Indications and Stocking of Antidotal Therapy for Common Heavy Metal Poisonings

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Introduction

• Heavy metals may enter the body in food, water, or air, or through the skin.

• Heavy metal toxicity is an uncommon diagnosis. If unrecognized or inappropriately treated, heavy metal exposure can result in significant morbidity and mortality.
Introduction

• The antidotes of metal poisonings are chelation agents, such as British anti-Lewisite (dimercaprol, BAL), calcium disodium edetate (CaNa$_2$EDTA), dimercaptosuccinic acid (DMSA), 2,3-dimercaptopropanesulfonic acid (DMPS), which forms a complex with toxic heavy metals and leads to their removal.

• Chelators are of great importance in the treatment of metal poisonings, including arsenic, mercury, lead, copper, chromium, iron, thallium and other forms of toxic metal poisoning.
Common Metal Poisoning

- Lead (Pb)
- Mercury (Hg)
- Arsenic (As)
- Chromium (Cr)
- Iron (Fe)
Common Cause of Poisoning

• Intentional
• Folk or herbal Medicine
• Occupational and take-home exposure
• Environmental
• Accidental
# Mineral drugs in Traditional Chinese Medicine

<table>
<thead>
<tr>
<th>Name</th>
<th>English Name</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>砒石, 砒霜</td>
<td>Pishi, Pishuang</td>
<td>$\text{As}_2\text{O}_3$</td>
</tr>
<tr>
<td>雄黃</td>
<td>Xionguang, Realgar</td>
<td>$\text{As}_2\text{S}_2$</td>
</tr>
<tr>
<td>雌黃</td>
<td>Cihuang, Orpiment</td>
<td>$\text{As}_2\text{S}_3$</td>
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<tr>
<td>水銀</td>
<td>Shuiyin, Hydragyrum</td>
<td>$\text{Hg}$</td>
</tr>
<tr>
<td>升藥，紅粉</td>
<td>Shenyao, Hongfen</td>
<td>$\text{HgO}$</td>
</tr>
<tr>
<td>红升丹</td>
<td>Hongshengdan</td>
<td>$\text{HgO}/\text{As}_2\text{S}_2$</td>
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<tr>
<td>輕粉，粉霜</td>
<td>Quingfen, Calomel/Fen-shuang</td>
<td>$\text{Hg}_2\text{Cl}_2$</td>
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<tr>
<td>朱砂</td>
<td>Zhusha, Cinnabar</td>
<td>$\text{HgS}$</td>
</tr>
<tr>
<td>黄丹，密陀僧</td>
<td>Huangdan, Lithrage</td>
<td>$\text{PbO}$</td>
</tr>
<tr>
<td>紅丹, 銅丹</td>
<td>Hongdan, Qiandan</td>
<td>$\text{Pb}_3\text{O}_4$</td>
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</tbody>
</table>
Inorganic Lead

**Acute effects**
- Abdominal pain *(lead colic)*
- Encephalopathy
- Hemolysis
- Acute renal failure
- Elevation of liver enzyme

**Chronic effects**
- Fatigue and asthenia
- Arthralgias and myalgias
- Anemia
- Peripheral neuropathy *(motor)*
- Neurobehavior disturbances and chronic encephalopathy
- Gout and gouty nephropathy
- Chronic renal failure
- Hypertension
- Impaired fertility
CDC’s Action Levels for Blood Lead in Children

- 1960: 60 ug/dL
- 1973: 40 ug/dL
- 1975: 30 ug/dL
- 1985: 25 ug/dL
- 1991: 10 ug/dL
- 2012: 5 ug/dL
Acceptable Blood lead level

Current suggestions in Taiwan

• References for general population: < 5 μg/dl
• Action level of child: 5 μg/dl
• Action level of adult: 10 μg/dl
• Legal limit of female worker: 30 μg/dl
• Legal limit of male worker: 40 μg/dl
從鉛水管的恐慌談鉛的風險溝通

Lead pipe problem

吳明玲醫師
衛生福利部暨臺北榮民總醫院臨床毒藥物諮詢中心
臺北榮民總醫院臨床毒物與職業醫學科
民國104年10月27日

http://www.pcc-vghtpe.tw/tc/index.asp
# Management Recommendations: Adult Population

