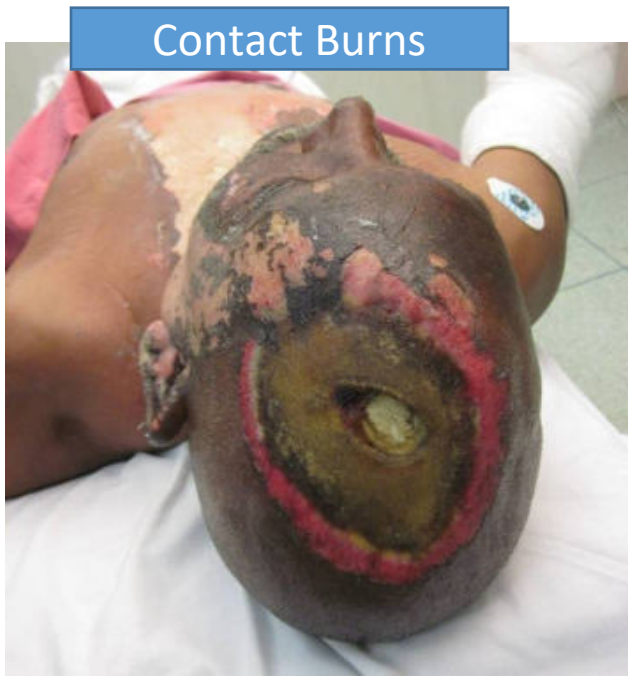
Non Thermal injuries, Burn Reconstruction Principles

Types of non Thermal Injuries

- 1. Electrical injuries
- 2. Chemical injuries
- 3. Cold Injuries
- 4. Ionizing radiation injuries

Electrical injuries



PATHOPHYSIOLOGY

- **Joule Effect:**
- Passage of current through a solid conductor results in conversion of electrical energy to heat

- **Ohm's Law:**
- I = V / R
- Intensity of the current (amperage) is directly proportional to the potential flow (voltage) and inversely proportional to the resistance

- **Joule's Law:**
- J = 0.24 x I sq x R x T
- J = Heat Production I = Current R = Resistance T = Time
- **Resistance of body tissues**
- Nerves and Blood Vessels - Good to excellent conduction
- Muscle Bone and Skin - Resistant to passage of electricity Electrical Burns
- **Extent of injury depends on**
- Type of current (alternating vs direct)
- Pathway of flow
- Local tissue resistance
- Duration of contact Electrical Burns

Mortality of electrical burns

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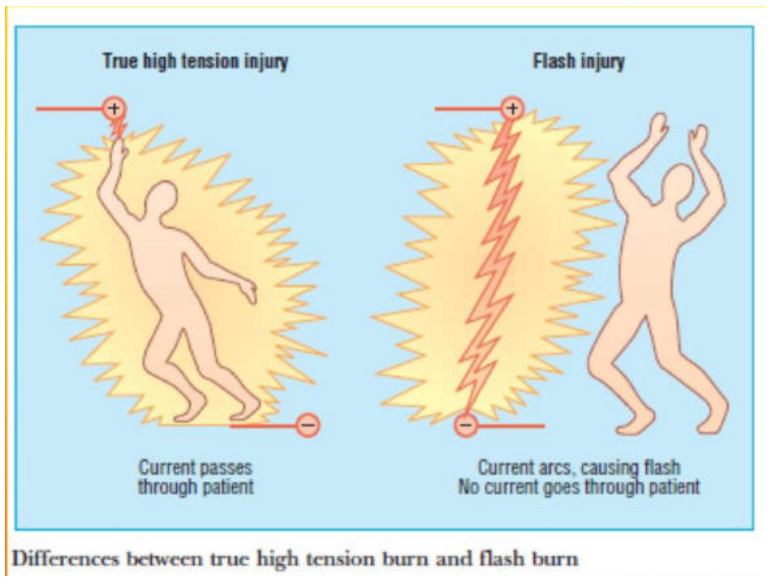
- **Low-voltage injuries**:
- Alter the cardiac cycle

- **High-voltage injuries**
- Cause concomitant tissue damage
- Survival of contact with voltage greater than 70,000 volts uncommon



Differences between true high tension burn and flash burn

What is Arc Flash/Blast?

