

Burn Education Day

Early Management

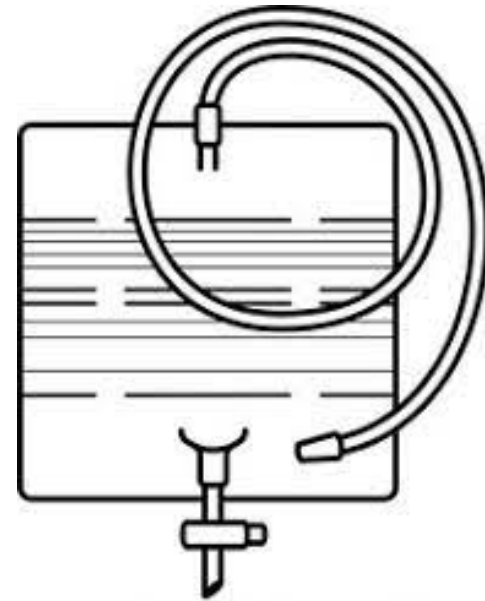
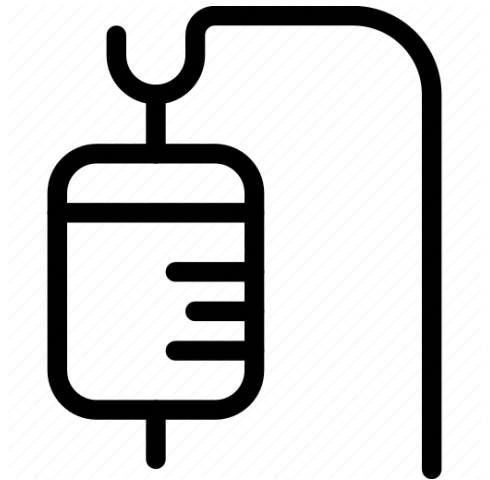
ACI Statewide Burn Injury Service

<http://www.aci.health.nsw.gov.au/networks/burn-injury>

Agency for Clinical Innovation

aci.health.nsw.gov.au

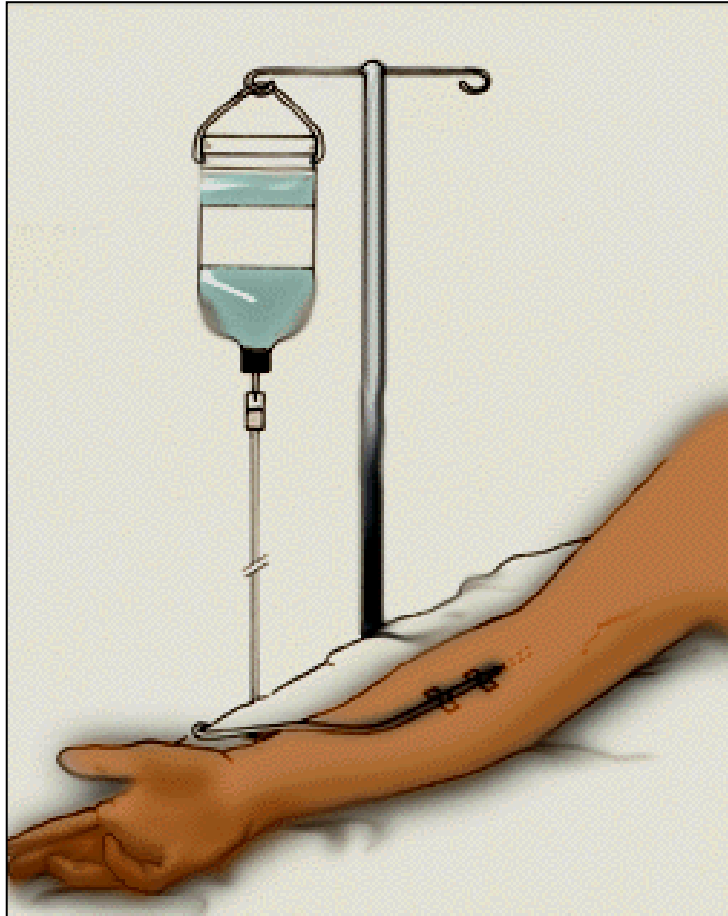
Fluid Management



Burn Pathophysiology

- Unique total body response in large thermal injury (>20% adults/>10% paedts)
- Increased capillary permeability persists for ~ 24 hours (starts to resolve ~ 8-12hrs)

How to administer fluids



Goals of resuscitation

- The maintenance of vital organ function at the least physiological cost.
- The restoration and preservation of tissue perfusion in order to avoid ischaemia.

