FORENSIC & TOXICOLOGY

SUMMARY

Done by Shahed Atiyat

Electrocution

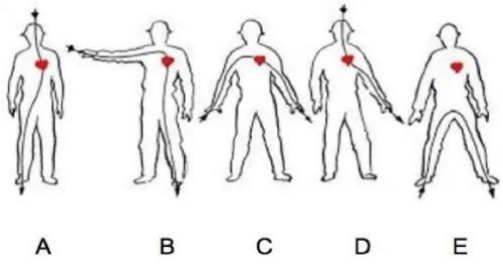
Death or severe injury happens due to the passage of electric current through the body.

Sources of electricity:

1. Demotic, 240 volts (the most common source).
2. Industrial, up to 40000 volts.
3. Lightning, up to 300 million volts.

Factors that affect the degree of injury/ damage in the electrocution:

- Current strength and voltage.
- Resistance (more resistance = less conduction but severe injury).
  - Bone (highest) > fat > tendon > skin > muscle > nerve > blood (lowest).
  - The skin has a variable resistance (higher when dry, lower when wet).
- Duration of contact.
- Type of current (Alternating current [AC] or Direct current [DC]).
  - AC is worse; it cause prolonged muscle contraction make it harder for a persons to release the electrical source & it disrupt the normal heart rhythm (ventricular fibrillation).
- Pathway through the body.
- Surface area & site of contact.
- Environmental conditions (humidity, metal, …).
- Personal factors (age, medical illnesses like heart disease).



Pathways of electrocution

The more vital organs/tissues passing through = the more dangerous the electrocution is.

"**A**" considered the **most** dangerous (the current passed through the **heart**, **brain** & **diaphragm**).

Causes of death in electrocution:

1. Ventricular fibrillation (cardiac arrest) — the most common cause.
2. Asphyxia — due to respiratory muscles paralysis or damage of brain stem (respiratory arrest).
3. Thermal injury — in case of high voltage exposure.
4. Multi-organ failure & CNS damage.
5. Secondary trauma — like falls, infection, septicemia (due to burn).

Electrocution marks:

Local effects

- **Joule burn:** burn due to thermal effects caused by electrical energy (more in low-voltage). When the current passes through the body, the body's tissues resist the flow of current, and this resistance generates heat.
  - Blisters, redness, superficial-deep thermal burn at the site of contact.

- **Crater lesion:** usually seen in case of the high-voltage electrocution:
  1. Center zone: charred black and necrotic tissue.
  2. Intermediate zone: damaged tissue with coagulative necrosis (not completely dead tissue).
  3. Outer zone: hyperemia and inflammation due to increased blood flow.

- **Exit wound:** Larger and more irregular. May have a charred edges with extensive tissue necrosis. The electrical current exits the body with greater force than it enters leading to extensive damage. In high-voltage current, the exit often appears as a 'blow-out' type wound.
- Flash or spark burn.
- Wounds (lacerated or punctured wound with contusion at the margin).

Systemic effects

- CNS damage.
- Eye (cataract).
- With recovery there may be muscular pain, fatigue, headache, irritability.
- Immediate death.

Autopsy findings:

External findings:

1. Electrocution marks.
2. Burned clothes and body hair.
3. Fractured ribs (due to severe convulsions).
4. Extensive ecchymosis.
5. **Rigor mortis develops early** with blue-red livor mortis is well-developed.
6. Suspended animation.
7. Joule burn at the site of entry is diagnostic.

Internal findings:

1. Ocular congestion with dilated pupils.
2. Pulmonary edema.

3. Petechial hemorrhage (brain, pleura, pericardium).
4. Bone pearl's on X-ray is **pathognomonic** for electrocution.

Clinical features of lightning injury:

1. Clothing: torn/ singed.
2. Skin:
   - Superficial burn, **Lichtenberg** burn "lightning flower" **(pathognomonic for lightning).**
   - Metallization.
3. Cardiac: arrhythmia (V. Fib).
4. Neurological:
   - Immediate: pupil dilation/anisocoria (asymmetric pupil size), LOC, amnesia, seizures.
   - Delayed: myelopathy, complex regional pain syndrome.
5. Vascular: spasm.
6. ENT: tympanic membrane rupture (blast injury).
7. Ocular: cataract, retinal detachment.

Lichtenberg

Metallization

Notes:

- The **mode** of death in electrocution is syncope.
- The most common **cause** of death is arrhythmias.
- The **manner** of death is accidental.

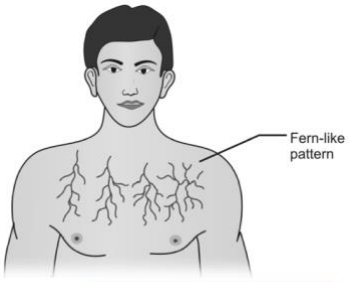


Fig. 14.8: Litchenberg flowers/Filigree burns