BURNS: NETS RETRIEVAL OF CHILDREN WITH BURNS >10%

PRACTICE GUIDELINE ©

DOCUMENT SUMMARY/KEY POINTS

- Burns >10% Total Body Surface Area (TBSA) are classified as severe and usually require triage through NETS for transfer
- If the TBSA affected is truly >10%, fluid replacement will be required.
- The NETS calculator has the Burns Parkland fluid replacement formula available.
- All burns triaged by NETS should include consultation with the NSW Severe Paediatric Burns service. All images should be sent to kidsburns@chw.edu.au
- Near border areas, referral to interstate paediatric burns services may be appropriate

CHANGE SUMMARY

- N/A New document

READ ACKNOWLEDGEMENT

- NETS clinical staff should read and understand this document.

Disclaimer

This document is available on-line as a stimulus for interchange of knowledge and ideas in the field of Neonatal and Paediatric Retrieval. It is provided "as-is" and without support or warranty of any kind. Many of our guidelines may not be appropriate for use in retrieval settings other than NETS NSW, especially in non-Australian environments.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1st September 2017	**Review Period**: 3 Years
Team Leader:	Staff Specialist	**Area/Dept**: NETS

Rationale

- To identify and appropriately assess mechanism and severity of burns in paediatric patients
- To guide the NETS stabilisation and transfer of paediatric patients with burns

Referral and Retrieval Criteria

- Many burns are able to be assessed and managed locally in consultation with the Burns Surgeon – discuss with the on call Burns Surgeon at The Children's Hospital at Westmead
- Please consult the ACI State-wide Burn Injury Service document "NSW Burn Transfer Guidelines" and "Clinical Practice Guidelines: Burn Patient Management" for referral and retrieval criteria for paediatric burns
- Ask to turn on Vision for Life (VFL) Camera
- Photos of burn injury are required. They may have been previously sent to the Burn Injury Service prior to NETS involvement. They should be emailed to kidsburns@chw.edu.au
    - Take on plain dry surface
    - Consider putting tape measure next to wound while photographing
    - May need to change lighting to adequately capture image – consider flash off, heat lamp off
- Where available, connect VFL with Burns surgeon/Intensivist
- Once the Burns surgeon has seen and assessed the burn an agreed % TBSA will be managed by the NETS team in retrieval. If the NETS team think the % TBSA is different at first look, this should be reviewed with the Burns Surgeon
- Check if tetanus immunisation status up to date and if in doubt give Tetanus Toxoid (needs to be given within first 24 hours of burn injury)

Assessment

Primary survey

- Remember to assess for concurrent traumatic injuries.
- Beware of chemical burns in terms of contact precautions
- Resuscitation must precede direct assessment of burn injury

A ***Airway maintenance with cervical spine immobilisation***

B ***Breathing and ventilation***

- Administer 100% oxygen
- Remember the patient may be hypoxic despite a normal saturation trace where there has been significant smoke and carbon monoxide (CO) inhalation. The measured

oxygen saturation will not differentiate between haemoglobin that is saturated with oxygen and haemoglobin that is saturated with CO

C ***Circulation with haemorrhage control***

- Insert 2 x IVC, preferably into non-burned skin (this is not always possible)
- Collect and send blood for VBG (if indicated), FBC, UEC, carboxyhaemoglobin level and Group & Hold

D ***Disability***

- Assess and document neurological status 30 minutely

E ***Exposure & environmental control***

- Avoid hypothermia
- Log roll to view posterior surfaces

F ***Fluid resuscitation proportional to burn size***

- Modified Parkland formula should generally be used for burn injury >10% TBSA – access via NETS drug calculator

Assessing airway

Consider inhalational burn / injury when consistent mechanism, combined with any of these features:

- Stridor, hoarse voice, swollen lips
- Carbonaceous material around/in mouth/nose/sputum
- Singed facial/head/nasal hairs
- Intraoral oedema & erythema
- Tracheal tug, increased work of breathing

Consider early intubation if:

- There are significant head and neck burns where oedema and swelling may compromise the airway
- Circumferential chest burns; which may restrict chest expansion
- Burns involve a large TBSA and are requiring high volume (>40mL/kg) fluid resuscitation and significant analgesia and/or escharotomies

Airway Security

- In a child with significant facial burns, securing the airway may present a challenge; especially if delayed. Local anaesthetic support will be necessary as an inhalational anaesthetic to facilitate intubation is safest
- If the face is burned and the endotracheal tube (ETT) is unable to be secured in the usual manner with tapes it will require dental suture. Conference early if this is necessary as it will require support from dental services

This Guideline may be varied, withdrawn or replaced at any time.