Differences in children

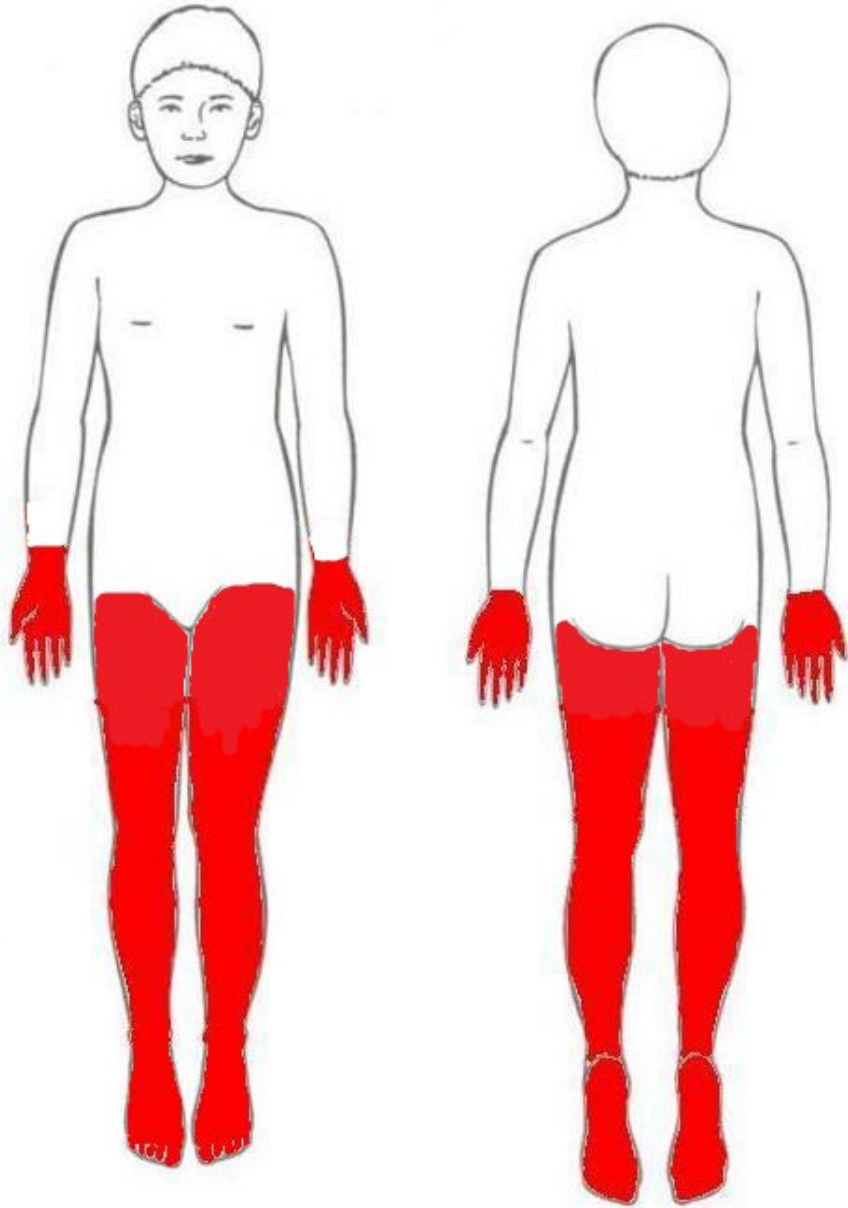
- Limited physiological reserve
- Tendency to hypoglycaemia
- Greater surface area to mass ratio
- IV fluid required at lower % TBSA
- Need higher volume per kilogram
- Increased requirement = normal daily maintenance

Fluid Resuscitation

- Modified Parkland Formula:

$$\text{Area burnt} \times \text{Weight} \times 3$$

- Use Hartmann's solution.
 - Half in first 8 hours from injury.
 - Second half in next 16 hours.
 - Add maintenance + glucose for children <16yrs
- Calculation starts from TIME OF INJURY
- Revise according to urine output