<table>
<thead>
<tr>
<th>Blood lead level (µg/dL)</th>
<th>Management recommendations and requirements for adults</th>
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<tbody>
<tr>
<td>&lt; 5</td>
<td>No action needed</td>
</tr>
<tr>
<td>5–9</td>
<td>Discuss health risks</td>
</tr>
<tr>
<td></td>
<td>Reduce exposure for pregnancy</td>
</tr>
<tr>
<td>10–19</td>
<td>Discuss health risks. Decrease exposure. Monitor BLL</td>
</tr>
<tr>
<td></td>
<td>Remove from exposure for pregnancy, certain medical</td>
</tr>
<tr>
<td></td>
<td>conditions, long-term risks</td>
</tr>
<tr>
<td>20–29</td>
<td>Remove from exposure if repeat BLL in 4 weeks remains ≥ 20 µg/dL</td>
</tr>
<tr>
<td>30–79</td>
<td>Remove from exposure. Prompt medical evaluation and</td>
</tr>
<tr>
<td></td>
<td>consultation advised for BLL &gt; 40 µg/dL</td>
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<tr>
<td></td>
<td>OSHA requirements may apply</td>
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<tr>
<td></td>
<td>Chelation not indicated unless BLL &gt; 50 µg/dL with</td>
</tr>
<tr>
<td></td>
<td>significant symptoms</td>
</tr>
<tr>
<td>≥ 80</td>
<td>Urgent medical evaluation and consultation indicated</td>
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<tr>
<td></td>
<td>OSHA requirements may apply</td>
</tr>
<tr>
<td></td>
<td>Chelation may be indicated if symptomatic and/or</td>
</tr>
<tr>
<td></td>
<td>BLL ≥ 100 µg/dL</td>
</tr>
</tbody>
</table>

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Inorganic mercury poisoning

- Acute: corrosive and nephrotoxic.
  - salivation, metallic taste, abdominal pain, bloody diarrhea
  - proteinuria, and acute renal failure.
  - fatal hypovolemic shock may result.
  - aspiration: irritation, pulmonary edema, ARDS.
Arsenic Poisoning

**Acute**
- N/V, abdominal pain, diarrhea, dehydration, shock, QT prolonged, TDP, Liver & kidney damage, acute encephalopathy (seizure, delirium, coma)
  - → peripheral neuropathy, bone marrow depression, hair loss
- Industrial arsine gas: garlic odor, hemolytic anemia, AKI

**Chronic**
- peripheral neuropathy, bone marrow depression
- Hyperkeratosis, hyperpigmentation, Mee’s line,
- Skin cancer, peripheral vasculopathy (black foot disease)
Chromium poisoning (Acute)

- Intensive GI irritation or ulceration and corrosion, epigastric pain, nausea, vomiting, diarrhea
- Hemorrhagic diathesis, intravascular hemolysis
- Toxic nephritis, renal failure, liver damage
- Circulatory collapse, peripheral vascular collapse, acute multisystem shock, coma, and even death, depending on the dose.
Iron Poisoning

Clinical course

• **Phase I (0.5-2 h):** Vomiting, hematemesis, abdominal pain, diarrhea, hematochezia, lethargy, shock, acidosis, and coagulopathy.

• **Phase II (6-24h):** apparent recovery and may contribute to a false sense of security.

• **Phase III (2-12 h after phase I):** profound shock, severe acidosis, CNS depression cyanosis, and fever.

• **Phase IV (2 to 4 days):** possible hepatotoxicity. Acute lung injury may also occur.

• **Phase V (days to weeks):** GI scarring and strictures.
## Chelating agents

<table>
<thead>
<tr>
<th>Chelator</th>
<th>Main indication</th>
<th>Other application</th>
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<tbody>
<tr>
<td>CaNa$_2$EDTA</td>
<td>Lead</td>
<td>manganese, cobalt</td>
</tr>
<tr>
<td>DMPS</td>
<td>mercury, arsenic, lead (chronic)</td>
<td>copper, chromium, cobalt</td>
</tr>
<tr>
<td>DMSA</td>
<td>lead, arsenic, mercury</td>
<td></td>
</tr>
<tr>
<td>Prussian blue</td>
<td>thallium, radioactive cesium</td>
<td></td>
</tr>
<tr>
<td>Dimercaprol (BAL)</td>
<td>arsenic, mercury, lead (in addition to EDTA)</td>
<td>copper</td>
</tr>
<tr>
<td>D-Penicillamine</td>
<td>copper (Wilson disease)</td>
<td>lead, mercury rheumatoid arthritis, cystinuria</td>
</tr>
<tr>
<td>Deferoxamine</td>
<td>iron, aluminum</td>
<td></td>
</tr>
</tbody>
</table>
Chelator Stocking

• Taiwan Poison Center established a chelator storage and distribution system for the response of the various metal poisoning accidents since 2001. The most life-saving chelators (EDTA, DMSA and DMPS) were chosen for the most common forms of heavy metal intoxication—lead, arsenic, or mercury.

