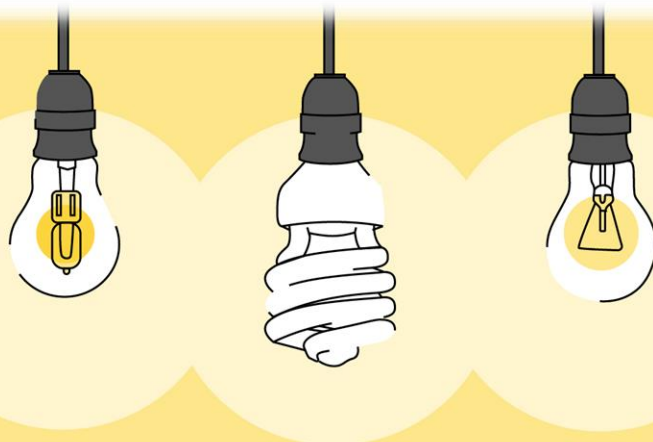


ELECTRICAL INJURIES,
ATMOSPHERIC
LIGHTENING,
EXPLOSION INJURIES

Electrical injuries



Depends on:

- Nature of current

*In India, the domestic supply is 220-240 volts
AC at 50 Hz*

- Amperage vs voltage

- Amount of current

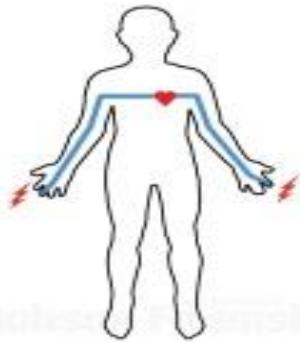
$$A = V/R$$

Effect of various amounts of AC & DC on body

mA (AC)	mA (DC)	Effects
1	1	Threshold of sensation
5	5	Tremor and spasm
10	10	May involuntarily let go of electric line
20	20	Painful muscular contractions (tetany)
25	25-80	No permanent harm
25-80	80-300	LOC, arrhythmias, respiratory spasms
80-100	>300	Irreversible ventricular fibrillation , death

- 
- Path of current

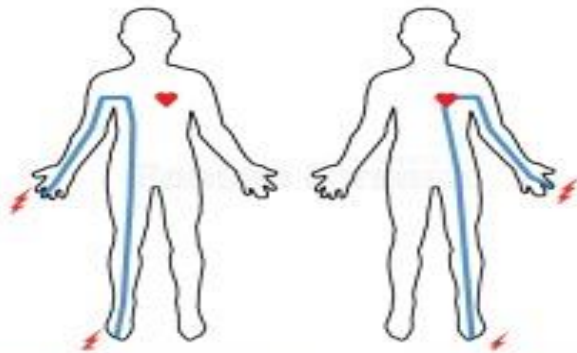
Hand & Hand Contact
thru hands, arms and chest



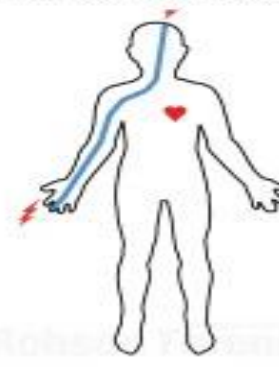
Hand & Arm Contact
thru hand and arm



Hand & Foot Contact
thru hands, arm, chest, abdomen, leg and foot



Hand & Head Contact
thru hand, arm, neck and head



- Duration of current

$$Q = I^2 \times R \times t$$

Cause of death

- Low voltage (household) current
 - Ventricular fibrillation
- High voltage (industrial) current
 - Paralysis of respiratory center
 - Electro thermal injury

Post Mortem findings

□ External

• Electric entry mark

a. Contact burn

b. Joule burn

✓ produced in low voltage currents

✓ Appearance:

- *Crater*, 1-3 cm in diameter with a ridge around circumference

- *Charring*

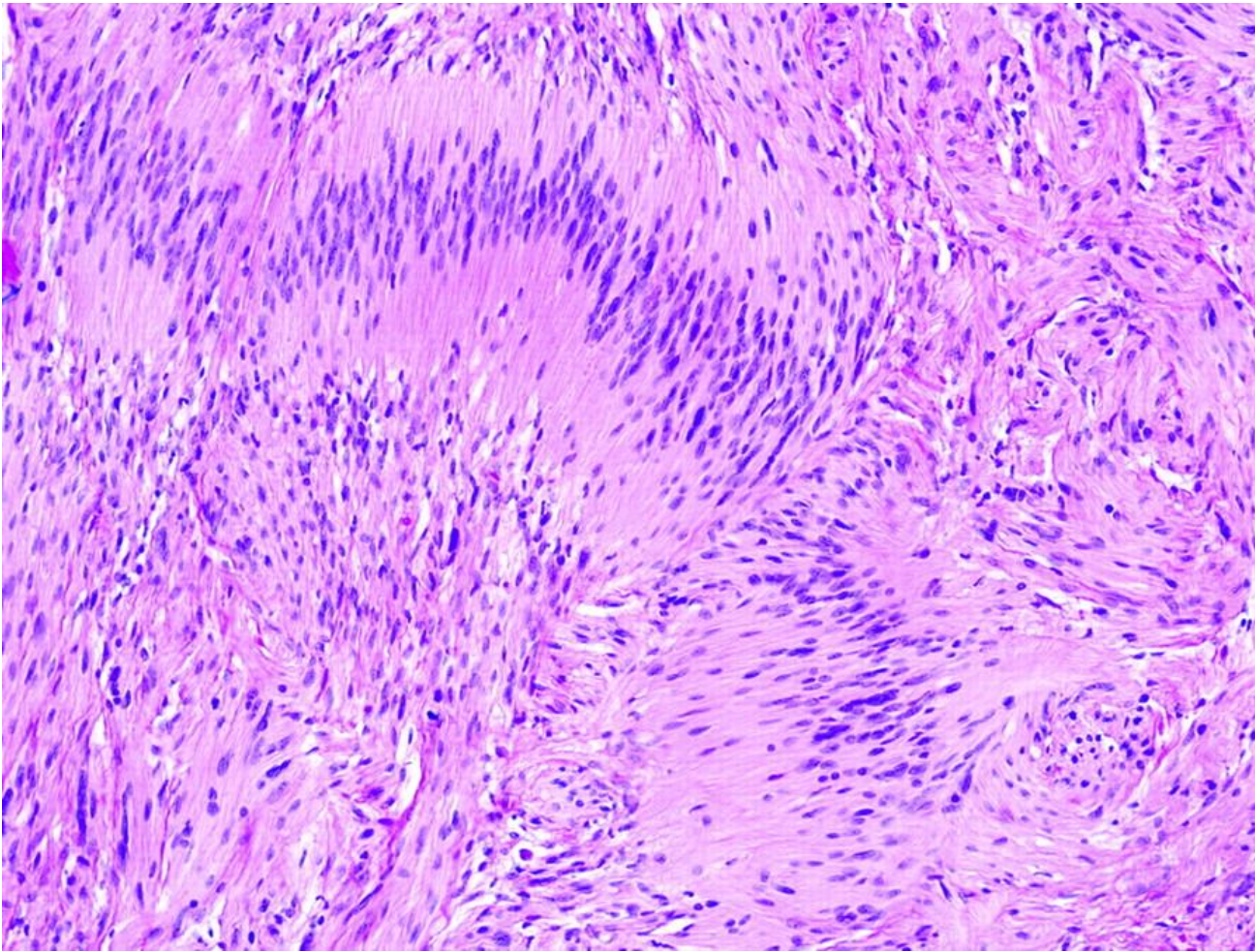
- *Metallization* -- *Acro reaction Test*

Absence does not
rule out
electrocution



✓ Histology:

- *Micro blisters*
- *Electric channels* – cells separated in the form of sharp slits
- *Palisading and streaming of nuclei*
- *Collagen* stains blue in ordinary H&E stain



Palisading of nuclei

Dr. Shiuli, Forensic Medicine & Toxicology, KGMU.

c. **Flash/spark burn**

- ✓ Produced in high voltage currents, when sparking occurs between conductor and victim
- ❖ *Crocodile skin* - High temperatures causes keratin of skin to melt over multiple areas
- ❖ *Arc eye* - superficial and painful keratitis

d. **Electric splits**

- ✓ Point of entry shows laceration



Crocodile skin

Dr. Shiuli, Forensic Medicine & Toxicology, KGMU.