Age: 18yo

Weight: 80kg

TBSA: 40%

Time of burn: 0800

Time of presentation: 0900

Fluid calculation – first 24 hours

$$3\text{ml} \times 80\text{kg} \times 40\% =$$

Fluid to be given in first 8 hours =

Rate =

Fluid calculation – first 24 hours

$$3\text{ml} \times 80\text{kg} \times 40\% = \mathbf{9600\text{ ml}}$$

$$\text{Fluid to be given in first 8 hours} = \mathbf{4800\text{ ml}}$$

$$\text{Rate} = \mathbf{685\text{ ml/hr (7hrs)}}$$

Fluid resuscitation for children

**3mls x kg body weight x TBSA = total fluid for 24 hour
period**

from the TIME of injury

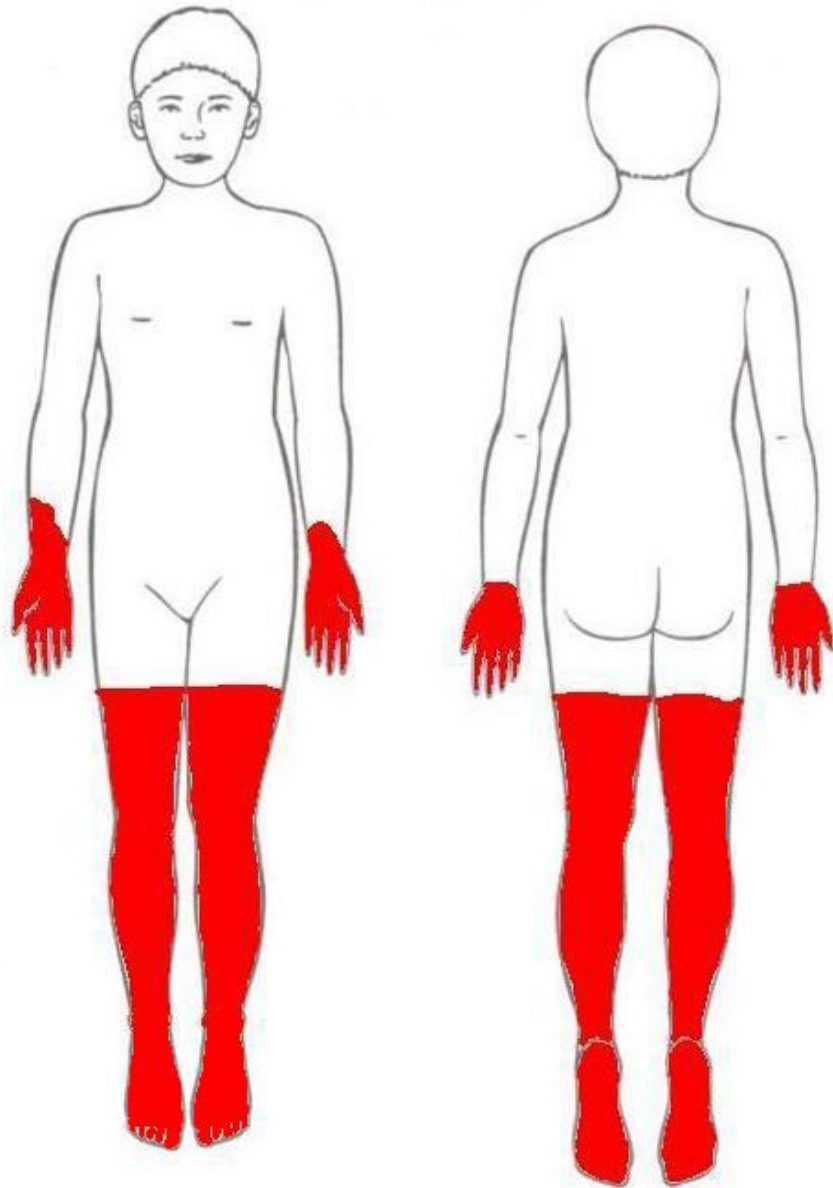
+

Maintenance fluid

Maintenance Fluids (Paeds)

0.9% (normal) saline + 5% dextrose

- 4ml / kg / hr up to 10kg
- +
- 2ml / kg / hr from 11-20kg
- +
- 1ml / kg / hr for each kg over 20kg



Age: 2yo

Weight: 10kg

TBSA: 30%

Time of burn: 0700

Time of presentation: 0800

Fluid calculation – first 24 hours

$3\text{ml} \times 10\text{kg} \times 30\% =$

Fluid to be given in first 8 hours =
=

+

Maintenance fluid

Fluid calculation – first 24 hours

$$3\text{ml} \times 10\text{kg} \times 30\% = 900\text{ml (over 24 hrs)}$$

$$\begin{aligned}\text{Fluid to be given in first 8 hours} &= 450\text{mls} \\ &= 64\text{ml/hr (7hrs)}\end{aligned}$$

+

Maintenance fluid

$$4\text{ml} \times 10\text{ kg} = 40\text{ ml/hr (constant rate)}$$

Formulae are only guides

Fluid should be administered via
Two large cannulae
(16G at least in adults)
preferably inserted through un-burned skin

Monitoring resuscitation

Urinary Output

Adults: 0.5 ml/kg/hr (30-50 ml/hr)

Children (<16yrs): 1.0 ml/kg/hr

Urinary catheter is vital in

>10% TBSA Children

>20% TBSA Adults

Genital burns

Monitoring resuscitation

- Urinary output
- Heart rate
- Blood pressure
- Central invasive haemodynamic
- Electrolytes
- Blood gases
- pH (<7.39 - lactic acidosis?)

