

ONE DOES NOT SIMPLY PASS THE FRCA



... WITHOUT LEARNING ABOUT BURNS

Anaesthetic Teaching

- Burns
 - Inhalational Injury
-

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Golden Statements

- Management

- Look at the Burn  But don't forget ATLS principles
- Feel the burn  MDT input is likely required
- Taste the burn  Crystalloid is the fluid of choice
- Think about the burn  Hypovolaemic shock in first few hours???
- Touch the burn  Blood loss can be significant and insidious

(And remember)

- Love is 4 letter word... but so is Burn!

Parkland formula's magic Integer = **4**

Never/Always Statements

- Hypovolaemic shock in the first few hours after a burn is **NEVER** due to a burn alone
 - Inhalational injuries are **ALMOST NEVER** seen with flash burns or brief high temperature burns
 - Compromises in airway are **ALMOST ALWAYS** due to reduced GCS
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Background



90% Not admitted

10% Admitted to Hospital

Specialist burns unit

Plastic Surgery

Medically managed

1.4% Die

Sepsis

Multi Organ Failure

Risk Factors

For Death (~ 28% of these will die)

- Old Age (10<Age>64)
- Higher % Surface Area of Burn (?*)
- Inhalational Injury (x 3.6)
- Chronic co-morbidities

For Early Death (<48 hours)

- Burn Shock
 - Inhalational Injury*
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Treatment Goals

- Pneumonic is RCS (or **R**oyal **C**ollege of **S**urgeons)
 - **R**esuscitation (early)
 - **C**omplications (prevention of...)
 - **S**urgical Debridement (early)
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Anaesthetic Concerns

- A = Airway problems
 - B = (*Ventilatory problems*)
 - C = Substantial Blood loss
 - D = Temperature control issues & Profound Hyper-metabolism
 - E = Acute and Chronic Pain management issues
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How do you Assess?

LPT: Hx is really Important as it may be unobtainable later...

- Full medical history
 - Nature of the burn*
 - Patient's surroundings*
 - Extent of the burn (Wallace*)
 - Ask about breathing and Inhalational injuries
 - Any other Injuries (and Mechanism)
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How do you Manage?

ABCDE... with C-spine (ATLS)

- A
 - 100% FiO₂
 - Airway assessment
 - Compromises in airway are almost always due to reduced GCS

Indications for Intubation (split into assessment/numbers)

- Full thickness neck burns
 - Deep facial burns
 - Oropharyngeal oedema
 - **GCS < 8**
 - Reduced PaO₂/Increased PaCO₂
 - HBCO => 25-30%
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How do you Intubate?

LPT: Early intubation here **Saves Lives** because the airway is unlikely to be oedematous yet...

- Use an Uncut tube
 - Size 8.0 or bigger
 - Suxamethonium is safe for 24 hours
 - (Increased risk of K⁺ release from exntrajunctional AChR)
 - And then contraindicated for 1 year
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Breathing

Assess

- Tracheal position
 - Penetrating injuries can cause tension pneumothoracies, blasts can cause contusions
 - Chest movement
 - (Life saving **escharotomies** for full thickness burns)
 - Act as a tourniquet and **increase compartment pressures** (accumulation of tissue fluid)
 - Problem when pressures => 40mmHg (needs decompression)
 - ARDS
 - As a result from alveolar contusions
 - Aim for LPV ($V_t \leq 6\text{mls/kg}$)
 - Don't give steroids* or antibiotics prophylactically
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Circulation

Access:

- 2 x Large bore cannula (ideally through unburnt skin)
- (Note Femoral access is usually spared as it's in the creases)

Delivery:

- Give Hartmann's
 - TSA Burn => 15%
 - TSA Burn => 10% + Inhalational Injury
- Speed depends on level of haemodynamic compromise (shoot first, calculate later...)

