# Burns management in ED

## Electrical injuries

# Electrical injuries

- Nerves in the brain, muscle and in the heart are considered "excitable" tissue meaning that electricity can affect their function drastically.
- Secondary injuries can occur if a person is thrown due to electrical jolt.
- ***Voltage***, ***amount of current*** and ***type of current*** determine the extent of the injury sustained.
- Type of current means the direction of flow:
  - Direct current (DC)= electricity flows in one direction
  - Alternating current (AC)= moves back and forth in a particular direction or can change direction

# Types of electrical injuries

| | Alternating current | Direct current |
|---|---|---|
| **Low voltage (<1000 volts)** | Domestic power supply<br>• Contact burns<br>• Cardiac issues if pre-existing cardiac issues | Car battery<br>Electroplating<br>Diathermy |
| **High voltage (>1000 volts)** | High tension power lines<br>Power station or substation<br>• Muscle injury (rabdo)<br>• Tissue damage- entry and exit wounds | Lightning |

# Types of electrical injuries...part 2

| Voltage | Skin | Deep tissue | Cardiac arrhythmias |
|---|---|---|---|
| **Low voltage (<1000volts)** | Local entrance and exit wounds<br>Muscle spasm | Only at site of entrance and exit | Immediate cardiac arrest, possible ECG changes |
| **High voltage (>1000 volts)** | Flashover burn can cause fire => deep burns<br>Full-thickness burns at entrance and exit | Muscle damage with rhabdomyolysis and compartment syndrome | Transthoracic current may cause myocardial damage and possible arrhythmias |
| **Lightning** | Superficial or dermal flashover burns. Exit wounds on the feet | Eardrum perforation and corneal damage | Respiratory arrest-likely will need prolonged CPR |

# Pathology

- Electrical injuries cause damage to the tissues from the generation of heat.
- Skin can have more resistance depending on how thin it is versus if it is calloused. And whether it is wet or dry: dry skin is more resistant.
- Our bodies will increase in temperature due to the heat produced from the electrical source.
  - If electricity has been conducted through bone there can be a large increase in body temperature and can cause secondary thermal burns.
  - Due to the depth of bones, heat is expelled slower causing damage to muscles, nerves and connective tissue.

