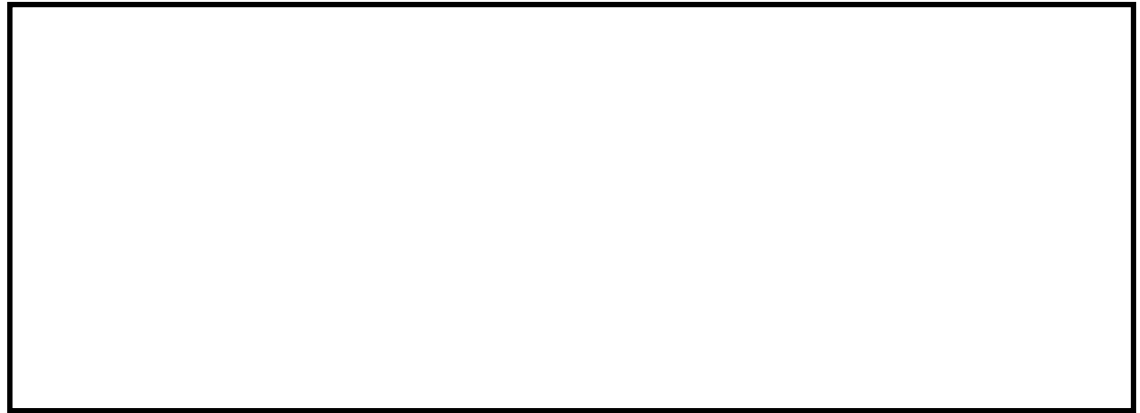


# ASPHYXIANTS





- Irrespirable gases.
- Respiratory embarrassment.
- Henderson & Haggard classified it into 5 classes.

## **CARBON MONOXIDE (CO) POISONING**



**CAN'T BE  
SEEN**



**CAN'T BE  
SMELLED**



**CAN'T BE  
HEARD**



**CAN BE  
STOPPED**

# A. IRRITANT TO RESPIRATORY TRACT

- Irritate.
- Inflammatory changes.
- Divided into 5 sub classes :
  - a) Halogens- Cl, Br, I, Fl.
  - b) Halogen compounds- Phosgene, Chloropicrin.
  - c) Sulphurous gases-  $\text{SO}_2$ ,  $\text{H}_2\text{S}$ .
  - d) Nitrogenous gases-  $\text{N}_2$ ,  $\text{N}_2\text{O}$ ,  $\text{NO}_2$ .
  - e) Phosphorous gases-  $\text{PH}_3$ , Phosphides.

## B. CHEMICAL ASPHYXIANTS

- CO: Reduces O<sub>2</sub> carrying capacity of blood.
- HCN: Interferes with Respiratory enzymes  
(Cyt O)

## C. SIMPLE ASPHYXIANTS

- Act mechanically by excluding O<sub>2</sub> from tissue.
- ✓ Co<sub>2</sub>, No<sub>2</sub>, Methane.

## D. VOLATILE AGENTS

- Act as either anaesthetic or toxic to different organs.
- ✓ Aliphatic hydrocarbon, Aromatic hydrocarbon, Halogenated hydrocarbon.

# CARBON MONOXIDE [CO]

- Colourless, tasteless, non irritating, odourless.
- Lighter than air.
- Burns with bluish-white flame.
- Combine with metals like nickel, iron to form colourless liquid 'Carbonyls'.
- Combination with chlorine 'Carbonyl chloride or Phosgene gas'.

➤ Formed in following ways:

✓ Incomplete combustion of carbonaceous matter.

✓ Household domestic coalgas.

✓ Water gas ( passing steam over red hot coal)

✓ Kerosene stoves.

✓ Blast furnaces.

✓ Mine explosions (After damp)





Carbon monoxide



Haemoglobin in RBCs



Carboxyhaemoglobin



Reduces the O<sub>2</sub> carrying capacity of blood

- Affinity of CO to Hb is 200-300 times >> than O<sub>2</sub>.
- Gas has no specific toxicity of its own.