✓ The clinical use of BAL is now limited due to its adverse effects and availability of safer chelators.

✓ Penicillamine and iron chelator are available in major hospitals because they have other applications.
Treatment of metal poisoning

- Removal of the patient from the source of exposure
- Prevention of the absorption of orally ingested metals
- Prevention of local corrosive action of metals on the mucous membranes
- Supportive care,
- Binding of the metals in body fluids (especially blood) and conversion to less toxic complexes
Metal poisoning through dermal route
Lead poisoning through lead-containing patch

• 75/M, use 3-month herbal patch due to leg ulcer

• S/S: anorexia, N/V, BW loss, headache, dizziness, constipation and weakness for 2 months.

• Hb 7.1 g/dl, MCV 70 fl, ALT 82 U/L, AST 64 U/L, Na 128 mmol/L, K 2.9 mmol/L; Panendoscopy: reflux esophagitis.

• Dx: Lead poisoning    Tx: EDTA, DMSA
Lead content of herbal patch

516,898 ppm (52%)

250,000 ppm (25%)

Case 1: 75 /M, leg ulcer
topical use for 3 months
Blood Lead:225.7 μg/dL

Case 2: 56/F, breast cancer
topical 1 bid for 1 year
Blood Lead:199.0 μg/dL
Arsenic and mercury poisoning through anal use of herbo-metallic ointments

- 51/M, developed peri-anal gangrene and progressive limbs weakness after usage of herbo-metallic ointments for 2 weeks. The prescriptions was got from an unlicensed herbalist and used for his anal fistula.
- In the beginning of treatment, he had fever and anal pain.
- Day 8, 10: visit a TCM clinic due to dizziness, rash, skin itching, anorexia, herbal powder was given. He developed diarrhea which subsided after DC the powders (Hg 13.2 ppm, 12 ppm).
- Day 11: numbness over distant end of fingers and toes started
- Day 15: Worsening numbness and unstable gait appeared, high fever, severe anal pain, walking difficulties. The Fournier’s gangrene was noted, so wound debridement and colostomy were performed.

Herbal Suppository (for anal fistula)

- 8 kinds of materials prescribed, mixed as 5 medication
  - A: indigo naturalis+musk+**hong-dan**($\text{Pb}_3\text{O}_4$)
  - B: Tung oil+hong-dan
  - C: hong-dan+rice wine
  - D: gypsum
  - E: sulfanilamide ointment+mercuriochrome

- Therapy course:
  - 1st week: A+D qd, 2nd week: B qd, C prn if itchy (use everyday)

<table>
<thead>
<tr>
<th></th>
<th>Lead</th>
<th>Mercury</th>
<th>Arsenic</th>
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</thead>
<tbody>
<tr>
<td>A:</td>
<td>71.9</td>
<td>4.67</td>
<td>13.3</td>
</tr>
<tr>
<td>C:</td>
<td>166,700</td>
<td>24.5</td>
<td>—</td>
</tr>
<tr>
<td>C:</td>
<td>12,200</td>
<td>16.5</td>
<td>—</td>
</tr>
<tr>
<td>D:</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

11/25/2015
Day 26: Hyperkeratosis, Hair loss, Leg edema

anal wound (Day 1) after debridement

hand and lower limb atrophy (Day 26)

EMG: severe axonal sensori-motor polyneuropathy
Toxic epidermal necrolysis after dermal use of realgar-containing herbal ointment

- 24 y/o man visited a TCM clinic for **atopic dermatitis**. Multiple herbal prescriptions were used orally and topically for **18 days**.
- Day 7: diminished appetite, dizziness, itching skin rash, and exfoliation
- Day 15: **generalized edema, nausea, vomiting, diarrhea, vesicular formation and discharge with poor odor**
- Day 16: fever and near-syncope 2-3 times per day.
- Day 18: visit TCM twice, syncope at clinic. He received some treatment and was sent back home.
- Midnight of day 18: whole body discomfort, visit ED.
Realgar-related death

- Diagnosis: toxic epidermal necrosis, complicated with soft tissue infection and sepsis
- ICU care, He died 2 days later
- Direct cause of death: Pseudomonas aeruginosa bacteremia with septic shock and multiple organ failure syndrome.
- Post-mortem blood arsenic level: 1225.4 ug/L.

