

Toxicology of High Priority Substances

Part 3: Cd, Cr, Dioxin and TCE

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Cadmium

- Forms
 - Inorganic: cadmium salts
 - Elemental: calcium fume and dust
- Bound by metallothionein in liver and kidney; saturation leads to appearance of toxicity
- Half-life: 8-30 years; poorly excreted
 - Chelation techniques increase the toxic effect
 - Toxic effects progressive
 - Not susceptible to intervention

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Cadmium: Toxic Responses

- Cell injury: mechanism not known
- Physiologic: none
- Allergenic: not known
- Mutagenic: poorly
 - Carcinogenic: lung cancer
- Teratogenic: no information

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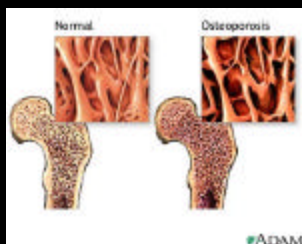
Cadmium: Target Tissues

- Lungs:
 - Acute chemical pneumonia
 - Emphysema, fibrosis
 - Lung cancer
- Kidneys: renal tubular dysfunction
 - Bone disease, kidney stones

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Measuring and Managing Cadmium Exposure

- OSHA Standard
 - Blood and urine cadmium levels
 - Urine β_2 -microglobulin
 - Evidence of renal tubular toxicity
- Medical removal depending on monitoring results

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Chromium

- Forms
 - Inorganic
 - Chromium III: insoluble, but toxic
 - Chromium VI
 - Soluble, easily absorbed
 - Converted to Cr V-IV-III in cells
 - Elemental and organic forms are not known toxins
 - Half-life: 1-2 months

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Chromium: Toxic Responses

- Cell injury: interferes with cellular respiration
- Physiologic: none
- Allergenic: allergic dermatitis, asthma
- Mutagenic: yes
 - Carcinogenic: lung cancer
- Teratogenic: probable, little data

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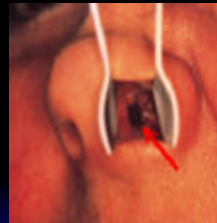
Chromium: Target Tissues

- Lung:
 - Acute irritation
 - Asthma
 - Fibrosis, lung cancer
- Upper respiratory tract
 - Sinusitis, septal perforation
- Skin
 - Dermatitis: irritant, allergic

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Measurement and Management of Chromium Exposure

- Measurement
 - Blood and urine levels
- Management
 - Removal
 - Ascorbic acid to reduce conversion from VI-III
 - Topical EDTA for chromium ulcers
 - Chelation has not proven to be helpful

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Dioxins

- Family of chlorinated organic compounds
 - Chlorinated Dibenzo-*p*-dioxins (CDDs)
 - 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
- Persistent: half-life 7-12 years
- Lipophilic: reside in fat
- Ubiquitous

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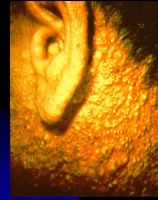
Dioxins: Toxic Responses

- Cell Injury: upper respiratory irritation, chloracne, immunotoxicity
- Physiologic: none known
- Allergic: none known
- Mutagenic: not seen
 - Carcinogenic: increased overall incidence
- Teratogenic: changed sex ratio

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Trichloroethylene (TCE)

- Long use as a solvent and anesthetic
- Short half life: ~hours to a day
 - Metabolites: few days

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TCE: Toxic Responses

- Cell injury: via reactive metabolites, liver, peripheral nerves
- Physiologic: brain, heart
- Allergic: none
- Mutagenic: no
 - Carcinogenic: probably
- Teratogenic: probably

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TCE: Target tissues

- Brain: headache, depression, coma
- Heart: irritability, sudden death
- Liver:
 - acute chemical hepatitis
 - Cirrhosis
- Kidney: tubular injury
- Skin: dermatitis

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Thanks for listening

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