PAEDIATRIC ACUTE CARE GUIDELINE	
Poisoning – Iron	
Scope (Staff):	All Emergency Department Clinicians
Scope (Area):	Emergency Department

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Poisoning – Iron

This is a general approach to iron poisoning – for specific details, please contact **Poisons Information: 131126** or refer to the Toxicology Handbook

Background

Accidental iron ingestion is common in children but severe iron toxicity requiring chelation is rare.

Iron causes two major effects:

Local – Gastrointestinal irritation

- Abdominal pain
- Nausea and vomiting

Systemic – Cellular toxicity causing multi-organ failure

- Systemic toxicity may occur with doses greater than 60 mg/kg and is life-threatening with doses greater than 120 mg/kg

General

Severe iron toxicity is classically described in five stages, although in reality, clinical manifestations of significant iron intoxication do not occur as distinct stages but as a clinical continuum.

Risk Assessment

- Vomiting and abdominal pain are common even after doses that are not associated with systemic toxicity
- Systemic iron toxicity is characterised by:
    - Shock
    - Acidosis
    - Hepatocellular injury
    - Renal injury

- Risk assessment is based on the potential dose of elemental iron ingested and the evolving clinical features observed
- The amount of elemental iron varies according to the form of iron, see Elemental Iron Equivalents table for common iron formulations
    - In Australia the packaging usually states the elemental iron content (thus conversion is not required)
- If in doubt, consult with the **Poisons Information Centre** (**Telephone 131126**)

Elemental Iron Equivalents	
Iron Formulation	**Percentage of Elemental Iron**
Ferrous sulphate	20%
Ferrous gluconate	12%
Ferrous fumarate	33%
Ferrous lactate	19%
Ferrous chloride	28%
Ferrous ferrocholinate	13%

Typical Clinical Course

- Symptoms are dose-dependent and range from mild GI upset to multi-organ failure
- Significant toxicity follows predictable course with five clinical phases over time

Phase	**Onset Post Ingestion/Duration**	**Clinical Features**
Phase 1 – Gastrointestinal	0.5-6 hours	• Abdominal pain • Vomiting • Diarrhoea
Phase 2 – Quiescent	6-12 hours	• Progressive increase in iron absorption and distribution • Improvement of gastrointestinal symptoms (sense of recovery)
Phase 3 – Cardiogenic Shock and Acidosis	24-48 hours	• Hypotension • Anion gap metabolic acidosis • Shock (may develop from Phase 1) • Potential multi-system failure • Coma

Phase 4 – Hepatic Necrosis	2-5 days	• Acute hepatic failure • Jaundice • Coagulopathy • Hypoglycaemia • Coma
Phase 5 – Bowel Obstruction	2-6 weeks	• Abdominal pain • Vomiting • Gastrointestinal fibrosis/strictures • Cirrhotic liver disease

Investigations

Screening (in deliberate overdose)

- 12 lead ECG
- Blood glucose level
- Paracetamol level

Specific:

- Abdominal X-Ray (quantity and confirmation of ingestion)
- Iron level at 4-6 hours post ingestion
- Blood gas
    - Bicarbonate is an indicator for metabolic acidosis (this may be used as a surrogate marker if iron levels are not available)

Management

- Priority is the restoration and ongoing replacement of adequate circulatory volume
- All patients with **deliberate self poisoning**, regardless of the dose, should be referred to hospital for evaluation

Ingested dose of Elemental Iron	Symptoms and Management
< 20mg/kg	**Patients usually remain asymptomatic** Do not require decontamination or referral to hospital
20-40mg/kg	**Patients often have mild GI irritation manifested by transient abdominal discomfort and vomiting. One or two vomits are common and symptoms usually last less than 6 hours.** Gastrointestinal decontamination is not required and minimally symptomatic patients (e.g. one or two vomits) do not require referral to hospital
40-60mg/kg	**Patients often have abdominal discomfort and vomiting but systemic toxicity is not expected. Symptoms usually resolve within 8 hours.** Symptomatic patients will require referral to hospital for abdominal X-Ray (to confirm that the dose is not larger) and general supportive measures (intravenous fluids may be required) Systemic toxicity is not expected and admission is usually not required

> 60mg/kg	**Patients have severe gastrointestinal symptoms and systemic toxicity may occur.** Patients should be referred to hospital for evaluation and management With appropriate management (which may include whole bowel irrigation +/- chelation) admission for greater than 24 hours is uncommon
> 100mg/kg	**Patient develop severe gastrointestinal symptoms and systemic toxicity that is potentially lethal.** Early aggressive evaluation, whole bowel irrigation, meticulous fluid resuscitation, chelation and management in an intensive care unit will be required

Decontamination

- Indicated if the risk assessment suggests that the ingested dose is > 60mg/kg, and
- Patient has a normal mental status, and
- There is evidence of iron tablets within the gastrointestinal tract (radio-opaque tablets are visible on X-Ray, or presentation within 6 hours with clinical evidence of significant ingestion)
- **Activated charcoal does not absorb iron**
- **Whole bowel irrigation** (WBI) with polyethylene glycol is the treatment of choice
    - Commence nasogastric infusion at 25mL/kg/hours
    - Consultation with clinical toxicologist is recommended
- Endoscopic removal may be indicated in patients with a potentially lethal iron ingestion where whole bowel irrigation has failed or is impractical

Antidote

- **Desferrioxamine (chelating agent)** is the antidote for systemic iron poisoning
- The decision to administer desferrioxamine is based on the presence of toxicity (shock, metabolic acidosis, altered mental status) or predicted severe toxicity based on a serum iron level > 90 micromol/L (500 microgram/dL) at 4-6 hours post ingestion.
- Clinical Toxicology should be contacted if administration of desferrioxamine is considered.
- Specific dosage and administration details should be obtained from the Toxicology Handbook.

Enhanced Elimination

Not useful

Disposition

- Children though to have ingested < 40mg/kg may be managed at home provided they remain asymptomatic.
- Larger or symptomatic ingestions are evaluated in hospital. The child who remains asymptomatic at 6 hours and has an abdominal X-Ray negative for iron may be safely discharged.

- All patients who have deliberately self poisoned with iron are evaluated in hospital. If the history suggests ingestion of < 60 mg/kg of iron and they remain asymptomatic at 6 hours, further medical observation is unnecessary.
- Symptomatic patients requiring intravenous fluid therapy or WBI require admission to a medical ward.
- Those presenting with established systemic iron toxicity or requiring intravenous chelation therapy are admitted to intensive care.

Nursing

- Baseline observations include heart rate, respiratory rate, oxygen saturation, blood pressure, pain score and neurological observations
- Minimum of hourly observations should be recorded whilst in the emergency department
- Any significant changes should be reported immediately to the medical team
- A baseline ECG should be performed on arrival
- Continual cardiac monitoring should be done during desferrioxamine infusion
- Fluid balance should be strictly monitored
    - Note the urine may have a red discolouration in the event that chelating agent is given

References

• Murray L, Little M, Pascu O, Hogget K. (2015) Toxicology Handbook, 3rd Edition, Churchill Livingstone Australia.
• Poisons Information Service 131126
• AMH Children's Dosing Companion (online). Adelaide: Australian Medicines Handbook Pty Ltd; 2015 January. Available from: http://childrens.amh.net.au
• Australian Medicines Handbook (online). Adelaide: Australian Medicines Handbook Pty Ltd; 2015 January. Available from: http://amhonline.amh.net.au
• Toxinz Poisons Information (2013) National Poisons Centre, New Zealand. Online – http://www.toxinz.com

This document can be made available in alternative formats on request for a person with a disability.

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