中藥處方

• 當歸飲子(複方)：當歸、白芍、川芎、生地黃、白蒺藜、防風、荊芥、何首烏、黃耆、甘草、生薑

• 人參養榮湯(複方)：人參、白朮、黃耆、甘草、陳皮、肉桂、當歸、熟地黃、五味子、茯苓、遠志、白芍、大棗、生薑

• 溫經湯(複方)：吳茱萸、人參、桂枝、川芎、生薑、半夏、甘草、當歸、芍藥、阿膠、牡丹皮、麥冬

• 桂枝湯(複方)：桂枝、白芍、甘草、生薑、大棗

• 五苓散(複方)：赭苓、澤瀉、白朮、茯苓、桂枝

• 越婢加术湯(複方)：麻黃、石膏、白朮、生薑、甘草、大棗

• 蒲公英

• 地膚子
Arsenic content of herbal ointment

- Anti-inflammatory-analgesic oint: 7640 ppm
- Skin cure and reactivation oint.: 8171 ppm

45,427 ppm
5,512 ppm

4,229 ppm
1.14 ppm  Face
Mercury poisoning after using skin whitening cream

- 50 y/o F, topical use of skin cream for 1.5 month
- S/S: tingling pain, paresthesia over face, aggravated headache, severe dry eye and eye itching
- PH: tension headache, goiter s/p subtotal thyroidectomy >10 years and follow-up thyroid function remain normal.

The product was claimed to be manufactured in China and sold in USA

urine Hg: 39.6, 87.2 ug/g creatinine
blood Hg: 33.46, 15.45 ug/L

- Mercury: 26,992 ppm
Chromium poisoning

- 22 y/o M, worker, entering chromic acid-containing tank
- Chemical burn, 15% TBSA
- Urine chromium 88,208 µg/L
- Presentation: acute renal failure, acute pulmonary edema with respiratory failure, chrome ulcer, leucocytosis, anemia, thrombocytopenia, elevation of liver enzyme and CK.
- Treatment: mechanical ventilation, plasmapheresis, CVVH, hemodialysis, DMPS, N-acetylcystein.
Acute severe chromium poisoning after dermal exposure to hexavalent chromium.


Figure 1. Sequential change in chromium and creatinine levels.
Metal poisoning through Inhalation
Cinnabar vapor inhalation (HgS)

- 73 y/o M, inhaled cinnabar for management of his insomnia, dizziness, general weakness, severe cough, and progressive dyspnea after 3-hour exposure for 2 consecutive days

→ Acute respiratory distress syndrome

- On ETT day 7, Refer to our service day 9.
  Blood Hg 319 µg/L, Urine Hg 357 µg/L

- Treat with DMPS and NAC, died on day 19
Mercury Vapor Poisoning - 4 Cases Report

• A 43 y/o men heated mercury for gold electroplation at bedroom.

• All four family members exhibited symptoms of acute mercury vapor poisoning with weakness, fatigue, diarrhea, sore throat, anorexia, generalized soreness, cough and dyspnea.

• Two dogs and four pet mice died later
Initial Mercury Level

Day 4 (after DMPS use for 3 days)

- Father: 5396.1 (U), 326.7 (B)
- Mother: 2698.2 (U), 390.5 (B)
- Girl: 3026 (U), 141.3 (B)
- Boy: 2381.2 (U), 120.3 (B)

Unit: μg/L
Metal poisoning through oral route
Lead Poisoning - mineral herb

- 30 y/o M, one week use of herb drug (PbO) for management of urolithiasis.
- S/S: nausea, vomiting, abdomen fullness, acid regurgitation, weakness, anemia, elevation of liver enzyme.
- Blood lead 42 μg/dL
- Herbal powder: Pb 23750 ppm, Hg 127 ppm
- DMPS therapy: 250 mg IV q6h*2days, then 100 mg po q6h (June 20-July 1, total 12 day)
Mercuric Nitrite Poisoning

• 20 y/o girl presented with GI upset (vomiting, sore throat, abdomen pain) after ingesting 150 ml insecticide (cypermethrin and tetramethrin) & unknown amount of mercury-containing chemical at 00:05 AM

