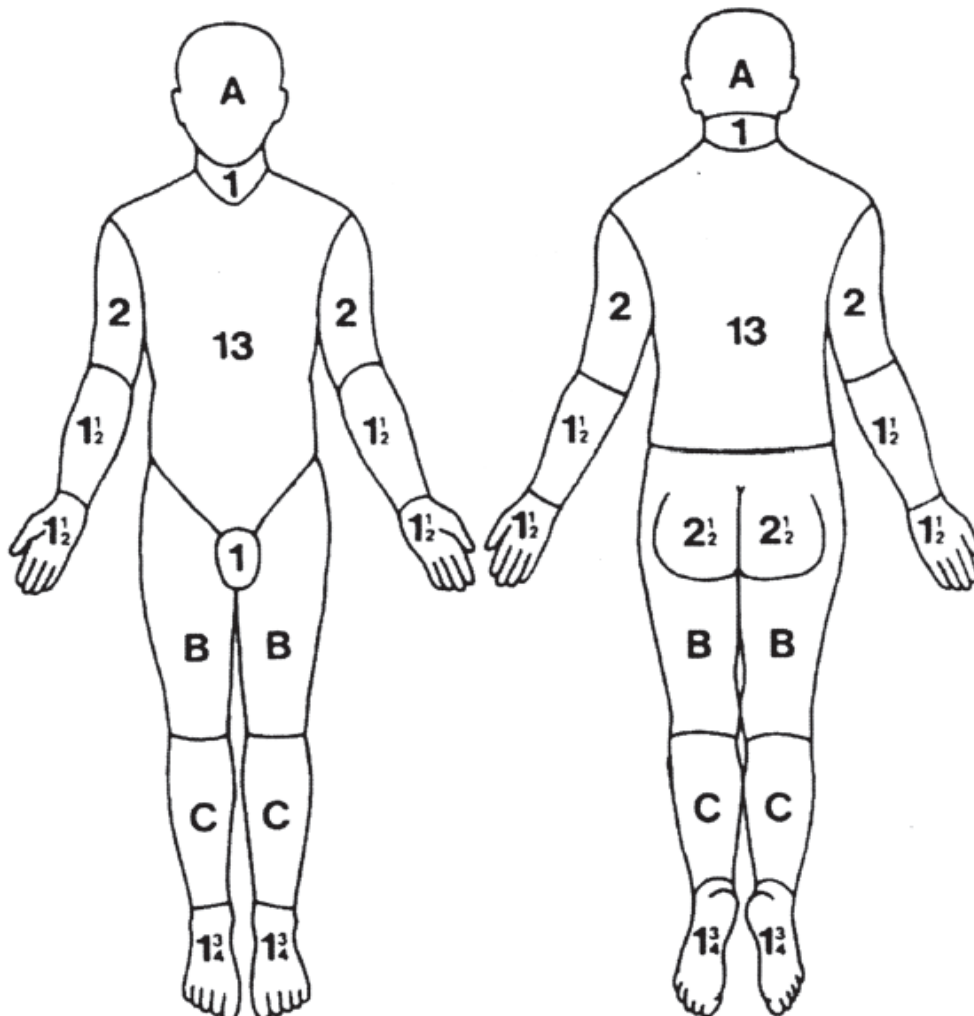
considerably over or underestimate the true burn area. Erythema is not counted as burn in the BSA calculation as the epidermis is intact.

Table 1. Assessing burn depth

Depth	Colour	Blisters	Capillary refill	Sensation	Healing
Epidermal	Red	No	Present	Painful	Yes
Superficial dermal (partial thickness)	Pale pink	Small	Present	Painful	Yes
Deep Dermal (partial thickness)	Dry, blotchy or mottled cherry red	May/not be present	May/not blanch	Dull	Yes
Full thickness	White	No	Absent	Absent	No

Table 2. Assessing burn area using Lund and Brower charts

	Surface area				
	0 year	1 year	5 years	10 years	15 years
A	9.5	8.5	6.5	5.5	4.5
B	2.75	3.25	4.0	4.5	4.5
C	2.5	2.5	2.75	3.0	3.25



Another useful method of estimating relative surface area is to use the patient's palm and adducted fingers which approximates to 1% of their body surface area.

Mersey Burns app is a free clinical tool for calculating burn area percentages, prescribing fluids using Parkland, background fluids and recording patients details. It is designed for clinicians and runs on a range of smartphones and website.