Extra fluid is required in

- Inhalation injury
- Electrical injury
- Delayed resuscitation
- Dehydration
 - Fire-fighters
 - Intoxicated patients

Haemochromogenuria

- Extensive deep burn
- Electrical injury
- Blunt trauma
- Tissue ischaemia
- Urinary excretion of
- Haemoglobin from destruction of RBCs
- Myoglobin from muscle break down



©EMSB

Haemochromogenuria

- Urine becomes dirty red colour
- Haemochromogens deposited in proximal renal tubules
- Acute renal failure

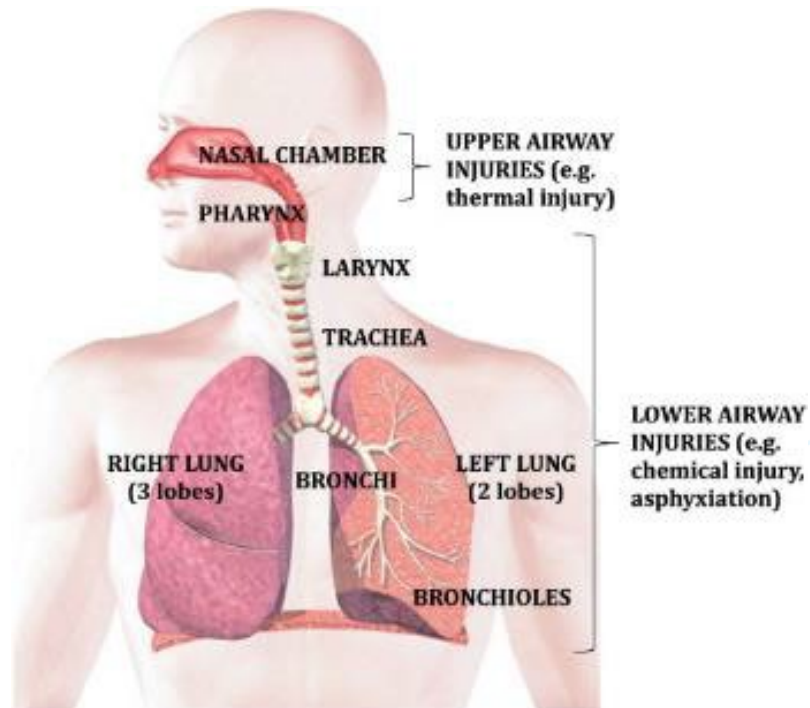
Haemochromogenuria

- Increase urine output to 1-2 ml/kg/hr
- Mannitol 12.5 g/l resuscitation fluid
- Sodium bicarbonate 25 meq/l (Alkalinise urine)

Tetanus

- Check immunisation status on admission
- Give tetanus prophylaxis if indicated

Inhalation Burn



Inhalation Injury

- Can be caused by heat, chemical compounds in the atmosphere or soot particles
- May increase mortality by up to 40%

Inhalation Injury

- Upper airway (supra-glottic)
- Lower airway (sub-glottic)
- Systemic intoxication (CO, HCN poisoning)

Supra-glottic Injury

- Upper airway is a good heat exchanger.
- Hot gases cause thermal injury.
- Loose mucosa allows rapid swelling.
- Obstruction in first 5 to 12 hours.
- Diagnosis on history, examination.
- Treat by EARLY intubation.

Sub-glottic Injury

- Smoke is a mixture of particles.
- Particles penetrate to different levels.
- Dissolve to give variety of chemicals (acids and alkalis).
- Cause inflammation of all airways.
- Best diagnosed by bronchoscopy.
- Onset can be days after injury.
- Merges with lung component of SIRS.

