

Epidemiology:

- In Aus/NZ - 220,000 cases/yr, 10% of these hospitalised, 0.02% fatal.
- Children <4y usually scalds
- Highest rates were young children & elderly.
- ~50% of burns and scalds occur in the kitchen.

Types:

- Thermal 95% - Scalds 60%, flame 40%
- Electrical
- Chemical
- Radiation

Systemic effects

- Cytokine release if burn SA >30%
- Release of TNF α
- \uparrow Capillary permeability
- \downarrow Myocardial contractility
- Peripheral & splanchnic vasoconstriction
- Bronchoconstriction
- ARDS if severe
- \uparrow Basal metabolic rate & basal body temperature ($\sim 0.03^{\circ}\text{C}$ per % BSA)
- \downarrow Humeral & cell mediated immunity

Assessment

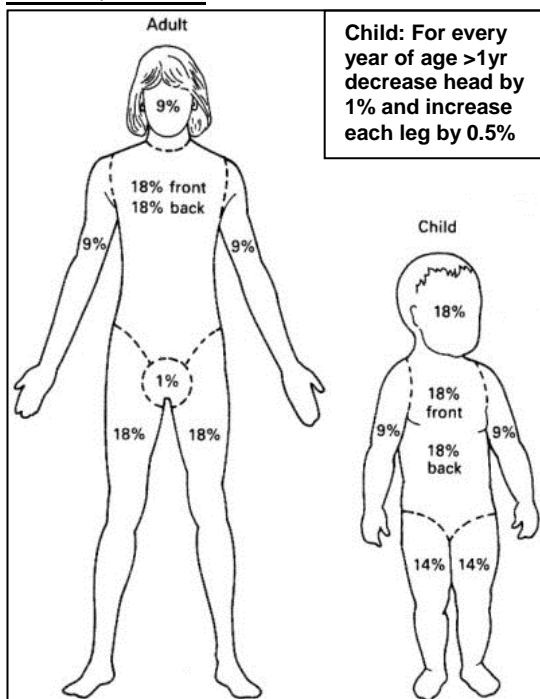
History: AMPLE, When, what, how long, how hot (or concentrated for chemical), enclosed/open space, explosion, other trauma. What first aid given.

Examination: Where burnt (esp airway - upper/lower signs, face, hands, genitals), how extensive, approx depth.

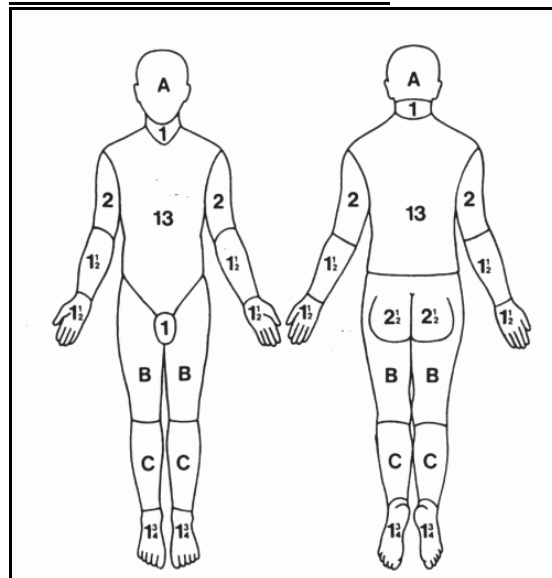
Consider: NAI, EtOH/Drug use.