## 6. Further management

### Burns >10%

Children with burns  $\geq 10\%$  will require intravenous fluid replacement therapy in addition to their normal maintenance fluid requirements for the first 24 hours. This should be given at Hartmann's fluid. The additional fluid required per day to treat the burn can be estimated using the following modified Parkland formula:

$$3 \text{ ml} \times \text{TBSA burn \%} \times \text{weight (kg)} = \text{volume fluid (ml)}$$

Half of this fluid should be given in the first 8 hours (from the time of burn), and half over the next 16 hours PLUS 0.9% sodium chloride 5% glucose for maintenance fluid. See appendix A for a worked example.

This is necessary as children have low glycogen stores, which are soon depleted in a burn induced hypermetabolic state, leading to hypoglycaemia.

Analgesia should be given as intravenous opiates in small increments and not intramuscularly to these patients. Intranasal fentanyl can also be used.

### *Urine output*

Consider catheterisation to accurately monitor urine output aiming for at least 1 ml/kg/hr. if the UO falls below this for more than 2 consecutive hours review the patient's clinical picture.

## 7. Smoke inhalation

Smoke inhalation may cause mucosal oedema in the upper respiratory tract which can rapidly occlude the airway.

Upper airway burns require early intubation before swelling renders this difficult or impossible. Obtain urgent anaesthetic assessment.

Check capillary blood gas for carboxyhaemoglobin level. Alert CED senior if level  $>5\%$  and start 100% non-rebreather oxygen from the outset. A COHb non-invasive sats monitor can be used as a baseline screen for elevated CO levels but is not reliable to definitely rule out CO poisoning without performing a blood gas.

Asymptomatic patients with any of the above features should be admitted for observation as respiratory distress can be delayed for several hours.

## **8. Electrical burns**

Discuss with CED senior. Inspect for entrance/exit wounds. A 12 lead ECG is often required as is a urinalysis. Significant electrical burns can cause rhabdomyolysis. If urinalysis is normal, no significant soft tissue damage, and a normal ECG the child can be discharged. Urinalysis in the presence of myoglobin should read positive for blood.

## **9. Chemical burns**

Refer to "Toxbase" for specific and up to date advice. Dry powders should be brushed off first, after which copious amounts of water should be used to wash the area. Certain caustic chemicals may react with water and deepen the burn if not done beforehand.

## **10. Referrals for advice**

The following should prompt a discussion with the burns and plastics team who may wish to see the patient for possible admission to the burns unit, follow-up the child themselves or offer advice for local management:

- Inhalation injury (defined as either visual evidence of suspected upper airway smoke inhalation, laryngoscopic +/- bronchoscopic evidence of tracheal/bronchial contamination/injury or suspicion of inhalation of products of incomplete combustion.
- Partial thickness burns greater than 2% TBSA
- Any full thickness burn irrespective of size
- Circumferential burns to trunk or limbs that may require escharotomy
- Significant burns to the face, hands, feet, perineum or genitals
- Any airway compromise or inhalation injury
- Burns associated with major trauma or with significant co-morbidities
- Burns to an area involving a joint which may adversely affect mobility and function
- High voltage electrical or severe chemical burns
- Any burn not healed in 2 weeks
- Suspected NAI should be referred to a specialised burn service for an expert assessment within 24 hours

Children presenting to Royal Derby Hospital CED should be referred to the on-call plastics SHO at Queen's Medical Centre Nottingham

Children presenting to Queen's Hospital Burton ED can be referred to the on-call plastics team at either QMC Nottingham or Birmingham Children's Hospital (BCH) (take into account severity of burn and child's place of residence when deciding).

## **11. Emergency Department management**

Following the algorithm for burns management, all other burns seen that do not fall into the above categories are suitable to be managed in the emergency department in the first instance.

### ***Cooling measures***

All burns and scalds should be cooled for at least 20 minutes. This should include any pre-hospital cooling time and is effective within 3 hours following the burn injury.

### ***Wound care***

Thoroughly clean the wound, remove all loose/dead skin and de-roof large blisters using diluted antiseptic or saline. For partial thickness burns use a non-adherent anti-microbial dressing such as atrauman. The aim of the dressing is to provide a moist environment to protect the wound and absorb excess exudate.

### ***Reviewing minor burns***

In most burns a repeat wound inspection after 48 hours is advised to make sure that the initial assessment of the burn depth and area was correct and that complications such as infection have not occurred.

For children presenting to Royal Derby Hospital CED - children should be asked to return to CED in 48 hours and booked in as category 5 review patient. Their details should also be entered into the "Burns and IV antibiotic clinic" folder so that the CED team for that date are aware of the patient and can be contacted if they are not brought.