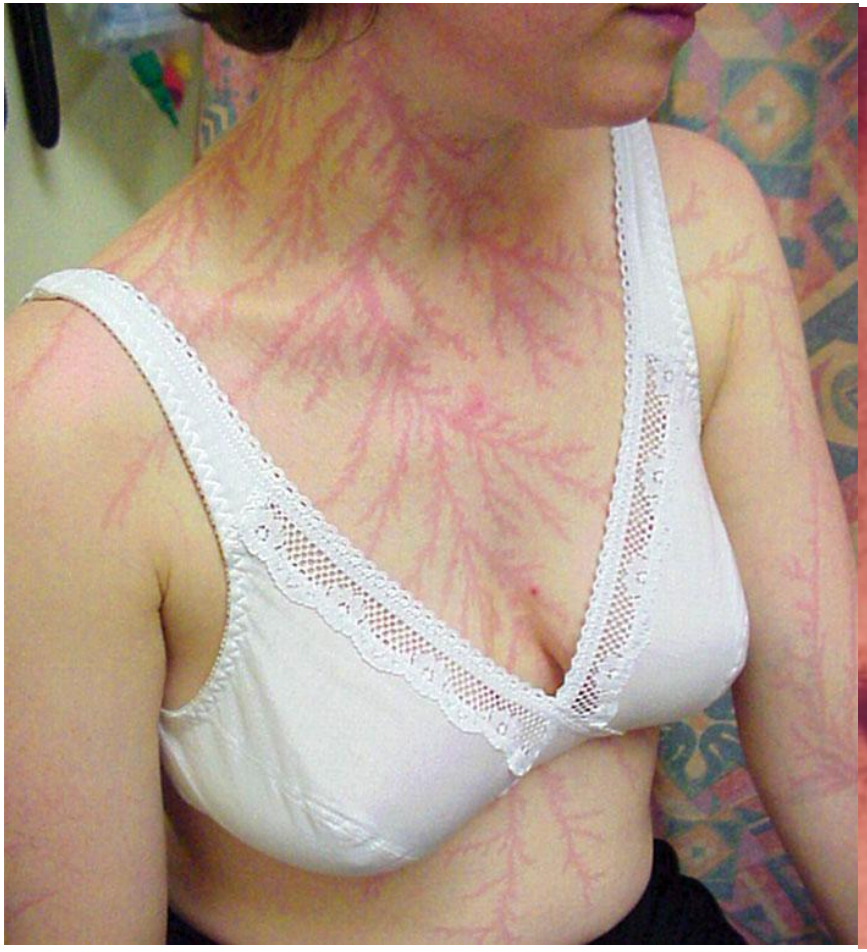
# Pathology of high voltage injuries

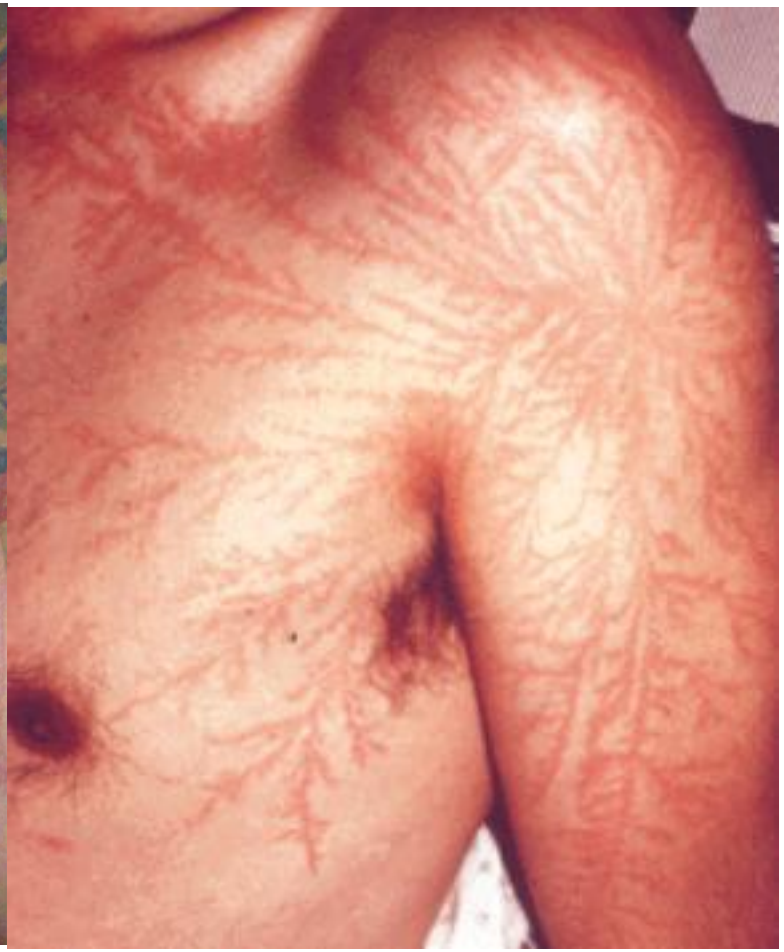
- Internal organ damage can result due to secondary injuries such as falls from power lines or being thrown due to electrical conductivity.
- Due to muscle damage the limbs swell and patients experience intense pain. The swelling can increase to the point where peripheral circulation is compromised (compartment syndrome). Fasciotomy is needed.
- Muscles release myoglobins when damaged which cause further damage and muscle necrosis. Myoglobin and haemoglobin can lead to renal impairment (rhabdomyolysis).

# Pathology of lightning injuries

- Ultra-high tension, high aperage, short duration electrical discharge from a direct current.
- Direct strike results in high mortality rates.
- More common is a side flash which occurs when lightning strikes an object of high resistance and the current is deflected through the victim when travelling to the ground.
- Likely to have deep exit wounds in the feet.
- Respiratory arrest is caused by disruption of the medullary respiratory centre followed by cardiac arrest is common post a lightning strike.
- Tympanic perforation and corneal damage is common

# Lichtenberg flowers





# Management of electrical burns

- First switch off the power supply or remove live wire or remove victim with an object made from non-conduction material.
- Primary survey
  - Airway with C-Spine protection
  - Breathing- aware of potential arrest.
  - Circulation- ?CPR
- History
  - How long ago did the incident occur?
  - Was there flash over or ignition?
  - Was there an episode of LOC?
  - Associated trauma- fall or thrown?
  - Cardiac arrest or arrhythmia?
- Secondary survey
  - Remove all clothes and jewellery
  - Assess site of entry and contact wounds: special attention to head, hands and feet.
  - Estimate TSBA and depth of burns
  - Neurological assessment- peripheral nerves and C-spine
  - Document, document, document

# Resuscitation

- Fluid requirement is always more that anticipated.
- Patient with deep tissue damage, Rhabdomyolysis should be anticipated and an ICD inserted and urine output closely monitored.
  - 0.5ml/kg/hr in adults
  - 1ml/kg/hr in children
- If an electrical current is sent through the chest is can cause temporary cardiac arrhythmias.
- High voltage electrical injury patients who had an LOC or an initially abnormal ECG may need 24 hours of cardiac monitoring.
- Arrhythmias are more common in patients with pre-existing cardiac disease.

# Peripheral circulation

- Hourly peripheral circulation assessment
  - Skin colour
  - Oedema
  - Capillary refill
  - Peripheral pulses
  - Skin sensation
- Compartment syndrome should be anticipated.
- Fasciotomy may be needed to relief the pressure.

# Paediatric electrical injuries

- These will usually be low voltage as they will be from home appliances.
- Infants- Full thickness wounds around the mouth as they suck on cords.
- Children- finger and hand injuries from playing with wires.
- These are considered “special areas” and should be sent to the burns unit.
- ECG should also be obtained on arrival, and undergo 24 hour of cardiac monitoring if there was LOC, or abnormal ECGs.