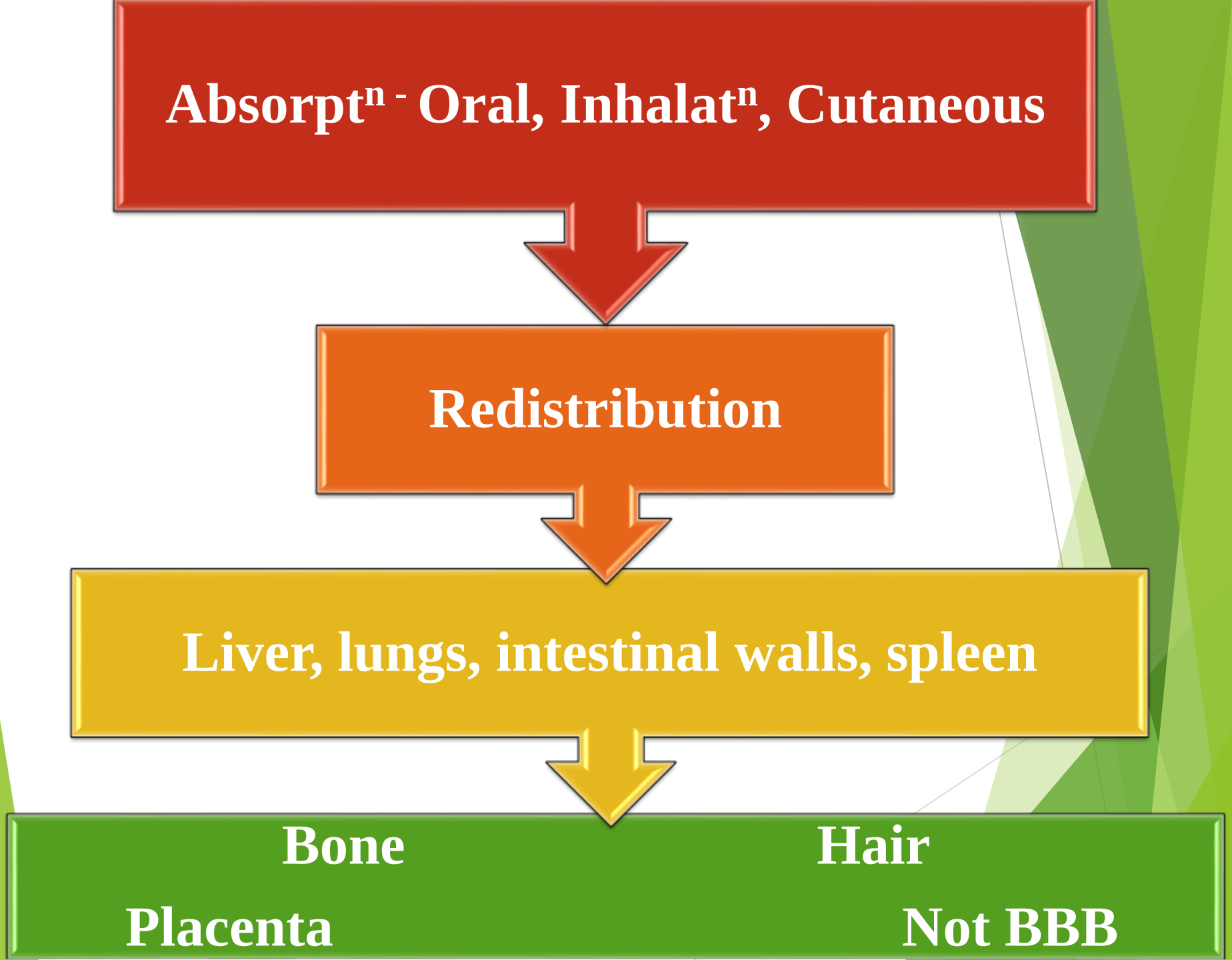
METALLIC POISONING

ARSENIC

- **Acute heavy metal poisoning - commonest**
- **Metalloid**
- **Pentavalent < toxic Trivalent**
- **Fatal dose –**