- As an alternative, white cotton tape and Duoderm® may be used to gently secure.
- Adequate sedation and muscle relaxation should be used to assist in maintaining the security of the ETT; this should not negate other physical means of securing the ETT
- Provision of arm splints to prevent inadvertent pulling of ETT by child should be in place if arms are not burned

First aid / Cooling burn wound

Separate the child from the heat source

- Remove clothing from burned areas (clothing traps heat and prevents effective cooling)
- However if clothing is adherent to skin, DO NOT peel off
- If the burn is from a chemical source, flush area affected by chemical agent with running water (especially if involves eyes)

Cooling the burn

- Run water (tap water ok) over the burn for at least 20 minutes within first 3 hours post-injury
- The ideal temperature is 15°C (8-25°C) ie. NOT iced water
- Spraying water is also effective
- Combines soaked in water and applied to wound are NOT effective although can be analgesic. They require changing every 1-2 minutes
- Remove all soaked clothing ASAP
- During and after active cooling prevent hypothermia with cling wrap over burn, warm blankets over non burned area and a space blanket

Assessing body surface area involved

Rule of nines *(Lund & Browder chart – see Appendix One)*

- Divides body surface into areas of 9% or multiples of 9%, excepting perineum (1%).
- Paediatric Rule of Nines: see Appendix One
- For children less than 10 years of age use their palmar surface area (fingers and palm) to approximate 1% TBSA.

*** Ignore simple erythema when calculating %TBSA i.e. for scalds – blistered areas only are counted. For this reason sunburn can be difficult*

Assessing burn depth

Burn depth depends on

- Mechanism of injury
- Length of exposure to heat source or offending agent
- Initial assessment of burn depth can be difficult, and the appearance can change over time, so the burn is continually re-assessed and should not be focused on during the retrieval, except to ignore simple erythema

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Fluid resuscitation

- Use Parklands formula as a starting point as per the NETS calculator fluid guidelines for children with >10% TBSA burns.
    - Aim is to generate appropriate urine output and therefore an IDC is ideal for close monitoring
    - Modify the infusion rate according to the urine output, not by formula
    - For children <30kg, aim for 1mL/kg/hr (0.5-2mL/kg/hr may be acceptable)
    - For >30kg, aim for 0.5mL/kg/hr (0.5-1mL/kg/hr may be acceptable)
    - If urine output in previous hour is:
        - < 0.5mL/kg/hr, increase IV fluids by 1/3 of current rate
        - > 2mL/kg/hr, reduced IV fluids by 1/3 of current rate
    - If haemoglobinuria present, need to aim for higher urine output
- Patients with delayed resuscitation, electrical conduction injury and inhalation injury have higher fluid requirements.
- Very young patients may also have higher fluid requirements.
- Additional maintenance fluids (containing glucose) should be run in children <30kg to avoid hypoglycaemia (given as 0.9% saline + 5% glucose).

***** Overestimation of %TBSA and excessive fluid resuscitation can be as detrimental to burn recovery as under-resuscitation***

Pain management

- Paracetamol is a useful adjunct and can be given PO/PR or IV depending on the circumstances
- Intranasal fentanyl might aid IDC insertion, dressings and other short procedures
    - 1.5 micrograms/kg/dose up to maximum of 75 micrograms
- Give intravenous analgesia – morphine IV for acute pain management
    - 0.05-0.1mg/kg IV morphine initially
    - Repeat every 15 minutes to maximum of 0.3mg/kg
- Consider a morphine infusion titrated to effect for ongoing analgesia

*** Note that wound management will aide with pain management.*

Wound management

- Specific wound management should be discussed with the accepting Burns Surgeon
- Lay the child on the Burns Sheet found in the NETS Thomas packs – this is sufficient dressing for any posterior burns
- For any anterior burns, Bactigras® or paraffin impregnated gauze® or Acticoat® if available should be applied and then cling film is recommended initially (if transfer is occurring within first 8 hours of injury)
- Apply Paraffin ointment or Chloromycetin® ointment to facial burns