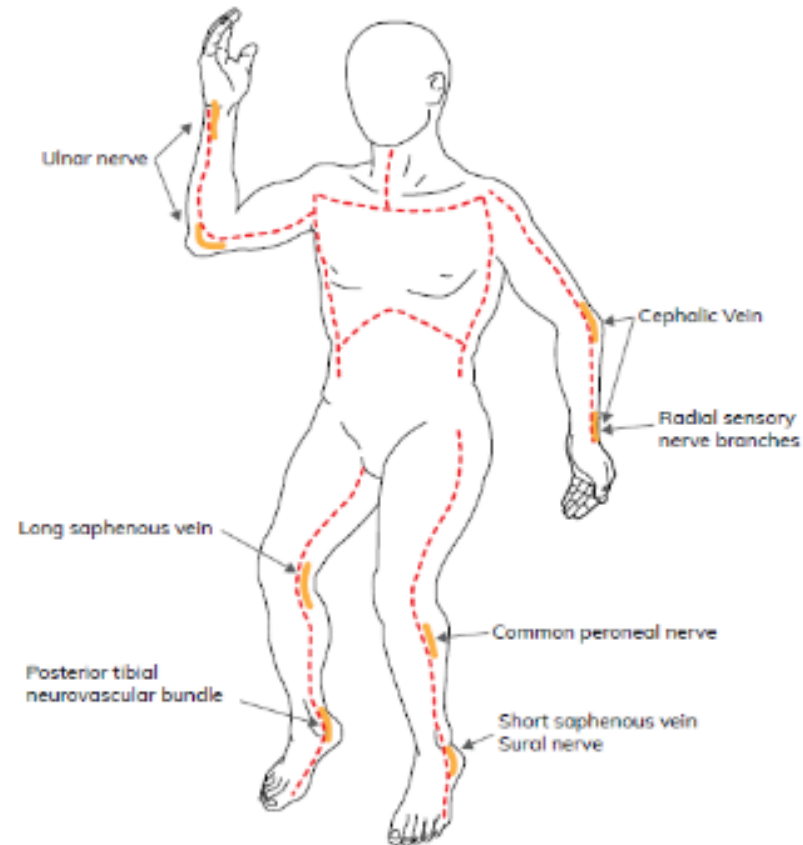
Systemic Intoxication

- Chiefly CO & HCN.
- Closed space injury.
- Displaces O₂ from Hb; blocks cytochromes
- Symptoms of headache, dyspnoea, irritability, confusion, coma, death.
- Usually combined with hypoxia.
- Treat with O₂.
- Usual cause of death at scene of fire.

Inhalation Injury

- Obtain adequate history
- Examine for signs of airway burn
- Give Oxygen
- Consider intubation early
- Monitor O₂ saturation

