بسم الله الرحمن الرحيم
والصلاة والسلام على خير المرسلين
سيدنا محمد عليه
أشرف الصلاة وأذكى التسليم
Heavy Metals

Amal Abd El-Salam El-Bakary
Assistant Professor in
Forensic Med & Clinical Toxicology
Lead toxicity
Lead Producers

- Battery manufacturing
- Chemical industries
- Gas-station attendants
- Lead miners & smelters

- Pigment manufacturing
- Printers
- Stained-glass makers
- Welders
Lead Sources

- Old toys / imported toys
- Lead painted pottery
- Inks
- Paints
- Dishes
- Stained glass
- Pool cue chalk
- Cosmetics
- Colored newspapers
- Hair dyes
Lead Sources

Drinking water:

when lead-containing materials are used in plumbing parts, such as pipes, solders, and brass or chrome plated faucets; any of these components may begin to corrode and break down
Lead Sources

Soil near heavily-used streets and roads

Soil next to homes that previously painted with lead-based paint.

Soil can contribute to high levels of lead in household dust.

http://www.niehs.nih.gov/kids/lead.htm
Common Sources of Lead in a Child’s Environment

✓ Paint and dust
✓ Soil
✓ Water
✓ Toys
✓ Pottery from foreign places
Recycling Lead

Gray Matter
Why Lead is Dangerous for Young Children

• Children 6 months to 6 years are at risk
  – Kids absorb more from hand to mouth activity
  – Can cause developmental delays because it interferes with brain maturation.
The only way to know if your child has high lead levels is by asking your doctor for a blood lead test.
II- Lead Poisoning:

1- Compounds & uses:

Metallic lead:

Inorganic lead:
- Lead Subacetate:
- Lead Sulphide:
- Lead Oxides:
- Lead Oleate:
- Lead Arsenate:
- Lead Carbonate:

Organic lead compounds:
- Tetra ethyl lead:
2- Mode of Poisoning:

In acute toxicity:
- From inhalation:
- From ingestion:
- From endogenous release:

In chronic toxicity:
- In industry:
  - Pipes of water
  - Painted toys with lead paints
  - Pesticides
  - Projectiles and bullets
- In home: “Household exposure”
  - Preserved food
  - Polluted water
  - Polluted air
3- Action:

Local:
Irritation at the site of absorption.

Remote:

CNS:
1- Neurotransmitters
2- BBB

Blood:
Heme synthesis

Enzymes:
SH containing proteins

Renal:
4- Toxicokinetics:

Absorption:  
from all roots  
in place of calcium

Distribution:
1st: Distribution:  
To R.B.C.s

2nd: Distribution:  
To all soft tissues especially  
“Heart, Kidney, Liver & Spleen”.

3rd: Distribution  
In the bone “epiphyseal end, hair  
& nail”.
4- Toxicokinetics:

**Metabolism:**

Lead metabolism is typically as Ca metabolism.

↑ Deposition of lead in bone by Alkalies, Ca rich diet & Vitamin D

↑ Mobilization of lead from bone by Acids, Chelators & "Parathormone"

**Excretion:**

75 % via kidney.
25 % via Bile, GIT, Saliva, Sweat & Milk
6- Clinical Picture:

I- Acute Lead Toxicity:

A- Low toxicity:

Ms: myalgia, mild fatigue, lethargy
Neuro: paraesthesia, irritability
Abd discomfort

B- Moderate toxicity:

Ms- sk: fatigue, arthralgia
Neuro: difficult concentration, headache, tremors
GIT: abdominal pain, vomiting, constipation.
General: Weight loss
6- Clinical Picture:

I- Acute Lead Toxicity:

C-Severe:

- Local symptoms:

**GIT irritation:**

Anorexia with metallic taste in mouth

Nausea:

Vomiting:

Abdominal colic:

Constipation:
6- Clinical Picture:

I- Acute Lead Toxicity:

- remote symptoms:

  CNS
  Headache

  Lead encephalopathy:

  **Incidence:**
  In Some cases especially in children.

  **Mechanism:**
  - Mitochondrial disturbance
  - Local oedema
  - Haemorrhage
  - Necrosis of the brain tissues

*Anemia: hemolytic
Toxic hepatitis*
6- Clinical Picture:

II- Subacute and Chronic Lead Toxicity

1. C.N.S. Disorders: "Plumbism" "Pb"
2. Renal Disorders
3. Blood Disorders:
4. Reproductive Disorders:
5. Endocrinal Disorders:
6. CVS Disorders
7. G.I.T. Disorders:
8. Carcinogenic effects:
1- Neurological Disorders:

A- Children

Lower blood levels than adults
Less than 10 µg/dL (sub-clinical).
Every by 10 µg/dL
IQ by 4-7 points.

Lead Encephalopathy
(70-80 µg/dL):
CNS stimulation:
CNS inhibition:
 Levels (40-120 µg/dL):
  - Forgetfulness,
  - Impaired concentration
  - Mood changes
  - Paresthesia
  - IQ - cognitive performance

 Slow nerve conduction:

 Lead Encephalopathy:
  up to 480 µg/dL
2- Renal Disorders:

**Fanconi-like syndrome**
- Incidence:
- Mechanism:
- Manifestations:

**Hyperuricemia:**
3- Blood Disorders:

**Anaemia:**
- **Mechanism:**
- **Types:**
  - Hemolytic
  - Hypochromic
  - Normo-cytic or micro-cytic

**Incidence:**
- Punctate Basophilia: ***
- Reticulocytosis: ***
Lead poisoning

Normal red blood cells

basophilic stippling
4- Endocrinal Disorders:

**Impedes vitamin D activation**

5- CVS Disorders:

**Increased risk for hypertension**

6- Reproductive Disorders:

**Males**

**Females**

**Developmental**
7- G.I.T. Disorders:

Blue line: “Burtonian Line”

Colic:

Constipation:

8- Carcinogenic Effects:
7- **Investigations:**

I- **Blood:**

**Blood Lead Level:**

**Blood Picture:**

- Anaemia
- Reticulocytosis
- Punctate Basophilia

**Haemoglobin level:**

II- **Urine:**

**Urine Lead Level:**

**Urine analysis:**
7- Investigations:

III- X- Rays:

X ray on long bone:
“Lead Lines” in five year old male with radiological growth retardation and blood lead level of 37.7µg/dl

(Photo courtesy of Dr. Celsa López Campos, Clinical Epidemiologic Research Unit, IMSS, Torreón, México)
8- **Treatment:**

**i- Emergency & Supportive Measures:**

A.B.C., fluids, dialysis

**ii- Antidotes**

(chelation therapy):

Def.

**Types:**

- **DMSA:**
  - **IV:** 4 mg/Kg/4h
  - **PO:** 10 mg/Kg/8h for 5d then…

- **BAL:**
  - **IM:** 2 mg/Kg/6h for 24h then…

- **CaNa2 Edetate:** 1gm/d for 5 days
  - (25 mg/kg in children)
  - (As suppositories).
8- Treatment:

iii- Decontamination:
   Ipecac
   Gastric Lavage:
   Remove lead source

iv- Elimination Enhancement:
   Dialysis
سبحانك اللهم وبحمدك
أشهد أن لا إله إلا أنت
استغفرك واتوب إليك
السلام عليكم ور حمَّة الله وبركاته
Reticulocytosis:
Punctate basophilia