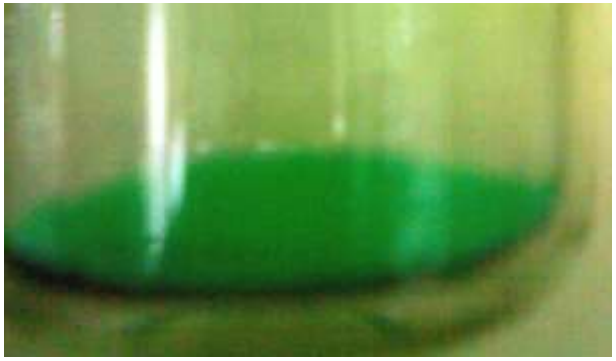
  200 - 300mg – Arsenic trioxide


Absorptn - Oral, Inhalatn, Cutaneous
Redistribution
Liver, lungs, intestinal walls, spleen
Bone
Hair
Placenta
Not BBB

Compounds

- Arsenic Trioxide / Arsenious Oxide/
  Sankhya / Somalkhar – White
- Arsenic sulphide – Red/ Yellow
- Sodium arsenite – White/ Greyish
- Arseniuretted hydrogen / arsine - gas
- Copper arsenite / Scheele's green
- Copper acetoarsenite / Paris green

RED, WHITE ARSENIC



PARIS GREEN

MOA

- ‘SH’ group
- Vascular endothelium
- Local – G.I.T
- Remote – C.N.S

Acute poisoning

- **Dermal – hair loss**

- **Transverse bands of opacity in the nails – Aldrich Mee's lines - 2 weeks**

Convulsions, Coma

Conjuntivitis
Lacrimation

Tachycardia
Hypotension
Arrhythmias

Metallic taste
Dysphagia
Vomitting

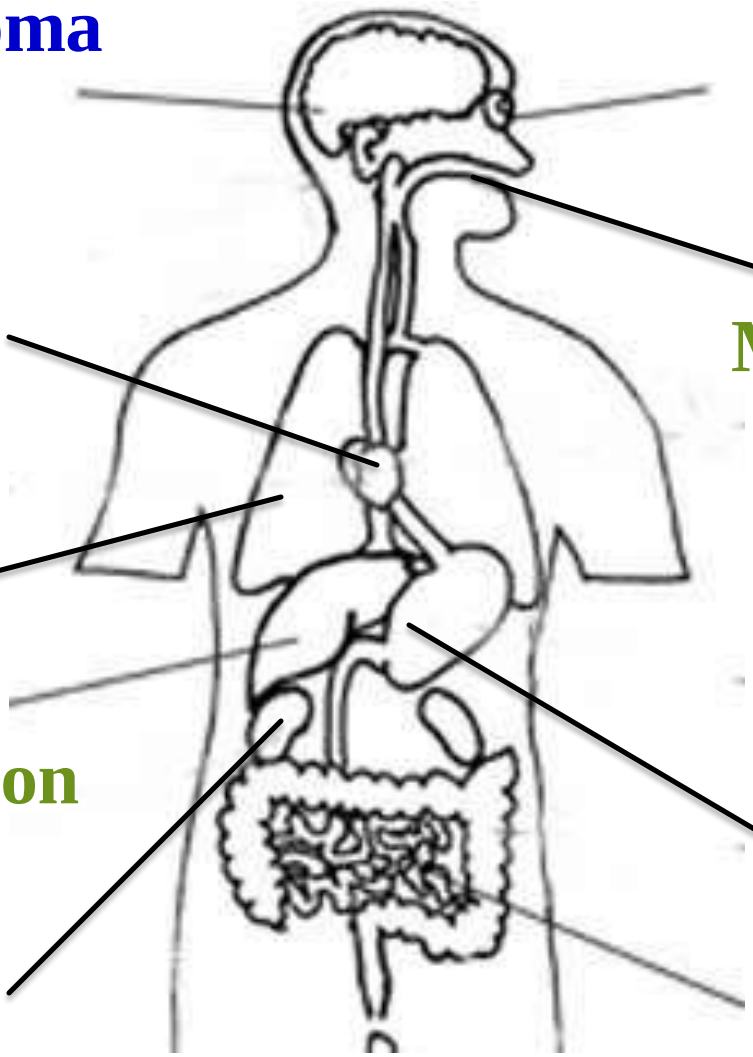
Irritation

Fatty degeneration

Abd. pain

Oliguria
Uraemia

Rice water
diarrhoea



Acute Poisoning

Chronic poisoning

- **Dermal - melanosis, facial edema, hyperkeratosis, ‘ Raindrop pigmentation ’**

- **Ocular – dimness of vision**
- **GIT – anorexia, nausea, vomiting, diarrhoea, wt. loss**
- **RT – nasal septum perforation, laryngitis, bronchitis**

Chr.