- Exit mark
 - Where the body was earthed
 - More damage than entry

□ Internal

- Congestion of all organs
- Petechial hemorrhages along the line of passage of current
- Brain – irregular tears and fissures
- *Zenker's degeneration*
- *Bone pearls*

Medicolegal Aspect

- Manner of Death
 - Accidental
 - Suicidal
 - Homicidal
- Judicial electrocution
- Pregnancy and Electric Shock
- TASER



Lightening

Atmospheric discharge of electricity

- Electrical discharge is between a negatively charged cloud and a positively charged object on earth - **negative lightning**
- 5% of lightning flashes are from positively charged clouds - **positive lightning**
- Temperature - about 50,000* C
- Amperage - 12,000 to 200,000 Amperes
- Voltage - equivalent to 1 million volts DC



https://youtu.be/Cz_uYBx1G5s

Post Mortem appearance

□ External

1. Clothes

- Torn, burnt, may be stripped off
- Melting belt knuckles and zippers
- Objects in pocket

Keraunopathology

2. Burns

- *Endogenous burns* – due to heat generated within the body.
 - Linear Burn
 - Punctate Burn

- *Tip toe sign* – small, circular, full thickness burns involving the sides of the soles of the feet and the tips of toes.



➤ *Arborescent burns* – irregular, superficial, thin, tortuous markings on skin resembling the pattern of a fern or tree



- Seen in 20% to 33% cases
- Not associated with burning
- No pathological changes
- Disappear in 1-2 days in survivors

- *Exogenous burns*

Surface Burns

3. *Mechanical lesions*

□ Internal

- Brain – congestion, edema, hemorrhages
- Lungs – congested, patchy hemorrhages
- Muscles – necrosis
- Spinal cord – damage
- Eyes & Ears – cataracts, corneal edema, tympanic membrane perforation

EXPLOSION INJURIES

Dr. Shiuli, Forensic Medicine & Toxicology, KGMU.

Explosions

- Natural
- Chemical
- Nuclear
- Electrical
- Magnetic
- Mechanical

Incendiary Bombs

- **Napalm Bombs** – is an incendiary mixture of a gelling agent and a volatile petrochemical.

Was used in flamethrowers, bombs and tanks in world war II

- **Molotov Cocktail – Petrol Bomb**

Consists of a glass bottle partly filled with gasoline with a rag put inside to serve as a wick



- **Letter Bombs** - explosive device sent via post with the intention to injure or kill the recipient

EFFECT OF BLAST

- A. In the Air
- B. In the Water
- C. Mechanical Explosion

IN THE AIR

- Most frequently seen
- Causes sudden displacement of air
- Produces
 - Blast wave injury
 - Scorching by flame or hot gases
 - Injury by flying missiles
 - Effect of anoxia

Injuries due to bombs

Primary Blast Injuries

- *Due to direct pressure effects of blast waves*
- Organs which contain air most likely to get damaged
- Most sensitive organ → Ear
- Classic injury → TM rupture,
- Blast Lung

Secondary Blast Injuries

- Produced by flying missiles
- Marshalls Triad

Tertiary Blast Injuries

- Victim lifted and thrown away
- Heavy piece of masonry falls upon

Burns

- Quaternary injuries
- Flash burns

Fumes

Explosive Injury

- Dust tattooing

Complete disruption

IN THE WATER

- Occurs in explosion under water, mines torpedoes
- More marked in viscera containing air
- Most common organ suffering damage - Intestines
- Retroperitoneal hemorrhage , injury of intra abdominal organs, rupture of bowel walls commonly observed

MECHANICAL EXPLOSION

- Steam or gas boiler bursts due to increased pressure



The best
way to predict
the future
is to create it.

- Peter Drucker