Burn Surface Area Estimation

Rule of Nines

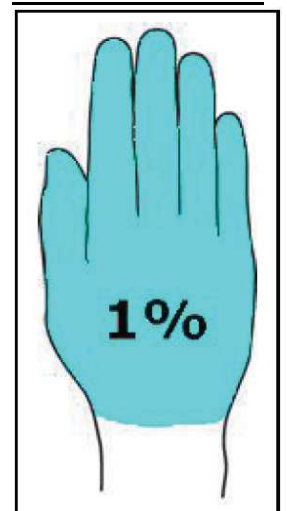


Or Lund & Browder Chart



Age	0	1	5	10	15	Adult
A	9.5	8.5	6.5	5.5	4.5	3.5
B	2.75	3.25	4	4.5	4.5	4.75
C	2.5	2.5	2.75	3	3.25	3.5

Or Hand Method



Palm and fingers of the patient = 1% TBSA

Burn Depth Assessment

Depth	Colour	Blisters	Capillary Refill	Sensation	Healing	Scarring
Epidermal (Superficial)	Red	No	Brisk 1-2s	Painful	Within 7d	None
Superficial Dermal (Superficial Partial)	Red/Pale Pink	Small	Brisk 1-2s	Painful	Within 14d	None, sl. colour mismatch
Mid-Dermal (Partial)	Dark Pink	Present	Sluggish >2s	Painful	2-3 weeks ± Grafting	Yes (if healing >3wk)
Deep Dermal (Deep Partial)	Blotchy Red/White	+/-	Sluggish >2s or absent	Variable	Grafting required	Yes
Full Thickness	White/Brown/Black/Deep Red	No	Absent	Absent	Grafting required	Yes

Burn Severity

TBSA, depth & site (airway, face, hands/feet, genitals), skin thickness (thinner in old/young)

Complications

- Tissue hypoxia - low O₂, CO, CN⁻, H₂S
- Infection esp *Pseudomonas* spp.
- ARF (hypovolaemia, myoglobinuria, sepsis)
- ARDS
- Hypothermia
- SIADH
- Scarring
- Psychological effects

Investigations

Urine: ?haemoglobin/myoglobin, output

Bloods: ABG, COHb (±CN/H₂S), FBC, UEC, Anion gap, LFT, CK, CMP (esp chemical burns e.g. HF)

ECG: ?myocardial injury

Imaging: CXR if ?inhalation injury, bronchoscopy if airway injury, IV Xenon lung scan

Management

First Aid:

- Stop, drop, cover face & roll if on fire
- 20min+ cold (15°C) running water(not ice) if <3hrs of burn. BurnAid. Cover with Glad wrap.
- Keep rest of body warm to prevent hypothermia
- Remove clothing and jewellery
- Apply C-spine collar if appropriate

Resuscitation

- Airway: May intubate with **suxamethonium** if burn <5d old else **rocuronium**.
 - Intubate immed if impending airway obs, hypoxia on 100% O₂, hypoventilation
 - Intubate urgently if ↓SaO₂ on 60-100% O, voice change, oral erythema/blistering
 - Early ETT if ?inhalation burn: orofacial burn, carbonaceous sputum, nasal hair/eyebrow singing.
- Breathing: Humidified O₂.
- Circulation: 2 x IVC if major burn. Try to avoid burnt tissue if possible. Aim for urine output of 0.5-1ml/kg/hr in adults, 1-2ml/kg/hr in children.
 - Fluids: No evidence for colloid over crystalloid. If TBSA>15% (Child: 10%) use **Hartmann's** init rate (Parklands): Total 2°/3° BSA (%) x Wt (kg) x 3-4mL. Give 1/2 in 1st 8h, rest over 16h. Add maintenance fluids for child<30kg.
 - If low urine output, & not responsive to ↑fluids, can use **mannitol** + **frusemide**.

Analgesia: Cooling, wrapping to air currents. PO **paracetamol/codeine** if minor, opioids e.g. **morphine** 0.1mg/kg IV (not IM - variable absorption) if larger.

Blisters: Controversial. Leave small blisters intact. Debride if large, over joints or ?infected.