- **Liver – hepatomegaly, jaundice, cirrhosis**
- **Kidney – nephritis**
-

- **Neurological -** encephalopathy, polyneuritis, tremors, ataxia, limb tenderness
- **Hematological –** anemia, leucopenia, thrombocytopenia, pancytopenia
- **Cardiac –** hypertension, myocarditis
- **Arsine –** hemolysis, renal failure

Diagnosis

- Urine level - > 100 µg/ l
- Blood - > 7 µg/100ml
- Hair level -
- Plain X- ray abdomen

- **Monitor –** CBC, Serum electrolyte,
- Urine – proteinuria, haematuria, pyuria
- LFT, RFT
- ECG & Chest X- ray
- **Initial & periodic screening –** exposed to arsenic

TREATMENT

- ✓ **Supportive –** Ferric oxide, Gastric lavage, I.V. fluids, Cardiac monitoring
- ✓ **B.A.L –** 3 - 5 mg/kg I.M. 4 hrly till urine < 50 µg / 24 hrs – 7 - 10 days
- ✓ **Penicillin –** 100mg/kg/day – 6 hrly - 5 days
- ✓ Haemodialysis / exchange transfusion

AUTOPSY FEATURES

- **Stomach - Red velvet app.**
- **Focal haemorrhages – flea bitten app.**
- **Intestines – inflammed,**
  Rice water contents
- **Cardiac – sub endocardial h'ges**
- **Heart, liver, kidneys – fatty degeneration**

PRESERVE

Routine viscera

Piece of long bone femur

Pulled scalp hair

Wedge of muscle

Small portion of skin

Medicolegal Importance

Acute poisoning -

mimics gastroenteritis / cholera

PM Imbibition

ARSENOPHAGIA / ARSENOPHAGIST

Lead

- Compounds:
- Lead acetate
- Lead carbonate
- Lead oxide
- Lead tetraoxide- Litharge
- Lead sulphide- Sindoor
- Lead monoxide- Mudrasang

Lead

Mechanism of action:

1) Combines with ‘SH’ group
2) ↓ Haeme synthesis
3) ↑ Haemolysis
4) CNS- oedema & direct cytotoxic
5) CVS, Kidney & Reprod. organs

Lead

- Permissible Blood Level:

Upper level- 80ug/100ml

↓ 35ug/100ml

- Acute poisoning- rare

- Acute exacerbation of chronic lead poisoning

- Tetraethyl lead

Lead

Treatment:

- Stomach wash
- Emetics
- $MgSO_4$ / $NaSO_4$
- Demulcents
- Ca Gluconate
- EDTA

Chronic lead poisoning: Plumbism / Saturnism

S/S:

- Anaemia
- Blue line
- Basophilic stippling
- Colic & constipation
- Dystrophy
- Encephalopathy
- Facial pallor
- Fertility changes
- Cardio- Renal

Diagnosis:

1) Low haematocrit & Hb, Basophilic stippling-significant poisoning

2) Free erythrocyte protoporphyrin, Zinc protoporphyrin

3) Lead level FEP > 35ug/100ml BL > 20ug/100ml

4) Urine – ALA, Pb > 150ug/L

5) Radiology

Modified Graef protocol

I. Severe acute poisoning with encephalopathy

II. Severe poisoning without encephalopathy (BL > 70ug/100ml)

III. Moderate (45-70ug/100ml)

IV. Mild (20-35ug/100ml)

I.	II.	III.	IV.
-BAL -EDTA -CT scan -KUB, Foley catheterization - Diazepam / Phenobarb	-BAL 12mg/kg/day -EDTA 50mg/kg/day BL: < 40ug	-EDTA 50mg/kg/day - Penicillamine 30mg/kg/day	- Penicillamine 30mg/kg/day

