

Overview

Uncommon but potentially life-threatening. Often a chronic exposure.

Toxic mechanism

Pb: Interferes with cell membrane integrity, haem & steroid synthesis, neurotransmitters.

Hg: Binds to SH⁻ groups disrupting cell membranes and inhibiting enzymes.

As: Binds to many cell enzymes, inhibits cellular respiration & DNA replication/repair. Reactive O₂ intermediates.

Toxicokinetics

Pb: Once abs through skin, inhalation or ingestion, competes to bind with proteins → enzymatic activity → damage to many organs. Children abs orally > adults. Crosses placenta.

Hg: Elemental Hg abs from lungs but not GIT. Inorganic Hg by skin & GIT. Organic Hg from GIT or lungs. Large Vd, lipophilic. Elim in faeces & renally. Long T_½ 30-70d.

As: Abs by GIT, skin & lungs. Distributes to kidney, liver then lungs, CNS/PNS and nails. Liver met. T_½ ~5d

Clinical features

Pb:

- *Acute*: metallic taste, abdo pain, N&V, black diarrhoea, haemolytic anaemia & hepatitis, lethargy, myalgia. Cerebral oedema, encephalopathy, seizures & coma are pre-terminal.
- *Chronic*: vague GI (anorexia, constipation, abdo pain) & CNS (headache, impaired conc/co-ord) symptoms, wt loss, motor peripheral neuropathy, ↓ intellectual development.

Hg:

- *Acute*:
 - *Hg⁰*: headache, N&V, fume fever, metallic taste, dyspnoea, pneumonitis (±ARDS)
 - *Inorg. Hg*: haemorrhagic GE, , N&V&D, metallic taste, grey mucous membranes
 - *Org. Hg*: GI upset, tremor, resp. distress, dermatitis, RF, ECG changes. Delayed neurotoxicity (psychological-conc, mem & mood disorders, cerebellar, sensory-glove-stocking paraesthesia, tunnel vision, hearing loss, speech problems, motor - tremor, weakness)
- *Chronic*: Insidious multi-organ disorder+neuropsychiatric sequelae with all features above & acrodynia (usually child) - red, oedematous rash of palms/soles/face that desquamates.

As:

- *Acute*: Rapid dev of metallic taste, hypersalivation & slight garlic odour, severe N&V & rice water diarrhoea±blood, abdo pain. Followed by encephalopathy, seizures, dysrhythmias, ARDS, RF, liver injury. Later marrow depression, alopecia & neuropathy.
- *Chronic*: Insidious onset over years of constitutional symptoms, cutaneous lesions, nail changes, painful peripheral neuropathy and skin/bladder Ca.

Investigations

Screening: ECG, paracetamol, BSL

Specific bloods:

Pb:

Whole blood lead level, FBC, UEC, LFT AXR, nerve conduction/psychomotor studies, free erythrocyte protoporphyrin (FEP - surrogate measure of total body lead burden), blood film (Pb/As: basophilic stippling), limb XR (Pb metaphyseal bands), endoscopy

Lead level	Effects
$\leq 10 \mu\text{g/dL}$ ($0.48 \mu\text{mol/L}$)	Minor dose-dependent \downarrow IQ in children
$> 10 \mu\text{g/dL}$ ($0.48 \mu\text{mol/L}$)	Subtle developmental, learning, motor & intellectual abnormalities in children
$> 30 \mu\text{g/dL}$ ($1.4 \mu\text{mol/L}$)	Non-specific symptoms, peripheral neuropathies, renal & fertility problems
$> 100 \mu\text{g/dL}$ ($4.8 \mu\text{mol/L}$)	Severe GI symptoms, encephalopathy, seizures & coma

Hg:

Whole blood mercury level, urine mercury level, CXR/AXR, endoscopy

Blood mercury level	Interpretation
$\leq 20 \mu\text{g/L}$ (100nmol/L)	Normal
$> 200 \mu\text{g/L}$ (1000nmol/L)	Symptomatic
$> 500 \mu\text{g/L}$ (2500nmol/L)	In acute inorganic Hg exposure
Urine mercury level	Interpretation
$< 10 \mu\text{g/L}$ (50nmol/L)	Normal
$> 100 \mu\text{g/L}$ (500nmol/L)	Neuropsychiatric sequelae

As:

Spot (Norm $< 30 \mu\text{g/L}$ or $4.0 \mu\text{mol/L}$) & 24hr (Norm $< 50 \mu\text{g/L}$ or $6.65 \mu\text{mol/L}$) urinary arsenic, blood level if anuric, FBC, UEC, LFT, ABG, CXR/AXR

Risk assessment

Pb: acute severe OD \rightarrow encephalopathy, cerebral oedema & death. Chronically \rightarrow vague multi-organ disorder with GI, CNS sequelae. Teratogenic. Impairs child intellectual development.

Hg: Accidental ingestion of Hg^0 & having dental amalgam are benign. Inhalation of Hg^0 aerosol or vapour, ingestion of inorganic salts, or organic Hg exposure risk toxicity.

As: Chronic intoxication can follow long-term drinking of artesian well water. Acutely $< 5 \text{mg}$ \rightarrow mild GIT symptoms, but $> 100\text{--}300 \text{mg}$ (child $< 1 \text{mg/kg}$) potentially lethal.

Management

Resus & Supportive Care:

- Rarely req. Mannitol & dexamethasone if cerebral oedema. Fluid status.

Decontamination: Remove source. Remove clothes & wash skin if dermal exposure.

Pb: Ingested FB removed endoscopically or flushed with oral high residue diet+PEG or WBI.

Hg: Don't vacuum Hg^0 . Give PEG if large volume Hg ingested.

As: WBI if co-operative & ingested inorganic As trioxide (shown on AXR).

Enhanced Elimination: Polythiol resin may reduce organic Hg enterohepatic circulation.

Antidote: Chelation therapy (see Antidotes)

Disposition

Depends on severity.

Notes

Pb sources: old houses with lead water pipes and lead paint, petrol, occupations (e.g. smelting, battery manufacture), traditional remedies, or occasionally foreign bodies (lead weights).

Hg sources: elemental (dental amalgam, thermometers), inorganic (industrial processes) and organic compounds (pesticides, wood preservatives, some medicines, and contaminated fish).

As sources: inorganic (ground water, industrial, traditional remedies), organic (fish: but in non-toxic forms).