Dressings:

- Superficial:
 - **Mepitel** (low adherent silicone gel + flexible polyamide net) with **Melolin** or hydrocolloids (**Duoderm**, **Comfeel**). Secure with **Hyperfix** or **Fixomull**.
 - If no dressing - **Solosite/Solugel** and **Intrasite** gels good to reduce discomfort.
- Partial thickness:
 - **Acticoat** or **Acticoat-7** (Init soak, then q6h moistening with water (not saline) to keep Ag release & prevent adherence to burn). Alternatively **Mepilex Ag** (doesn't req moistening & has slower Ag release - less stinging). Secure as above. In Ag-sensitive patients use **Bactigras** (**Chlorhexidine** impregnated **Vaseline** gauze) + secondary absorptive dressing. Redress burn q3-7d depending on dressing used.
 - Facial/genital burns: cleaned bd & **Vaseline gauze/white paraffin ± 2% mupirocin**
 - Burns over joints may require splinting (esp children).
 - **Silvazine (SSD): Silver Sulphadiazine 1% + Chlorhexidine Gluconate 0.2% + 2°** absorptive dressing. Less favoured now. Can change burn appearance/stain skin.
- Full thickness:
 - Glad wrap prior to transfer & r/v at Burns Centre.

Antibiotics: Not routinely for prophylaxis, unless v. severe. Give if signs of infection.

Other Mx: Tetanus IG/prophylaxis, SW/CPU if NAI. Vitamins, TPN, stress ulceration prophylaxis esp if large TBSA. Physio. Psych input if scarred/PTSD.

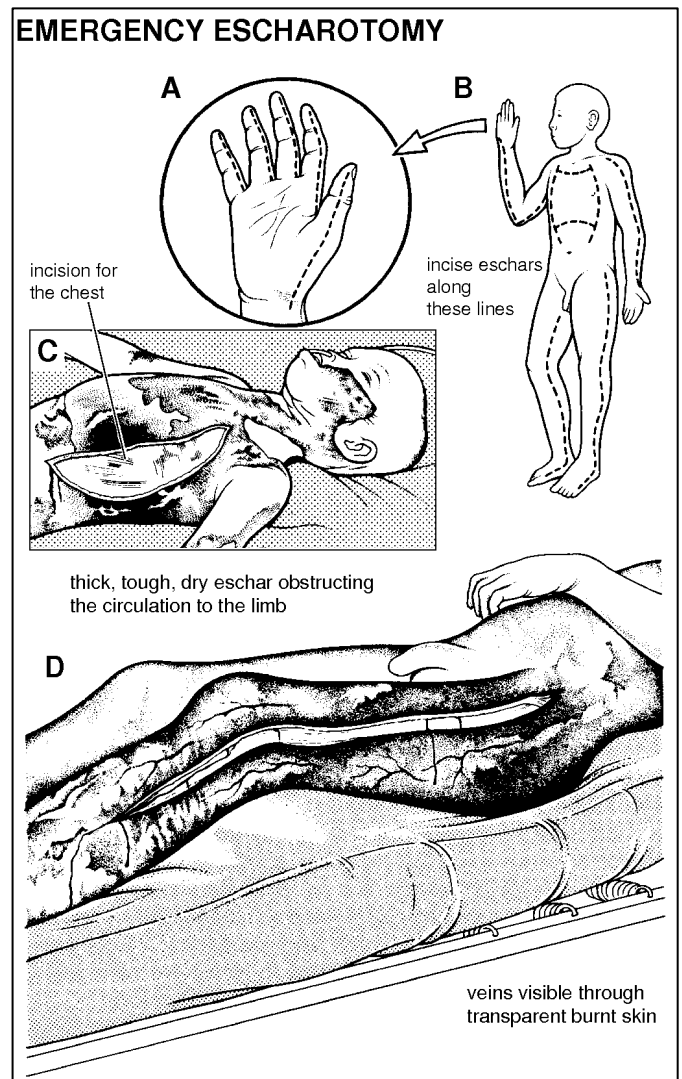
Surgery:

- **Escharotomy:** Incision of burnt tissue down into fat. Circumferential full thickness burns to limbs (longitudinal), chest (2 ant axillary line lateral cuts joined by 2 transverse cuts at 2ics & costal margin) or neck.
- **Fasciotomy:** Occ req with assoc skeletal trauma, crush injury, high-voltage electrical injury or if involving tissue beneath the investing fascia.
- **Grafting:** Full thickness. Cosmetic rev.