- **FATAL DOSE & FATAL PERIOD :**

0.01% is safe limit

0.02-0.05%- Poisonous manifestations.

1%- Unconsciousness in 15-20 min.

0.2%- death in 4 hours.

0.4%- death in 1 hour.

10%- death in 10-30 min.

# SIGNS & SYMPTOMS

- A. Depends upon Concentration in blood:
  1. **< 10%** : No untoward features.
  2. **10-20%** : With little exertion- lassitude, headache, SOB, giddiness.
  3. **30-40%** : Headache(throbbing), faintness, giddiness, nausea, muscular weakness, dyspnoea, mental instability.
  4. **40-50%** : symptoms become more intensified & pronounced.

**5. 50-60%** : Complete paralysis of limbs, involuntary evacuation of stool & urine, reflexes depressed.

**6. 60-70%** : Coma, death due to respiratory failure, death due to respiratory failure if exposure continues.

**7. >70%** : Coma deep & profound, Rapid death.

- **B. When gas is inhaled in dilute form :**

- ✓ State of helplessness.
- ✓ symptoms are less pronounced & delayed.

- **C. Sequelae of prolonged post hypoxic effects:**

- ✓ cerebral hemorrhage, optic neuritis, spastic paraplegia, retrograde amnesia, dementia, gastric irritability, breathlessness, tachycardia may persist for days or weeks.

- **CHRONIC CO POISONING :**

- ✓ who are at risk ?????

- Workers of gas houses

- Automobile workshop

- Inhabitants of ill-ventilated rooms

- Workers of mines.

- Person who smoke.

- ✓ Remain symptomless until saturation reaches above 20% (Approx).

# TREATMENT

- Remove from offending atmosphere.
- Attend source of gas.
- Artificial respiration.
- 100% oxygen.
- Hyperbaric oxygen (2-2 ½ ATM).
- Patency of airway.
- Exchange blood transfusion.
- ✓ Special gas mask should be worn by rescue workers.

# POST MORTEM APPEARANCES

- **EXTERNALLY:**

- ✓ Cherry red lividity.
- ✓ Petechial haemorrhagic spots- face, conjunctiva, .
- ✓ Blood- Bright red in color.

- **INTERNALLY:**

- ✓ Organs – Congested, hyperaemic, bright red.
- ✓ Varying degree of brain damage.
- ✓ Lungs – congested, oedematous, intrapulmonary haemorrhages, pulmonary oedema.
- ✓ Heart – right side filled with bright red blood, myocardial degeneration, patchy necrotic areas with haemorrhages.



# TESTS

➤ **Spectroscopic test:**

2 well defined bands between D & E lines of solar spectrum.

➤ **Kunkel test/ Tannic acid test:**

When 3% aq. Tannic acid solution added to blood after dilution with water, pinkish white precipitate is formed.

# Medico-legal Points

- Accidental CO poisoning – ill-ventillated, overcrowding.
- From house hold use of – geyser, radiator, oil lamps, cooking with butane lamps.
- Explosion in confined spaces, mines, industries.
- Suicidal deaths are common with coal gas in western countries.
- Homicidal use of CO is not uncommon unless victim is incapacitated.

- CO retards putrefaction- discovered in body several days or months after death.



# CARBON DIOXIDE (CO<sub>2</sub>)

- Colourless, odourless, heavy gas, 0.4% of atm gas.
- Formed in following ways:
  - ✓ Respiration, combustion, fermentation, decomposition.
  - ✓ After damp.
  - ✓ Ill ventilated rooms, overcrowding.

# MODE OF ACTION

- Gas is not toxic.
- Prevent tissue from obtaining required amount of O<sub>2</sub>.
- Potent vasodilator.
- Stimulant of respiratory centre, but when respiratory centre is depressed by anoxaemia or narcotics CO<sub>2</sub> fails to stimulate it.