- Supportive:

- Thiamine (neurological s/s)

- Stomach wash (radio-opacities)

- Lead colic

- i.v. fluids

- Mannitol / Steroids (cerebral oedema)

- P.M. Findings:
- Skin, conjunctiva- pale
- Blue line
- Kidney
- Brain
- Heart

- Medicolegal aspects:
- Accidental
- Abortifacient
- Cattle poison
- Deposition- bone,tooth,hair,nails
- Inhalation- ‘Plumbism’
- Juvenile Delinquency

Mercury

- Quick silver, Liquid silver

- Salts / Compounds of Hg:

1) Inorganic: Mercuric chloride , Mercuric oxide , Mercuric sulphide

2) Organic: Phenyl & Methoxy methyl

   ethyl & methyl

Mercury

- Sources of exposure

- Usual fatal dose:

  Mercuric chloride 0.5-1g/70kg

  Mercurous chloride 1.5-2g/70kg

- Mechanism of action:

- SH group
- Renal tubular damage & CNS

Clinical features

Acute	Chronic (Hydrargyrism)
1) Inhalation: 'Metal fume fever', G.I., blurring of vision, non-cardiogenic pulm. oedema 2) Ingestion: corrosion, abdominal pain, diarrhea, severe cases	Inhalation: 1) Tremor: Danbury tremors, Hatter's shake 2) Ataxia, Parkinsonism Syd. 3) Metallic taste, anorexia 4) Gingivitis, Blue line 5) Erythematous rashes 6) Erethism- Mad Hatter 7) 'Mercuria Lentis' 8) Renal damage
	Ingestion: Colitis , dementia, tremors 'Acrodynia'- 'Pink disease'

Mercury

- Diagnosis:

1) Radiology

2) Blood levels- Normal < 3ug/100ml

3) Urine – best marker – chronic normal < 10-15ug/100ml

4) Hair

Treatment

- Acute;

Metallic Hg & Inorganic:

1) Inhalation- Remove from source, supportive, chelation
2) Ingestion: X-ray abdomen, laxative, demulcents, gastric lavage, chelation
3) Injection: abscess drainage / excise, monitor CNS/ RFT, chelation

Organic: Supportive, chelation

Severe cases with ARF- Haemodialysis / filtration

Treatment

- Chronic: chelation

1) BAL- 100mg/4hrly OR
2) DMSA- 30mg/kg/day OR
3) Penicillamine- 250mg QID

Mercury

- Autopsy:
- Mucosa: G.I.-upper
- Large intestine-ulceration
- Kidneys

- Medicolegal aspect:
- industrial, occupational, agricultural
- Dentistry
- Food poisoning- ‘Minamata’

Copper

- Metallic copper
- Copper salts:

Copper sulphate- Blue vitriol

Copper subacetate- Verdigris

- Copper deficiency- anaemia, CNS, vascular
- Uses: Cu compounds
- Usual fatal dose: 10-20g Copper sulphate

Copper

- Toxicokinetics:

Safe daily intake: 2-3mg/day

Requirement 0.8mg/day

Absorption: GI mucosa

Intact skin

Clinical features

Acute :
Ingestion: Nausea,Vomiting & Abdominal pain,Incase high dose there may be gastro-intestinal bleeding,Acute Kidney injury.

Inhalation :
Eye irritation
Conjuntivitis

Chronic :
1) Chronic inhalation:
‘Vineyard Sprayer’s’ lung disease

2) Wilson’s disease

3) Metal fume fever

4) Skin exposure

Copper

- Diagnosis:

- Serum cerruloplasmin 35mg% or less

- Blood Cu level > 1.5mg/100ml

- Urine daily < 0.6 umole/day

- Radiography

Copper

- Treatment:
- Haemodialysis
- Egg white/milk
- Stomach wash
- Emesis- contraindicated
- Chelation- chronic (Penicillamine or EDTA)
- Symptomatic
- Eye exposure
- skin

Copper

- Autopsy:
  - Skin & conjunctiva
  - Stomach
  - Hepatic & Renal

- Medicolegal aspects:
  - Suicidal
  - Accidental