Burns Centre Referral Criteria:

- Partial thickness >10% TBSA, full thickness >5% TBSA
- Child partial/full thickness >5% TBSA
- Priority areas: face/neck, hands, feet, perineum, genitalia and major jts.
- Any circumferential burn.
- Burns by chemical, electricity, lightning
- Burns with concomitant trauma or pre-existing medical condition.
- Burns with associated inhalation injury.
- Suspected non-accidental injury.
- Pregnancy with cutaneous burns.

Ongoing care: Burns dressing clinic, plastics r/v, moisturiser, sun-block, antihistamine (itch)



Prognosis:

Mortality RF: Age>60, TBSA>40%, inhalation injury.

Mortality related to no. RF: 0 (0.3%), 1 (3%), 2 (33%), 3 (90%)

Fires

Components of injury: Flame burns, hypoxia (O₂ depleted by combustion), hyperpyrexia, toxic gases (CO, CN⁻, H₂S), inhalational injury - smoke particles <0.5µm → inflame alveoli.

Chemical Burns

- Can result from exposure to acids, alkalis, or petroleum products.
- Alkali burns (liquefaction) tend to be deeper than acid burns (coagulative necrosis).
- Remove clothing with care and if dry powder still present on skin, brush it away.
- Flush away the chemical with large amounts of water for at least 20-30min. Alkali burns to the eye require longer continuous irrigation until pH normalised.

Cement Burns: Calcium oxide→hydroxide (alkali) on exposure to sweat/water. Mx: irrigation.

Tar Burns: Bitumen laid at 200°C. Adheres to tissue→prolonged contact. Mx: soak in cold water then olive oil & remove tar carefully. Split tar in circumferential burn (as contracts on cooling).

Hydrofluoric Acid: See Toxicology Article & Antidote article.

Electrical burns

See Electrical Injury article

- Are often more serious than they appear on the surface.
- Rhabdomyolysis → myoglobin release, which may → ARF.
 - Rx: Fluids (so urine output>1.5ml/kg/hr), [bicarbonate](#)/[mannitol](#)/[frusemide](#).

Sunburn

Common from UV radiation.

Risk factors: Duration & timing of sun exposure, UV-B >UV -A, but less prevalent in sunlight, lack of sunscreens, lighter or lack of skin pigmentation, moist skin, less atmospheric filtration with height/ozone depletion, snow/sand/water glare (cf Arc Eye).

Presentation: Usually superficial burns, occ partial thickness with blistering. Systemic symptoms can accompany severe burns with headache, chills, malaise +/- nausea & vomiting.

Management

- Mild: Cool soaks and PO/topical NSAIDs may be helpful.
- Moderate: Lack of good evidence for PO NSAIDs, antihistamines and TOP steroids, antioxidants, or emollients.
- Severe: As for any other severe burn.

Complications

- Premature aging, solar keratoses, BCC, SCC and malignant melanoma
- Maybe associated with heatstroke or other heat-related illnesses
- Photosensitivity reactions or exacerbation of dermatological conditions

Prevention: Education, sun block/sunscreen with high SPF, limiting sun exposure. Slip, slap, slop.

Ionising Radiation

Iatrogenic, terrorist attack, nuclear accident. LD50=4 Gray.

Tissue sensitivity: Gonads > marrow, lung & GIT > breast, liver, thyroid, bladder > bone & skin.

Features: Early N&V (↑sev), burns after 48h, ↓↓marrow (>2Gy), colitis (>10Gy), pneumonitis, RF, liver failure. High doses (>15Gy): fatal vascular & cerebral syndromes. Decontam. Specialist Mx.