# SIGNS & SYMPTOMS

- 1. **Pure CO<sub>2</sub> gas**: Sudden death, Vagal inhibition, spasm of glottis.
- 2. **Co<sub>2</sub> < 2%** No symptoms occurs.
- 3. **2%-5%** : Breathing deeper, tidal volume increases.
- 4. **5%-10%** : Headache ( throbbing), dizziness, giddiness, dyspnoea, tightness in chest, impaired vision.
- 5. **>20%-40%** : symptoms will intensify.
- 6. **40%-60%** : dyspnoea, discomfort, muscle weakness.
- 7. **> 60%** : Unconsciousness, convulsion, death.

- **Seqalae:**

Residual aches, paralysis, amnesia, anoxia, anorexia, malnutrition, tendency to sleep, weakness, weight loss.

# TREATMENT

- Remove from offending atmosphere.
- Attend source of gas.
- Artificial respiration.
- 100% oxygen.
- Cardiac stimulants: amphetamine sulphate, coramine.
- Treat symptoms of irreversible brain damage respectively.



# POST MORTEM APPEARANCE

- **Externally:**
  - ✓ Cyanosis, eyes-congested, pupils-dilated.
  - ✓ Face- pale, flaccid with petechial haemorrhages.
  - ✓ Neck veins- engorged.
- **Internally:**
  - ✓ Organs- congested.
  - ✓ Lungs- oedematous, on cut section-frothy fluid blood.

# MEDICO LEGAL ASPECTS

- Nearly always accidental:
  - ✓ Ill ventilated rooms, overcrowded rooms.
  - ✓ After damp
  - ✓ Well cleaning, pits.
  - ✓ Intoxication during anaesthesia.

# SULPHARATED HYDROGEN( $H_2S$ )

- Colourless, transparent.
- Slightly heavier than air.
- Sweetish disagreeable taste.
- Smell of rotten eggs.
- Blue flame with production of  $SO_2$  & water.

- **Produced during :**

- ✓ decomposition of organic & vegetable mater.
- ✓ sewers (stink dump)
- ✓ rubber industry, sulphur dye work, tanneries.

- **FATAL DOSE & FATAL PERIOD:**

0.02%: local irritation.

0.05%: alarming symptoms.

0.15%: death within ½ hr.

0.18%: Immediate death.

# SIGNS & SYMPTOMS

- If  $> 0.18\%$  then unconsciousness, respiratory depression, convulsion, death.
- **Dilute form** : lacrimation, photophobia, conjunctivitis, headache, giddiness, nausea, vomiting, muscular weakness, convulsion, delirium.
- **Chronic poisoning**: above symptoms plus features of bronchopneumonia, GI disturbances, peripheral neuritis.

# TREATMENT

- Remove from offending atmosphere.
- Attend source of gas.
- Artificial respiration.
- 100% oxygen.
- Cardiac stimulants: amphetamine sulphate, coramine.
- Treat symptoms of lung complications respectively.

# POST MORTEM APPEARANCE

- Organs-dark brown (due to sulphmethaemoglobin)
- Lungs : congested & oedematous, evidence of bronchopneumonia & pulmonary oedema.
- Rapid putrefaction, greenish discoloration due to formation of sulphmethaemoglobin.
- Blood: dark brown in colour.

# WAR GASES

- Chemical compounds used at times of war for mass destruction.
- **ESSENTIALS:**
  - ✓ Cheap
  - ✓ Surely toxic
  - ✓ Getting volatalised
  - ✓ Heavier than air.
  - ✓ Stable, non corroding to its container.



1. Lung irritants or Asphyxiants or Choking gases:

Chlorine, phosgene.

2. Lacrimators or Tear gases:

Chloracetophenon(CAP),Bromobezylcyanide(BBC)

3. Vesicants or Blister gases:

Mustard gas, Lewisite

4. Sternutators or Nasal irritants or Vomiting gases:

Diphenyl-chlorarsine(DA), diphenyl-cyanarsine (DC)

5. Paralysants or Nerve poison: CO, HCN, H<sub>2</sub>S.

6. Nerve gases: Toxic chemicals having acetylcholine like action.

- Bhopal gas tragedy( dec 1984) : Union carbide plant- Mic(methylisocyanite) – mixture of methylamine & phosgene – killed >2000 people.
- Lewisite was used during second world war.