ARC FLASH

- Radiant Heat - Horrific burns, Fires
  - can be fatal (3m)
  - arc jets 20,000oC,
  - plasma boundary 5000oC
- Light - UV burns/blinding
- Noise > 160dB ruptures eardrum
- Molten Metal (copper) >1080oC
- Toxic Gas - PVC (HCl, CO)/ metal oxides

ARC BLAST

Rapid expansion of air, vaporisation of copper conductors. 67,000 times metal to gas

- Pressure wave >1400kg/m2
  - breaks bones, collapses lung
  - destruction of assets
- Projectiles >1600km/hr

CLASSIFICATION

- I **Physical**

1.Heat

2.Electrical Burn injuries

3.Lightening injuries

4.Radiation burns

5.Friction burns

- II **Chemical**

Acids --1.Sulphuric acid

2. Hydrochloric acid

3. Nitric acid

4.hydrofluoric acid

5.Chromic acid

Classification—contd.

Alkalies – 1.Caustic soda

2.Caustic potash

3.Lime

4. ammonia

Organics – 1. Phenol

2. Lysol

3.Cresol

Inorganic -- 1. Phosphorus

2. Sodium

3. Magnesium

III **Other special burns**

1.Hot coal tar burns

2.Jaggery burns

3.Molten metal burns

4.Hot oil burns

CHEMICAL BURNS

- Apart from damaging skin chemical toxins may get absorbed through skin and go into circulation in chemical burns.Toxic effects on patients are in

1. liver—acute liver atrophy
2. renal—renal failure
3. nervous –delerium and convulsions

