

Chronic Poisoning

Chronic Arsenic Poisoning

Introduction

- Arsenic is a naturally occurring element that exists in organic and inorganic forms, with the inorganic form (especially arsenite and arsenate) being highly toxic.
- Chronic exposure usually occurs through contaminated drinking water, occupational exposure (mining, smelting), herbal remedies, or long-term ingestion of arsenic-containing compounds.

Toxicokinetics

- **Absorption:** Rapidly absorbed from the GI tract, lungs, and skin (inorganic arsenic).
- **Distribution:** Widely distributed, binds to **sulfhydryl groups** of proteins, accumulates in liver, kidney, skin, and nails.
- **Metabolism:** Undergoes methylation in the liver.
- **Elimination:** Primarily excreted in urine (as monomethylarsonic acid and dimethylarsinic acid).

Clinical Features of Chronic Exposure

System	Clinical Features
Skin	<i>Hyperpigmentation</i> , "raindrop" appearance, hyperkeratosis (especially on palms and soles)
Hair/Nails	<i>Mees' lines</i> (transverse white lines on nails), brittle hair
Gastrointestinal	Chronic abdominal pain, anorexia, weight loss, nausea
Neurological	<i>Peripheral neuropathy</i> (symmetrical sensorimotor polyneuropathy starting in lower limbs), cognitive deficits
Hematological	Anemia, leukopenia, thrombocytopenia (due to bone marrow suppression)
Carcinogenicity	Skin cancer (basal/squamous cell carcinoma), lung and bladder cancer
Hepatic	Hepatomegaly, portal hypertension without cirrhosis (non-cirrhotic portal fibrosis)

Diagnosis

- **History of exposure** (especially groundwater contamination)
- **Urinary arsenic:** >50 µg/L in 24-hour urine is indicative
- **Hair/nail analysis:** Reflects chronic exposure
- **Blood levels:** Less useful in chronic poisoning

Management

Elimination of exposure

- Switch to **arsenic-free water** (filtered or alternate source).
- Occupational safety (PPE, air monitoring).

Chelation therapy

- **Dimercaprol (BAL)**: 3–5 mg/kg IM every 4–6 hrs (used more in acute exposure).
- **DMSA (Succimer)**: Oral agent, preferred in chronic cases.
 - Dose: 10 mg/kg PO every 8 hrs × 5 days, then 10 mg/kg every 12 hrs × 14 days.

Supportive therapy

- Nutritional support
- Neurological rehabilitation for peripheral neuropathy
- Monitoring of hepatic and renal functions
- Treat skin lesions and cancers appropriately

Chronic Lead Poisoning (Plumbism)

Introduction

- Chronic lead toxicity is a global health issue, particularly affecting children due to increased absorption and brain vulnerability.
- Sources include paint, batteries, contaminated soil, industrial exposure, cosmetics, and folk remedies.

Toxicokinetics

- **Absorption**: Adults absorb 10–15%, children up to 50% (GI tract); also via inhalation
- **Distribution**: 90% in RBCs, long-term storage in **bones and teeth** (mimics calcium)
- **Metabolism**: Not metabolized
- **Elimination**: Slow urinary excretion; biological half-life in blood: ~30 days; in bone: decades

Clinical Features of Chronic Exposure

System	Clinical Manifestations
Neurological (Adults)	Peripheral neuropathy – wrist drop, foot drop
Neurological (Children)	<i>Encephalopathy</i> , behavioral changes, decreased IQ, learning disabilities, seizures

Hematological	<i>Microcytic hypochromic anemia</i> , basophilic stippling of RBCs, interference with heme synthesis (ALA dehydratase, ferrochelatase inhibition)
GI Tract	Abdominal colic, constipation (Lead colic), metallic taste
Renal	Chronic interstitial nephritis, hyperuricemia, hypertension
Reproductive	Decreased sperm count, teratogenic effects
Bones and Gums	<i>Lead lines</i> in metaphysis of long bones (X-ray); Burton's line – blue-black line on gums

Diagnosis

Blood Lead Level (BLL):

- Children: >5 µg/dL is toxic (CDC reference)
- Adults: >10 µg/dL (occupational exposure limit varies)
- Severe toxicity: >70 µg/dL (neurological symptoms)

Additional tests:

- **Free erythrocyte protoporphyrin (FEP):** Elevated
- **Urinary ALA and coproporphyrin**
- **X-ray:** Lead lines in bones (children)
- **Basophilic stippling:** Peripheral smear

Management

Elimination of exposure

- Identify and remove source (paint, occupational hazard)
- Notify public health authorities

Chelation therapy

- **Calcium disodium EDTA (CaNa₂EDTA):** IV/IM, 25–50 mg/kg/day divided doses × 5 days
- **Dimercaprol (BAL):** IM, used in combination with EDTA in encephalopathy
- **DMSA (Succimer):** Oral chelator, preferred in children and mild cases
 - Dose: 10 mg/kg PO every 8 hrs × 5 days, then 10 mg/kg PO every 12 hrs × 14 days

Supportive management

- Treat seizures, cerebral edema in encephalopathy
- Monitor renal function and urine output
- Nutritional correction: Calcium, iron, and zinc reduce lead absorption

Prognosis

- With early removal and chelation, prognosis is good
- In children, **neurological damage may be irreversible** if exposure is prolonged or levels are very high

Chronic Mercury Poisoning

Introduction

- Mercury exists in elemental (metallic), inorganic, and organic (methylmercury, ethylmercury) forms.
- Chronic exposure occurs through occupational settings (dentistry, mining), contaminated fish consumption, or use of mercury-containing products (cosmetics, traditional medicines).

Toxicokinetics

- **Absorption:**
 - Elemental mercury: via inhalation of vapors
 - Inorganic mercury: poorly absorbed via GI tract
 - Organic mercury: well absorbed via GI tract
- **Distribution:** Accumulates in the brain, kidneys; crosses placenta and blood-brain barrier
- **Elimination:** Slow urinary and fecal excretion

Clinical Features of Chronic Exposure

System	Clinical Symptoms
Neurological (CNS)	<i>Erethism mercurialis</i> (abnormal irritability, shyness, memory loss, depression, hallucinations), tremors, insomnia, poor concentration
Neurological (PNS)	Peripheral neuropathy – paresthesia, weakness
Renal	Proteinuria, nephrotic syndrome, tubulointerstitial nephritis
Oral cavity	Excessive salivation, gingivitis, metallic taste, loosening of teeth
Gastrointestinal	Anorexia, weight loss, abdominal pain
Dermatological	Desquamation, acrodynia ("pink disease" in children – painful redness, swelling of hands and feet, rash)
Immune	Autoimmune reactions, glomerulonephritis
Developmental (fetuses)	Neurodevelopmental delay due to methylmercury crossing placenta



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