• PE: oral ulcer, lip erosion, pinkish vomitus, epigastric tenderness
Realgar intoxication

- 59 y/o M
- Realgar 150 g in 5 days
- Drowsy
- Pancytopenia
- Acute hepatic, renal function impairment
- Progressive numbness, pain and weakness of distal four limbs → Severe sensorimotor polyneuropathy, axonal type, with active denervation

As: 635,573 ppm
Cd: 1028 ppm
Pb: 92.43 ppm
Hg: 11.52 ppm
<table>
<thead>
<tr>
<th></th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 4</th>
<th>Day 6</th>
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<tr>
<td>Urine (µg/g Cr)</td>
<td>7,714</td>
<td>20,141</td>
<td>135</td>
<td>1727</td>
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<tr>
<td>Blood (µg/L)</td>
<td>135</td>
<td>171</td>
<td>1727</td>
<td>8.25</td>
</tr>
<tr>
<td>As</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hg</td>
<td>136</td>
<td>10.14</td>
<td>7.72</td>
<td>18.6</td>
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</tbody>
</table>

**50/M**

**Realgar ingestion 50 g?**

S/S: Dizziness, severe vomiting, hiccup and diarrhea

**Reference level:**

1-18 µg/L (blood)  
<120 µg/g creatinine (urine)
Iron Poisoning

• 1 y/o girl ingested 30 tablets of ferrous sulfate
• Presentation: vomiting, ataxia, drowsy
• Metabolic acidosis (pH 7.35, PO$_2$ 100, PCO$_2$ 35, HCO$_3$ 19.3)
• WBC 17,400/cumm, ALT/AST 229/100 U/L
• Prolonged APTT (48.1/29.9 sec)

Antidote: deferoxamine IV
Clinical experience of acute ferric chloride poisoning.

<table>
<thead>
<tr>
<th>Case No</th>
<th>Age</th>
<th>Sex</th>
<th>Route/Reason of exposure</th>
<th>Ingested dose (ml)</th>
<th>Major presentations</th>
<th>Upper GI Endoscopy</th>
<th>Severity of poisoning</th>
<th>Special management</th>
<th>Serum iron (μg/dl)*</th>
<th>Hospital days</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
<td>F</td>
<td>inhalation/occupational</td>
<td>---</td>
<td>nausea, vomiting</td>
<td>---</td>
<td>mild</td>
<td>---</td>
<td>NA</td>
<td>---</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
<td>F</td>
<td>inhalation/occupational</td>
<td>---</td>
<td>nausea, sore throat, weakness</td>
<td>---</td>
<td>mild</td>
<td>---</td>
<td>NA</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
<td>F</td>
<td>inhalation/occupational</td>
<td>---</td>
<td>nausea, vomiting</td>
<td>---</td>
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<td>---</td>
<td>NA</td>
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<tr>
<td>4</td>
<td>12</td>
<td>M</td>
<td>oral/accidental</td>
<td>a little</td>
<td>nil</td>
<td>---</td>
<td>asymptomatic</td>
<td>---</td>
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<td>5</td>
<td>40</td>
<td>F</td>
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<td>30</td>
<td>sore throat</td>
<td>---</td>
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<td>---</td>
<td>NA</td>
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<tr>
<td>6</td>
<td>35</td>
<td>M</td>
<td>oral/accidental</td>
<td>NA</td>
<td>sore throat</td>
<td>---</td>
<td>mild</td>
<td>---</td>
<td>NA</td>
<td>---</td>
</tr>
<tr>
<td>7</td>
<td>21</td>
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<td>oral/suicidal</td>
<td>NA</td>
<td>vomiting, sore throat</td>
<td>---</td>
<td>mild</td>
<td>DFO</td>
<td>NA</td>
<td>5</td>
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<tr>
<td>8</td>
<td>70</td>
<td>M</td>
<td>oral/suicidal</td>
<td>50</td>
<td>vomiting, diarrhea, sore throat, abdominal pain</td>
<td>gastritis</td>
<td>moderate</td>
<td>lavage, milk, DFO</td>
<td>day 3: 47</td>
<td>5</td>
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<td>9</td>
<td>20</td>
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<td>oral/suicidal</td>
<td>200</td>
<td>sore throat, oral ulcer, lip bleeding, abdominal pain</td>
<td>---</td>
<td>moderate</td>
<td>NaHCO₃, DFO, lavage</td>
<td>NA</td>
<td>5</td>
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<td>10</td>
<td>56</td>
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<td>oral/suicidal</td>
<td>50</td>
<td>vomiting, abdominal pain, metabolic acidosis</td>
<td>gastric and esophageal erosions and ulcers</td>
<td>moderate</td>
<td>lavage, DFO</td>
<td>3.5 h: 304</td>
<td>5</td>
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<tr>
<td>11</td>
<td>26</td>
<td>M</td>
<td>oral/suicidal</td>
<td>25</td>
<td>vomiting, sore throat, oral ulcer, epiglottic erosions and ulcers</td>
<td>esophagitis</td>
<td>moderate</td>
<td>lavage, DFO</td>
<td>day 2: 40</td>
<td>3</td>
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<tr>
<td>12</td>
<td>26</td>
<td>F</td>
<td>oral/suicidal</td>
<td>30</td>
<td>sore throat, oral ulcer, abdominal pain</td>
<td>gastritis</td>
<td>moderate</td>
<td>DFO</td>
<td>5 h: 200</td>
<td>5</td>
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<tr>
<td>13</td>
<td>31</td>
<td>F</td>
<td>oral/suicidal</td>
<td>25</td>
<td>nausea, vomiting, sore throat, oral ulcer, cyanosis, pneumonia</td>
<td>---</td>
<td>severe</td>
<td>DFO, ventilator</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>14</td>
<td>18</td>
<td>M</td>
<td>oral/accidental</td>
<td>120</td>
<td>vomiting, sore throat, oral ulcer, abdominal pain, hematemesis, bloody diarrhea, pneumonia, hypotension, metabolic acidosis</td>
<td>---</td>
<td>severe</td>
<td>DFO</td>
<td>13 h: 216</td>
<td>12</td>
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<td>15</td>
<td>29</td>
<td>M</td>
<td>oral/suicidal</td>
<td>450-500</td>
<td>nausea, vomiting, sore throat, oral ulcer, abdominal pain, metabolic acidosis</td>
<td>severe gastritis</td>
<td>severe</td>
<td>lavage, DFO</td>
<td>12 h: 127</td>
<td>8</td>
</tr>
<tr>
<td>16</td>
<td>25</td>
<td>F</td>
<td>oral/suicidal</td>
<td>200</td>
<td>vomiting, metabolic acidosis hemolysis, coagulopathy, pneumonia, shock</td>
<td>---</td>
<td>death</td>
<td>---</td>
<td>4 h: 2440</td>
<td>&lt;1</td>
</tr>
</tbody>
</table>