Assessment: (balance fluid delivery & inotropes against)

- Clinical response
- Invasive monitoring
- U/O > 0.5ml/kg/hr

LPT: Parkland Formula = $4 \times \text{Weight kg} \times \text{TSA burnt \%}$ (i.e. $4 \times 70(\text{kg}) \times 30(\% \text{burns})$)

LPT: Watch out for **Fluid Creep** & The triad of **Burn Shock**

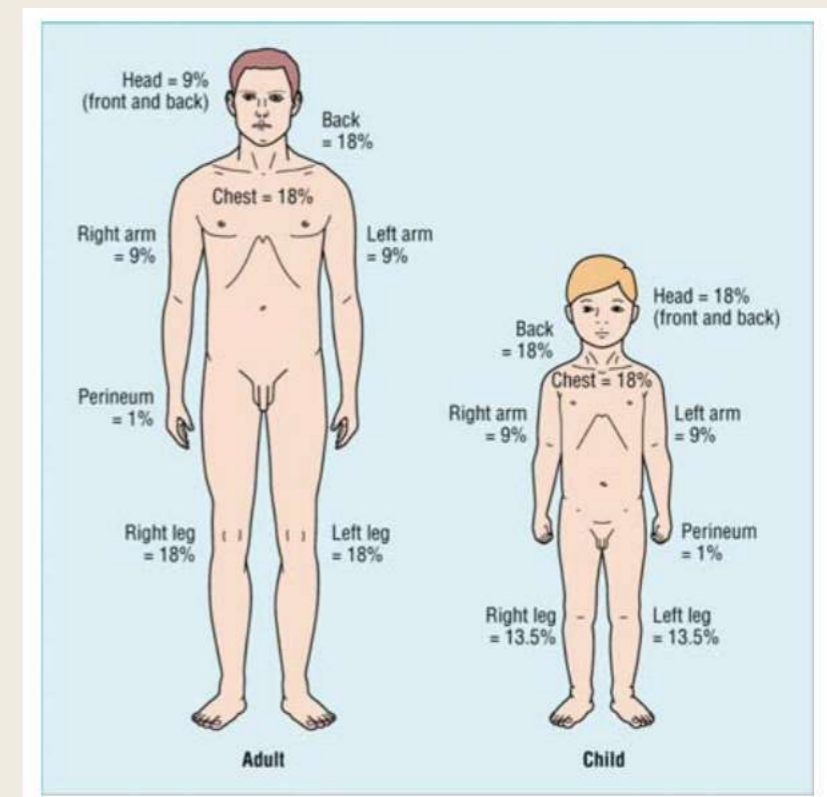
D & E

D

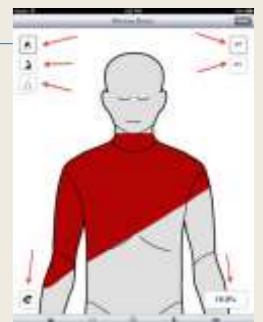
- Don't forget to assess Pupils and aim Temperature @ 38 deg C

E

- Expose for other injuries
- Estimate burns area
- Keep warm (yes really...)
- Remove Jewellery
- Insert Urinary Catheter
- Analgesia (titrate i.v. Morphine)
- Early enteral nutrition when possible (high in carbs and protein)



LPT: Mersey app (currently offline) lets you shade in burn areas!



All done?

Nope... it's time to think about that Inhalational Injury?



YOU TAKE A DRY HIT

Inhalational Injury!

Can be caused by

- Steam
- Super heated gases
- Hot liquids
- Noxious products of incomplete combustion (aspiration of)

Note that true inhalational burns occur in **enclosed spaces** where there is **delayed recovery** due to **reduced GCS**

Inhalational injuries are **ALMOST NEVER** seen with flash burns or brief high temperature burns

Management involves dealing with

- Heat
- Particulate matter/respiratory irritants
- Asphyxiation/systemic toxicity

Noxious matter i.e. aldehydes, nitrogen oxides, halogen acids, hydrogen chloride, phosphogene can all cause damage

Damage Classifications

Damage can be...