For children presenting to Queen's Hospital Burton ED - any burn that cannot be managed by their own GP should be referred to the burns team at Queens Medical Centre Nottingham or Birmingham Children's Hospital for follow-up (take child's home address into account).

In any case, consider a referral to tertiary Burns for:

1. Any burn that is not healing within 2 weeks
2. Infected burns
3. Burns which on review are more extensive than first appreciated and are now  $\geq 2\%$  partial thickness or have a full thickness base.

## **12. Wound infections**

Burn wounds have large amounts of necrotic tissue and cell debris within them, providing a good culture medium for bacteria. All wounds should be swabbed:

- On first presentation to hospital
- If the wound is smelly or oozing pus
- If the patient is unwell

Burns patients should not routinely receive prophylaxis antibiotics unless they are unwell and symptomatic.

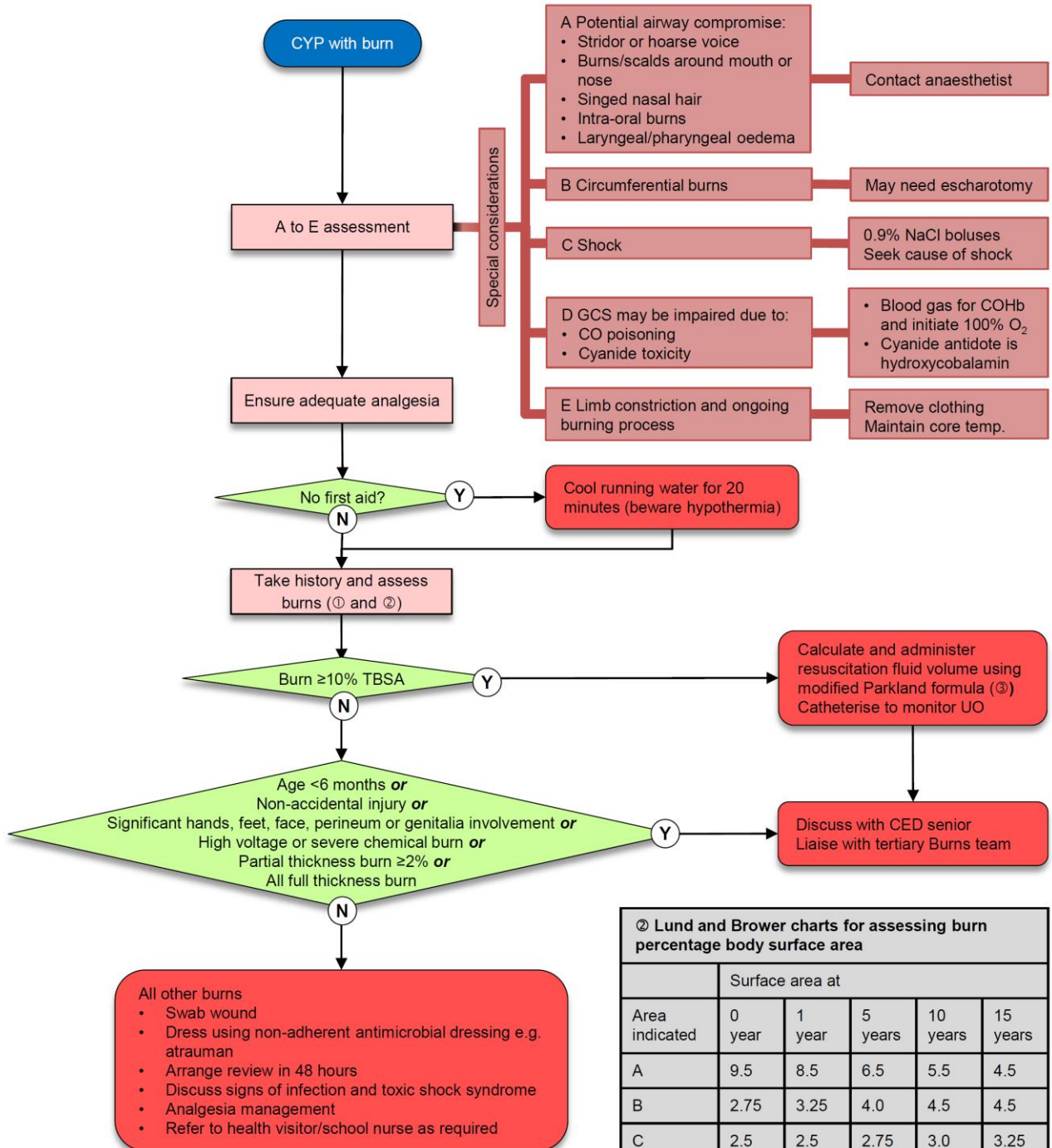
### **13. Safeguarding**

Most burns are accidental although a recent UK study estimated that 10% of children admitted to burns units had sustained their injuries as a result of abuse. Consider the following in all children, but especially those aged under 2 years:

- Previous ED attendances?
- Is the child under 6 months of age?
- What is the exact mechanism of injury?
- Is the mechanism of injury compatible with the child's developmental age?
- Where did the injury happen?
- Has medical attention been appropriately sought?
- Does the history match the injury?
- Is the child non-mobile?

### **14. Reattenders and toxic shock**

Any child with a burn who returns unwell with pyrexia, rash, diarrhoea, vomiting should have toxic shock syndrome considered.



① Classification of burn depth	
Superficial	Erythema only does not need treatment other than analgesia
Superficial partial thickness	Thin walled blisters. Blanches
Partial thickness	Mottled red and white or pink. May or may not blanch
Full thickness	Charred or white. Absent capillary refill and pinprick sensation

**③ Modified Parkland formula**  
 Total fluid requirement in first 24 hours = 3 ml x BSA (%) x weight (kg)  
 Half the total volume given in first 8 hours (from time of burn)  
 Rest of total volume given over next 16 hours

**② Lund and Brower charts for assessing burn percentage body surface area**

Area indicated	Surface area at				
	0 year	1 year	5 years	10 years	15 years
A	9.5	8.5	6.5	5.5	4.5
B	2.75	3.25	4.0	4.5	4.5
C	2.5	2.5	2.75	3.0	3.25

## 15. References

National Network for Burn Care. National Burn Care Referral Guidance. Version 1. February 2012.

Midlands Burn Operational Delivery Network. <https://www.mcctn.org.uk/burns.html>

Emergency Management of Severe Burns (EMSB) Course Manual. 18<sup>th</sup> edition. January 2020.

## 16. Documentation Controls

<b>Reference Number</b> CH CLIN C05	<b>Version:</b> 6		<b>Status</b> Final	
<b>Version / Amendment History</b>	<b>Version</b>	<b>Date</b>	<b>Author</b>	<b>Reason</b>
	V006	August 2024	Simon Li	Updated
	V005.1	22 May 2020	Jane Gadie, Priyanka Prosser and Jagan Vundela	Updated
<b>Intended Recipients:</b> Paediatric Emergency Consultants & Nursing staff at Derby Hospital				
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<b>Development of Guideline:</b> Dr Simon Li <b>Job Title:</b> Consultant Paediatric Emergency Medicine				
<b>Consultation with:</b> Dr Sunil Mistry, Dr Sarah Pearson and Dr Azaad Jameel - Consultants Emergency Medicine				
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<b>Review Date</b>			October 2027	
<b>Contact for Review</b>			Dr Simon Li Consultant Paediatric Emergency Medicine	



	Your patient	Worked example
1. Record TBSA %	%	13 %
2. Record patient's weight	kg	60 kg
3. Record time of burn	<b>A</b> HH:MM	14:45
4. Record current time	<b>B</b> HH:MM	16:00
5. Calculate how many hours have passed since burn (interval between <b>A</b> and <b>B</b> rounded to nearest hour)	<b>C</b>	1
6. Calculate how many hours remain of initial 8 hours post-burn period (8 minus <b>C</b> )	<b>D</b>	7
7. Work out total crystalloid needs for the first 24 hours (3 ml x TBSA % x weight kg)	<b>E</b>	$3 \times 13 \times 60 = 2340 \text{ ml}$
8. Work out rate of infusion so that the first half of the total amount is given within 8 hours of the burn injury ( <b>E</b> divided by 2 divided by <b>D</b> )		$2340 \div 2 \div 7 = 167 \text{ ml/hr}$
9. Work out rate of infusion so that the second half of the total amount is given within the remaining 16 hours ( <b>E</b> divided by 2 divided by 16)		$2340 \div 2 \div 16 = 73 \text{ ml/hr}$
10. Prescribe fluid needs on a fluid prescribing chart		
11. Prescribe maintenance fluid requirement to run alongside the above		

## 17. Appendix A: Fluid prescribing aid for the first 24 hours