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- Do not apply cling film to face, or to chemical burns
- SSD is no longer recommended for initial burns dressings and SHOULD NOT be used
- Circumferential burns should be discussed with the Burns surgeon as these may require escharotomies
- Elevate limbs if involved, where possible, to reduce swelling
- Circulation observations should be performed hourly if there is any suspicion of or risk of circulatory compromise

Educational Notes

Mechanisms of burns & special considerations

- Flame – exposure to prolonged/intense heat
  - House fires, use of flammable liquids or accelerants, automobile accidents, ignited clothing from stoves/heaters
- Scald – burns caused by hot liquids; water, oil, grease, tar;
  - is deepest where clothing is thicker, where clothing is compressed in natural creases of body, where liquid is held in natural creases of body
  - circumferential scald burns should raise suspicion of NAI
- Explosion/flash – explosions of natural gas, propane, gasoline, other flammable liquids; intense heat for a very short period of time
  - Clothing is protective unless it ignites
- Contact – results from hot metals, plastics, glass or coals
- Chemical
  - acids produce coagulative necrosis;
  - alkalis produce liquefactive necrosis
  - These agents will continue to cause damage until inactivated
  - Ensure PPE worn
  - remove all contaminated clothing
  - brush powdered substances away from skin
  - irrigate affected areas with copious amounts of cool water (towards floor)
  - continuously irrigate chemical eye injuries (acid: irrigate for 1 hour or until pain stops; alkali: irrigate for 2 hours or until pain stops)
- Electrical – caused by AC or DC current; current follows path of least resistance and causes injury in areas other than contact / entry site
  - these are thermal burns with extremely high heat
  - spinal precautions of particular importance as spinal fractures may occur secondary to violent muscle jactitations of body with conduction of electrical current

Do ECG

Electrical Source	Likely injuries		
	Skin	Deep Tissue	Cardiac Arrhythmia
Low voltage <1000V	Local entrance and exit wounds	No	Immediate cardiac arrest possible, otherwise nil
High voltage >1000V	Flashover burn, full thickness entrance and exit wounds	Yes, especially muscle. Compartment syndrome, rhabdomyolysis	Transthoracic current may cause myocardial damage and delayed arrhythmias
Lightning	Superficial or dermal flashover burns. Exit burns on feet	Eardrum perforation and corneal damage	Respiratory/ cardiac arrest – needs prolonged CPR

  - Primary and secondary survey as usual
  - 24 hours of ECG monitoring may be required for high voltage injury, unconsciousness, or abnormal ECG on arrival
  - Fluid requirements are likely to be greater that other forms of burns, due to concealed muscle damage in limbs that is not accounted for by standard Parkland's formula
  - Expect haemoglobinuria – insert urinary catheter to detect urine discolouration and monitor urine output. May need to increase fluid infusion rate
- Friction
- Reverse thermal (cold)
- Radiation – caused by alpha, beta or gamma radiation; may need decontamination to stop injury

Further notes

- Applying ice causes vasoconstriction and leads to further tissue damage, and hypothermia
- Circumferential burns can cause compartment syndrome due to oedema under the rigid burned skin, leading to circulatory compromise distally
- Classification of depth of burn

Epidermal burn

- Skin intact, brisk capillary refill
- Erythema (not to be included in % TBSA assessment)
- Heals spontaneously within 3-7 days with moisturiser or protective dressing

Superficial dermal burn

- Damage to upper layer of dermis
- Blisters present or denuded
- Pink, brisk capillary refill (under blister)
- should heal within 7-10 days with minimal dressing requirements