- A = Above Larynx
- B = Below Larynx
- C = CO (and noxious gases)

A

- Pharynx/Epiglottis is injured
 - Stridor/Hoarse voice
 - Visible oedematous uvula

As expected these cause **Intubation** problems

Damage Below Larynx

B

- Loss of epithelium
- Mucous secretion
- Inflammation
- Atelectasis
- Airway obstruction (e.g. from oedema/particulate matter)

As expected these cause **Ventilation** problems

Additional V/Q mismatch occurs due to release of NO = up bronchial blood flow but reduction in HPV

CO & Noxious gases

C

- CO poisoning is worsened by ventilatory problems i.e. low GCS/unconscious

The symptoms are similar to a good night out

- Nausea + Vomiting
- Headache
- Hypotension
- Convulsions

Factors for [HbCO] are obvious = [CO] & [t_{exposure}]

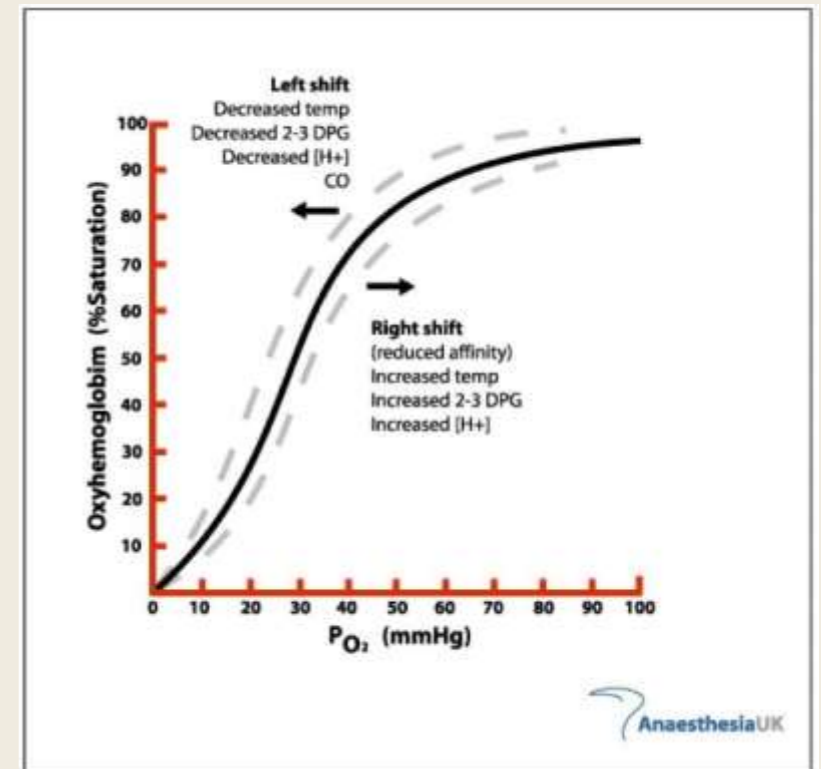
But these correlate poorly to toxicity but the end result is

- Tissue hypoxia and metabolic acidosis (cellular cytochrome oxidase system inhibited)

LPT: Pulse Oximetry **cannot** distinguish between HbO and HbCO = Normal Sats

Carbon Monoxide

- $t_{0.5}$ for CO is 4 hours
- Reduced to 1 hour with 100% FiO₂
- Reduced 30 mins with 3ATM + 100% FiO₂ (for)
 - Pregnant women
 - Comatose patients
 - HbCO => 40%
 - Failure to respond to FiO₂ 100%



LPT: (remember OHDC is the opposite of screws) **Lefty Tightly, Righty Loosy**

Other things to look out for...

- Cyanide poisoning

(Inability of aerobic respiration; cyanide inhibits the ETC)

- Persistent lactic acidosis despite fluid resuscitation ($>7\text{mmol/L}$)
 - Elevated Anion gap acidosis
 - Reduced a-v gradient
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- Antidotes have side effects!
 - Hydroxocobalamin (Cyanokit) is probably the safest
 - (Others -= Amyl/Sodium nitrites which include methaemoglobinamia!)
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How do you Assess?