Escharotomy



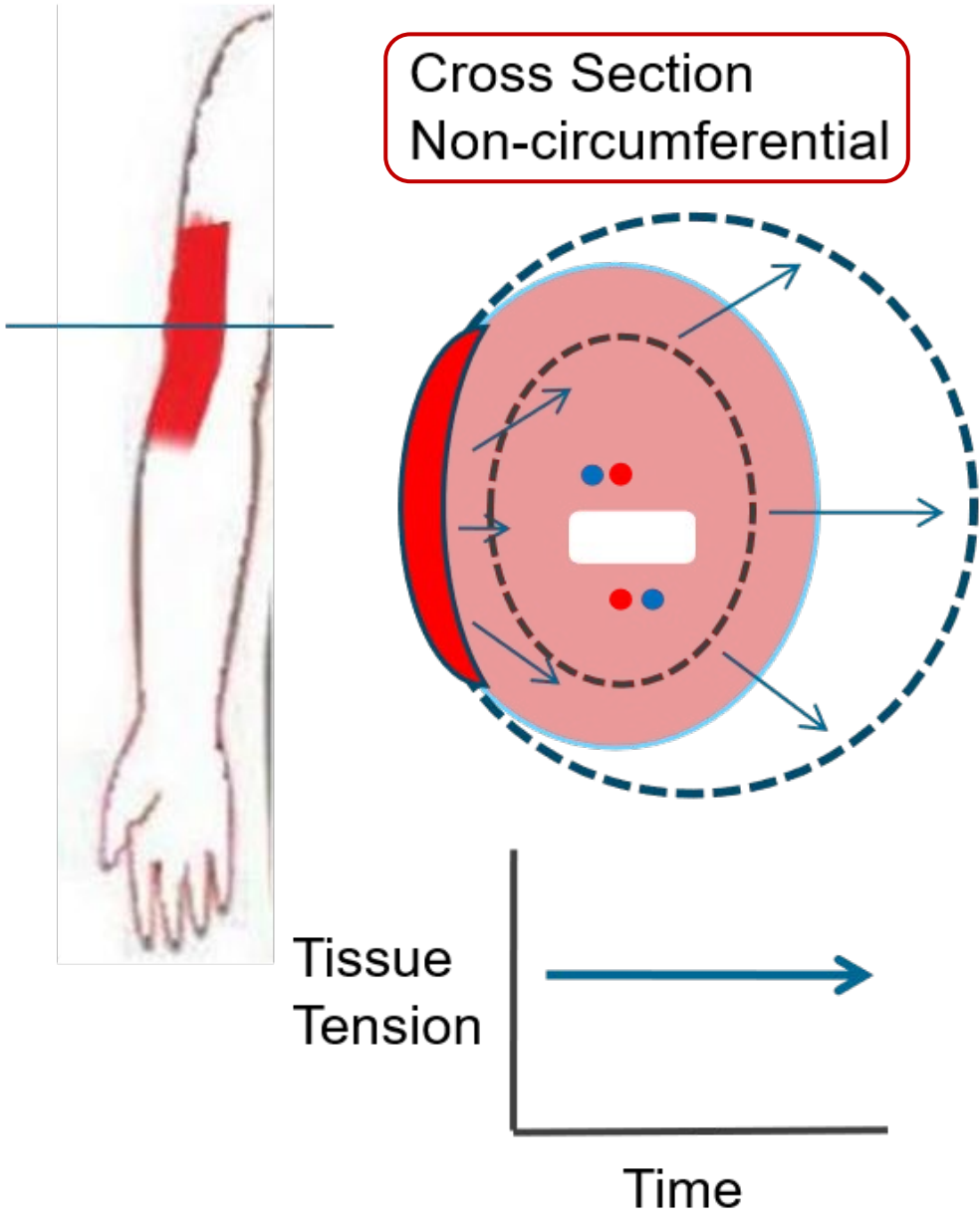
Circumferential Burns

- Burnt skin → rigid = eschar
- Fluid leaks from damaged capillaries → swells
- If burn circumferential fluid trapped in limb which cannot swell
→ **venous occlusion → arterial occlusion → ischaemia**
- Around chest → restricted expansion
- Child's front → restricts diaphragm