Carbolic acid (Phenol) , Creselic acid (cresol),

Chromic acid and Hydrofluoric acid are known to cause systemic toxicity

Management of chemical burns

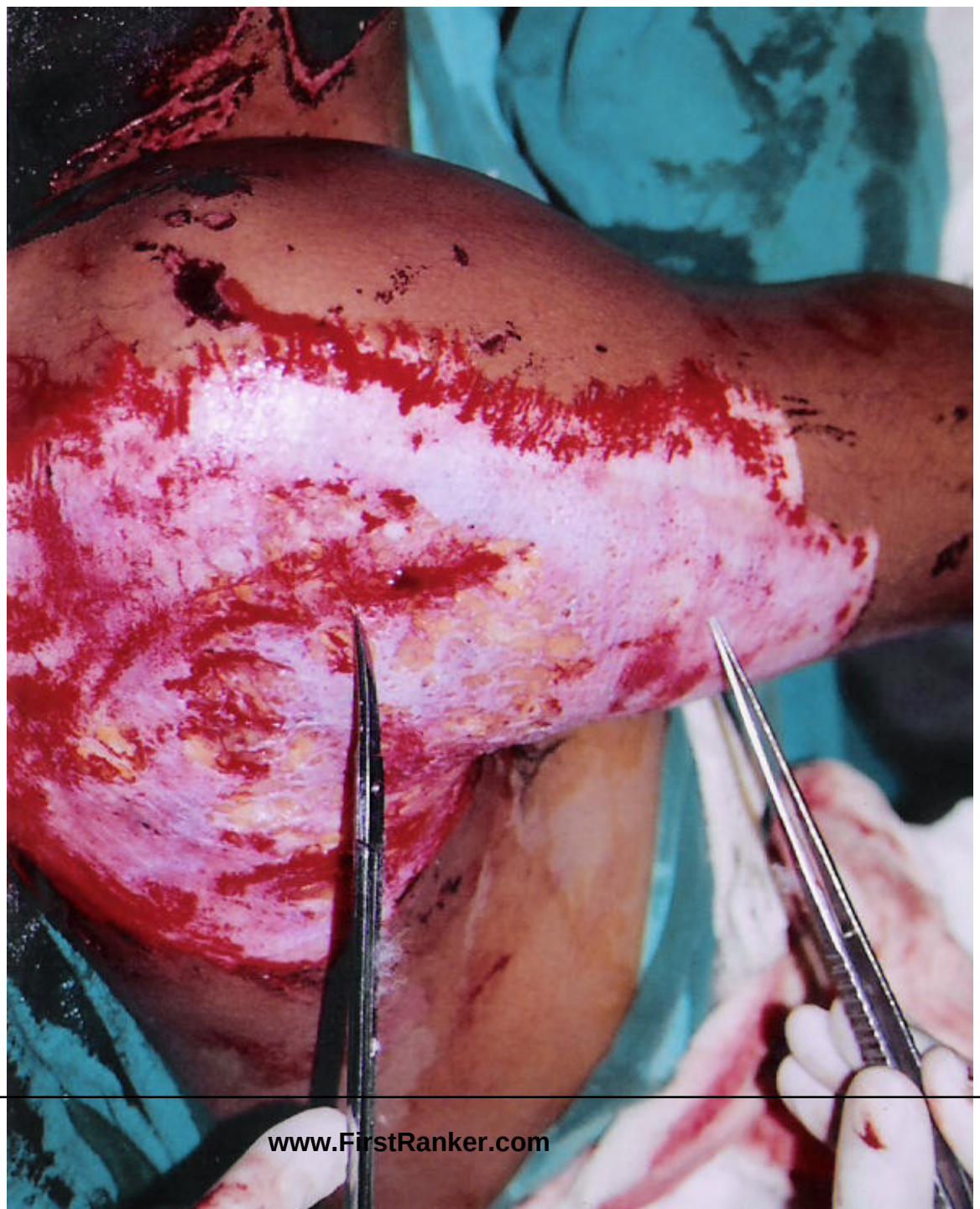
1.Wounds to be washed with running water minimum for 15 min or till litmus test becomes negative.

2.Proper care of eyes in facial burns with ophthalmic reference

3. Early excision and skin grafting.

Surgical

Surgical Management



Special Chemical Burns

- Hydrofluoric acid burns—HF acid is used in glass industry . Patient presents with severe intense pain at the site of burn. Treatment in these burns is Ca Gluconate irrigation or local injection.

- Phenol burns--- are known for its systemic manifestations. Treatment is irrigation with copious water and removal of phenol.

Hydrofluoric acid burns

Tar burns

Car battery acid burns

Burns of special sites

1.Burns of face –eye, ear

2.Burns of hand

FACIAL BURNS

- **Eye burns** –
- inability to close the lids
- exposure keratitis with damage to cornea.
- managed either with tarsorraphy or early excision and skin grafting

Ear burns –

- Ear cartilage is peculiar in nature –

1. is a single cartilage
2. perichondrium is tightly adherent with skin on both the sides

- Burns of ear if not properly treated may lead to chondritis and crumpled ear deformity.
- Treatment includes –

1. closed dressing with antibacterial cream
2. pillows to be avoided to prevent frequent rub and subsequent infection
3. excision and temporoparietal fascial cover in full thickness burns of ear.

Summary of tt. For specific chemical burns

- Irrigation with water-all except sodium , lithium, potassium metals and mustard gas
- Calcium salt inj. Or irrigation –hydrofluoric acid
- cover with oil – Na, K ,LITH. Etc.
- cover with water –phosphorous metal

Radiation burns

Management

- Aloe vera cream
- Corticosteroid creams
- Systemic Amifostine

Cold injuries

Frost bite

- **Rewarming of the skin**
- **Debridement and pain medication**
- **Whirl pool therapy**
- **Anticoagulants and antibiotics**
- **Surgery**
- **Hyperbaric oxygen**

Trench foot

Below freezing Temperature + moisture

Management

- Rest, warming
- Picric acid, Boric acid
- Alcohol