Mid dermal burn

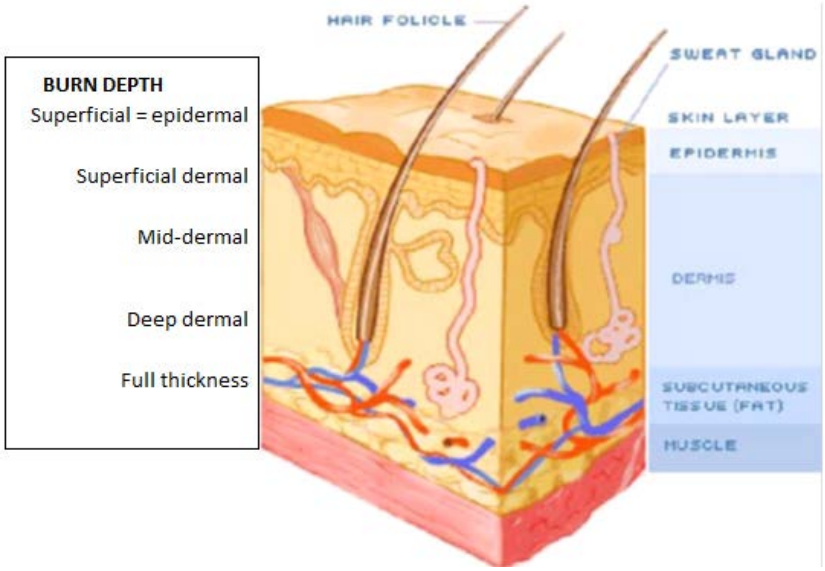
- Heterogenous, variable depths
- Dark pink, sluggish capillary refill
- Should heal within 14 days
- Deeper areas or over a joint may require surgical intervention and referral

Deep dermal burn

- Burn extends into the deeper layers of dermis but not through entire dermis
- Blotchy red / white, sluggish / absent capillary refill
- Generally requires surgical intervention

Full thickness burn

- Destruction of entire dermis, sometimes involving underlying subcutaneous tissue
- White, waxy/leathery, brown, black; no capillary refill
- Surgical intervention and long-term scar management required



NETS calculator uses the following formula to calculate fluid replacement

Modified Parkland Formula

(calculated from time of injury)

3-4mL Hartmann solution x body wt (kg) x TBSA (%)