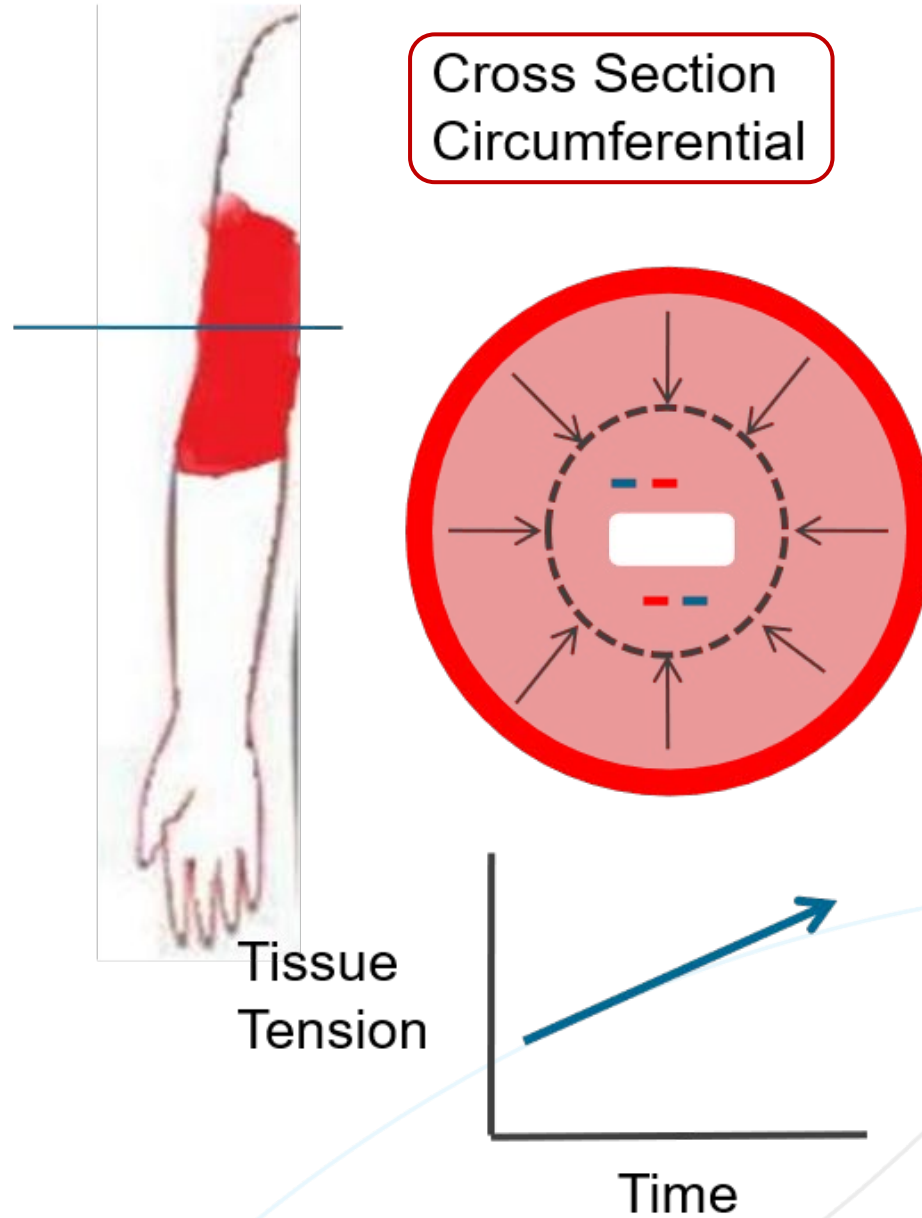
Elevation reduces swelling

? escharotomy

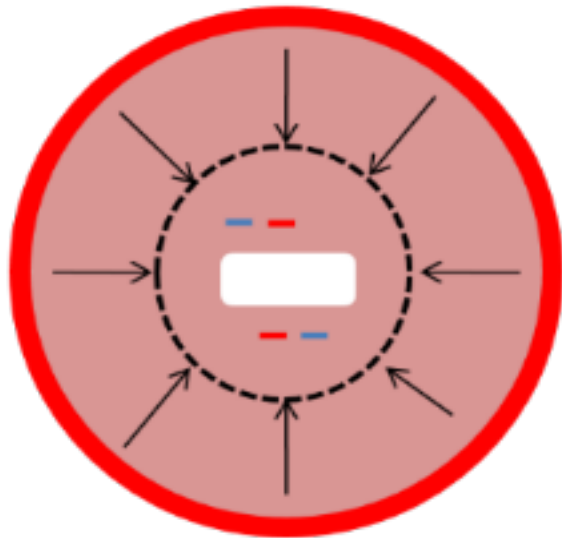
Cross Section
Non-circumferential



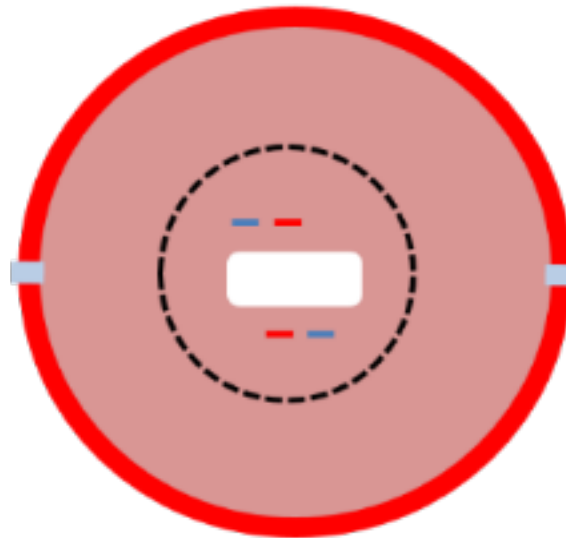
Cross Section
Circumferential



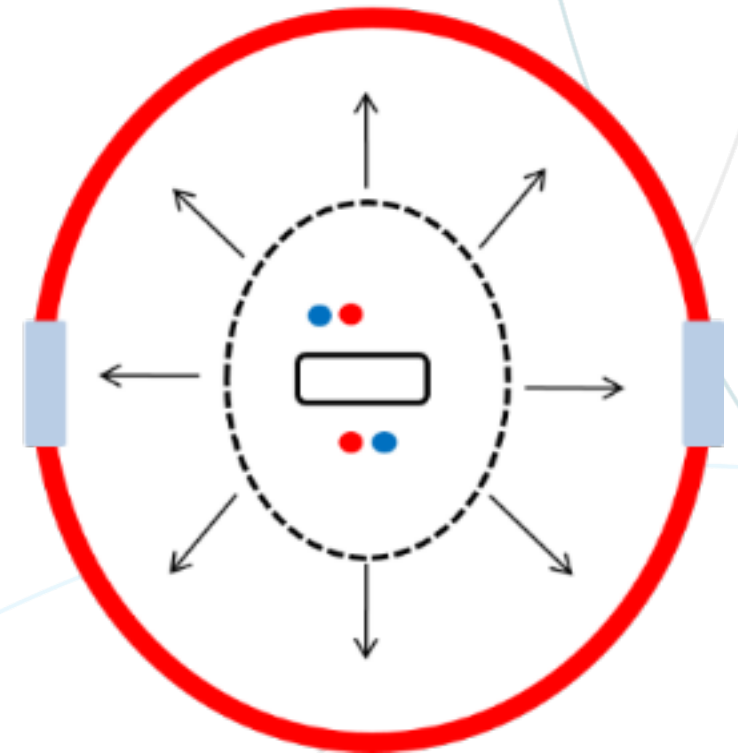
Circumferential
burn



Escharotomy
performed

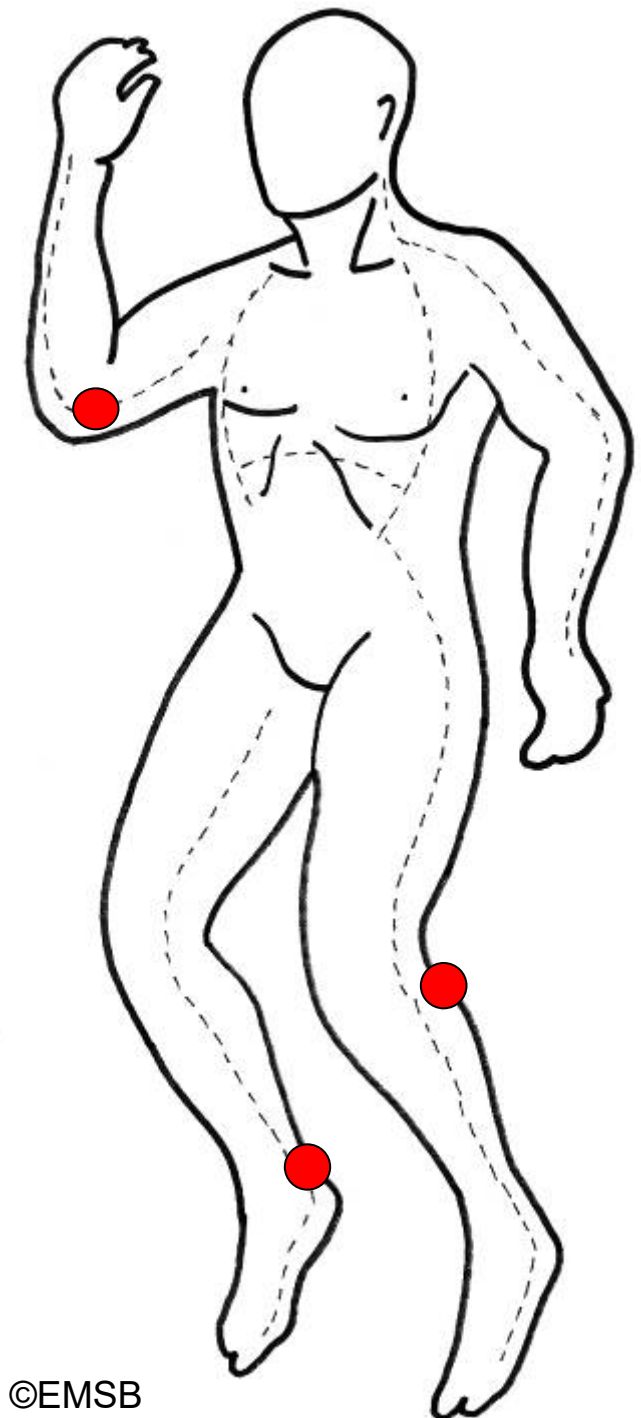


Pressure
released



Be careful of:

- **Ulnar nerve** posterior to medial epicondyle
- **Common peroneal nerve** winding around head of fibula
- **Posterior tibial artery and nerve**, posterior to medial malleolus.











Summary

- TBSA estimation major knock-on effects
 - fluid
 - escharotomies
 - airway
 - transfer requirement
 - wound management
- Often over-estimation

Structure of EMSB Approach

L O O K	A I R W A Y	B R E A T H I N G	C I R C U L A T I O N	D I S A B I L I T Y	E X P O S U R E	F LUIDS	A.M.P.L.E. History
						A NALGESIA	Head to Toe Examination
						T ESTS	Tetanus
						T UBES	Documentation
D O	C-spine control	Supplemental O ₂	Haemorrhage control & I.V. access	AVPU & Pupils	Environmental Control (& Estimate TBSA)		Referral Support
Primary Survey						Check First Aid	Secondary Survey

References

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ACI Statewide Burn Injury Service

<http://www.aci.health.nsw.gov.au/networks/burn-injury>

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