* Reference values of serum iron=50-150 μg/dl
DFO = deferoxamine
NA = non-available
Deferoxamine

Indications

• If patient is **symptomatic** (more than transient nausea/vomiting, diarrhea, lethargy, hypotension, bloody emesis or diarrhea)

• If patient is **acidotic**

• The peak **serum iron exceeds 350 to 500 μg/dL** (most patients with serum iron in this range will be symptomatic)
Thallium Poisoning outbreak

• 31 y/o m, an orthopedic doctor.

• Admission 3 days due to Flu-like symptoms, ileus; alopecia loss 2 weeks later

• 1.5 month later, painful feet, sleepy, hair loss

• admission presentations: Progressive distal numbness in feet/fingers (1 m), distal weakness, difficulty in walking (walking on cotton), dysarthria, nystagmus, poor accommodative ability of eyes, BW loss, Hair loss and Mees’ Line

• Discharge Dx: Thallium intoxication with polyneuropathy, optic neuropathy and brainstem dysfunction.
Thallium level

Case 1 (severe poisoning)
- Blood: 111.64 μg/L, Urine: 616.79 μg/L
- Hair: 10.499 ppm (< 0.01)

Case 2 (moderate poisoning)
- Blood: 102.91 μg/L, Urine: 434.85 μg/L
- Hair: 1.654 ppm
Antidote for thallium poisoning

- Prussian blue
Insufficient Stocking

• Although chelators are very essential for heavy metal poisonings, yet insufficiently stocked in health care facilities.

• The cause appears to be related to low incident of metal poisonings, limited hospital resources, cost and unfamiliarity with chelators.
Conclusion

- The chelators are effective in treatment of mercury, arsenic, lead, iron and thallium poisoning.
- Treatment should be initiated as early as possible in acute poisoning.
- Establish a chelator storage and distribution system for the response of the various metal poisoning accidents should be considered at the governmental level.
Comments or questions?

Thanks for your attention!