½ to be given in first 8 hours

½ to be given in the following 16 hours

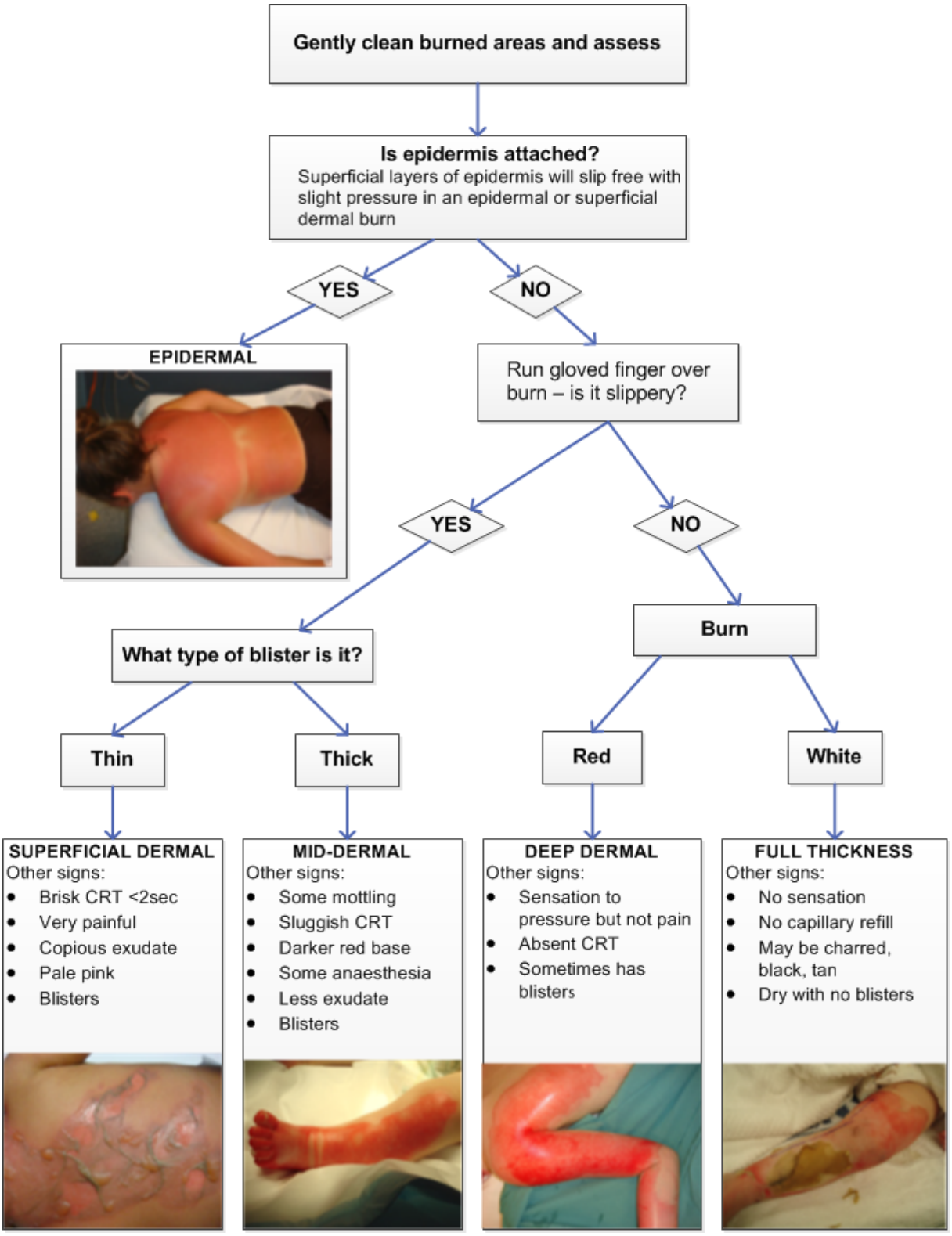
Related Information

1. Emergency Burns Care: Admission and Patient Transfer to CHW (Internal): http://webapps.schn.health.nsw.gov.au/epolicy/policy/2338
2. Australian & New Zealand Burn Association. 2012, Emergency Management of Severe Burns (EMSB), Course Manual (13th Ed.).

Appendix 1

Flow diagram for classification of depth of burn

http://www.wch.sa.gov.au/services/az/divisions/psurg/burns/documents/burns_guidelines_2014.pdf



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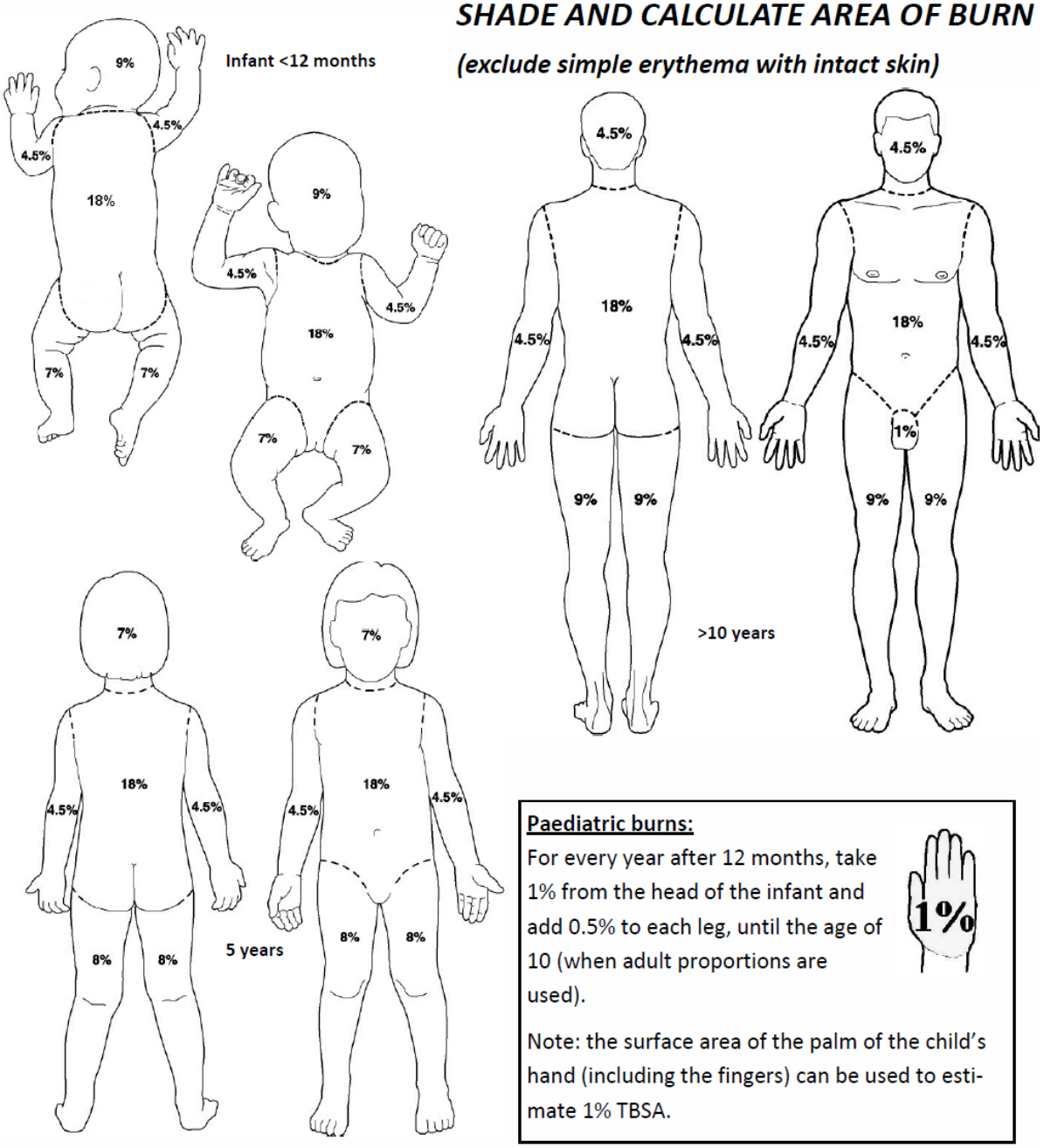
Appendix 2.