Hx

- Burn/fire in an enclosed space.
- Loss of consciousness at the scene, possibly due to:
- Drugs/alcohol,
- Head injury,
- Hypoxia,
- Carbon monoxide/hydrogen cyanide poisoning.
- Fatalities in the same incident increase the risk of significant injury.

Sx

- Voice changes, hoarseness, stridor (these are particularly worrying symptoms),
 - Cough
 - Burns to the face, lips, tongue, mouth, pharynx, or nasal mucosa,
 - Soot in the sputum, nose, and mouth,
 - Respiratory distress
 - Decreased level of consciousness or confusion, agitation
 - Clinical hypoxaemia; SpO₂ <94% in air,
 - Increased Carboxyhaemoglobin (COHb) levels.
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Management

- Early tracheal intubation
 - 1. Impending/actual airway obstruction
 - 2. Reduced GCS
 - 3. Cardiac arrest
 - 4. Hypoventilation
 - Aggressive pulmonary toileting
 - Bronchodilator therapy (salb, heparin/acetylcysteine?)
 - Bronchoscopic lavage
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Finally finished?

NOPE! Your homework awaits!

Table 1 British Burns Association referral criteria for patients with burn injuries³

Complex burn injuries include any of the following

Extremes of age	Under 5 yr or more than 60 yr
Site involved (dermal or full-thickness loss)	Face or hands or particularly the neck or circumferential of the limbs, torso, or
Inhalation injury	Any significant such as carbon monoxide poisoning
Mechanism of injury	Chemical injury (>1% TBSA); radiation injury; high tension electrical injury (>1% TBSA); surgical injury; adult or paediatric
Size of skin injury with dermal or full-thickness loss	<16 yr old with >5% TBSA
Pre-existing co-morbidities	Significant cardiorespiratory disease; pregnancy; immunosuppression; liver impairment, cirrhosis
Associated injuries	Crush injuries; fracture; other injuries

Table 3 Complications of burns

Complications from over-resuscitation⁴

Excessive burn oedema
Abdominal compartment syndrome
Need for fasciotomies on unburned limbs
Pulmonary oedema
Prolongation of mechanical ventilation
Excessive burn oedema
Early complications
Deep vein thrombosis (thrombo-prophylaxis)
Stress ulcers (early enteral feeding/proton pump inhibitor)
Adult respiratory distress syndrome
Renal failure (from inadequate resuscitation, significant muscle breakdown, haemolysis, or sepsis)
Hypothermia

Infective complications

Eyes (secondary infection of corneal burns)
Pneumonia
Burn wound
Urinary tract infection (common with urinary catheters and burns to perineum)
Sinuses and middle ear (complication of nasogastric feeding)
Infective endocarditis
Later complications
Pulmonary fibrosis
Chronic pain
Post-traumatic stress disorder
Psychological (effects of severe illness, disfigurement and loss of independence)
Depression
Sleep disorder

Table 2 Anaesthetic considerations for burn wound excision/grafting

Preoperative	Intraoperative	Postoperative
Anaesthetic history	Temperature: hot theatre (32°C), fluid warmers, monitor—aim to lose <1°C	Analgesia: regional blocks
gery	Monitoring limitations	Early use of multimodal analgesia including pregabalin
	Oesophageal Doppler	High opioid use
	Airway management, large minute ventilation, often high PEEP	Others: ketamine, topical morphine
trolytes—lucts sary	Neuromuscular blocking agents: avoid succinylcholine after 24 h, resistant to non-depolarizing muscle relaxants (NDMR)	Pain team—involve early
	Vasopressors/inotropes	Location—possible need for critical care
	Epinephrine used in soaked swabs to reduce blood loss	Warm room
%airway r 1	Positioning: prolonged procedure, may be prone	Clinical psychology involvement
	Timing—often prolonged procedure	Physiotherapy



Thank you for listening

Any Questions?