Modified Rule of Nines for calculating % TBSA

Modified Rule of Nines for calculation of total body surface area % (TBSA) burnt

SHADE AND CALCULATE AREA OF BURN

(exclude simple erythema with intact skin)



Paediatric burns:

For every year after 12 months, take 1% from the head of the infant and add 0.5% to each leg, until the age of 10 (when adult proportions are used).

Note: the surface area of the palm of the child's hand (including the fingers) can be used to estimate 1% TBSA.

TBSA _____% Estimated depth: _____

Appendix 3: Use NETS calculator – this chart is just educational

***Charting fluids for resuscitation and maintenance in children with** >10% TBSA burn*

RESUSCITATION FLUIDS - Modified Parkland Formula (first 24 hours following burn)

If >10% TBSA for children. Given as Hartmann's solution.

Weight _____kg

Time of burn _____hrs

TBSA % of burn _____%

8 hours post burn _____hrs

Current time _____hrs

3-(4) mls x _____(weight) x _____% TBSA burn = TOTAL resus fluids in 24hrs

= _____ X 0.5

= 50% replacement in 1st 8hrs post injury_____

SUBTRACT

Fluid already given since injury _____

EQUALS

Remaining fluid to be given in 1st 8 hours post injury_____

DIVIDED BY

Remaining time since injury to complete 1st 8 hours_____

EQUALS

HOURLY RATE FOR FIRST 8 HOURS _____ml/hr

Start time_____ Finish time_____

Remaining 50% of replacement fluids _____

DIVIDED BY 16 (HOURS) =

HOURLY RATE FOR SUBSEQUENT 16 HOURS _____ml/hr

Start time_____ Finish time_____

MAINTENANCE FLUIDS

(required for children <30kg only and commenced from time resus fluids started)

Given as 0.45% NaCl + 5% dextrose

Up to 10kg	4ml/kg/hr
10-20kg	40ml + (2ml/kg/hr for each kg over 10kg)/hr
20-30kg	60ml + (1ml/kg/hr for each kg over 20kg)/hr

Weight _____kg

= _____ml/hr

*******FLUIDS ARE TO BE REASSESSED ON AN ONGOING BASIS DEPENDENT UPON URINE OUTPUT**

(e.g. boluses may be given for low U/O or rate can be reduced for high U/O—discuss with Registrar if unsure)

Aim for urine output of **1ml/kg/hr** (range 0.5-2ml/kg/hr) OR >2mg/kg/hr for urine containing haemochromogens

FLUIDS ARE TO BE RECHARTED AT 24 HOURS*****