

Poisoning in Children

Aysha Maqbool, Huma Maqbool, Sajid Maqbool

Department of Paediatrics, Shaikh Zayed Postgraduate Medical Institute, Lahore

INTRODUCTION

Homes have always been considered as fortresses of protection and safety, but these same havens of safety may become menacing danger fields for the young inquisitive toddlers, containing within them unassuming, hidden and sometimes fatal traps.

Unattended for a minute, children especially between the ages of 1-5 yr are attracted by anything that catches their eye, and they fall easy prey to brightly coloured tablets or cleaning agents lying about the house.

Thus poisonings in children are generally a result of ingestion of household products or drugs; where failure to put such agents in a safe place is a common error and parental neglect contributory. Hence prevention should be the key word in any discussion.

The following are some pertinent warnings for a safe child-proof home.

- 1) Keep all drugs, pesticides, household chemicals out of sight and out of reach of children
- 2) Do not store poisons etc in food containers, soft drink or juice bottles.
- 3) Lock up all dangerous substances.
- 4) Do not tell children medicine is candy.

Once a child begins crawling, he begins to explore his environment, and begins putting anything he can hold in his mouth. Hence from about 9 months to about 4 yrs children are in an exploratory phase where diligent supervision is necessary.

During this age all efforts should be made by parents to keep all agents capable of pathological toxicity, away from children.

Household chemicals should be kept under lock and key. No drug, however trivial should be left lying around the house. And homes, should indeed be made havens of protection and safety for these youngsters.

Nevertheless, once a toxic agent is ingested, every effort should be made to identify it. This article deals with various common household poisons and

their specific treatment modalities.

Treatment generally involves 3 aspects;

- 1) Removal of the poison
- 2) Supportive therapy in fulminant cases
- 3) Life-sustaining measures

Removal of Poison

Stomach emptying is the first line of action in case of an ingestion. Unless contraindicated emesis is induced immediately, in the emergency room at home or even in the doctors office. Contraindications are coma, corrosive ingestion and petroleum ingestion.

- a) **Emesis:** Simple gagging can be induced by making the child drink a glass of water or milk and then inducing emesis by stroking the posterior pharyngeal wall. 10-15 ml syrup Ipecac can be given to a child with oral fluids. This can be repeated again after 15-30 min if the first dose is ineffective. Remember >30ml Ipecac should not be left in the stomach. Being a cardiotoxin, it can cause atrial fibrillation.
- b) **Gastic lavage:** If vomiting cannot be induced then a gastic lavage is resorted to. It is indicated in ingestion of toxic drugs < 3 hour ago, if the poison was enteric coated, or the drug is very slowly absorbed, e.g. tricyclic antidepressants. It is contraindicated in petroleum and distillate ingestion, coma; decreased cough reflex and in strong corrosives ingestion though if the patient arrives within 1 hr of the ingestion of corrosives, a lavage may be tried. A urinary catheter lubricated with water and marked at the nasoxiphoid distance can be passed in children and infants perorally. A glass syringe is attached and the gastric contents are aspirated. Then isotonic saline is used for lavage, and the procedure is continued 10-12 times till the aspirate is clear.
- c) **Antidotes:** These can be given via the tube and allowed to remain in the stomach. Tannic acid

precipitates a large number of organic and inorganic compounds. However, due to hepatotoxicity it should be used with care. Potassium permanganate covers a wide range of toxic organic compounds especially Nicotine, Physostigmine and Quinine. It is diluted generously (1:10,000) in solution to prevent gastric mucosal irritation by Potassium Permanganate directly. Magnesium oxide is used in aspirin and oxalic acid poisonings.

Activated charcoal is a potent adsorbent if given promptly. It is effective for by far the largest number of organic and inorganic compounds. The list includes drugs like Atropine, Morphine, Penicillin, Salicylates, Barbiturates and so on 1-2 tablespoon in 240 ml of water are given orally, usually post emesis.

Supportive Therapy

An emergency airway is established if required, and circulation is maintained. Parental fluids are started to maintain urine output and electrolyte balance and vital signs are monitored and stabilized.

Life Sustaining Measures

- a) Hemodialysis is used for circulatory poisons or tissue or colloid-binding poisons e.g. barbiturates, salicylates. Contraindications include GI bleedings or inexperienced personnel.
- b) Peritoneal dialysis may also be used, though contraindicated in peritoneal cavity infections.
- c) Exchange transfusions can be done in < 1 yr infants with salicylate or barbiturate poisoning. Forced diuresis and urine alkalization is also increasingly effective.

Specific Poisons and Their Management

1. Disinfectants, Bleaches:

Oxalic Acid is present in disinfectants and bleaching agents. Children usually present with GI upset, dysphagia, hematemesis, oral mucus membrane lesions, hypocalcemia and dilated pupils. Treatment includes oral magnesium hydroxide, calcium bicarbonate, and chalk and water. Emesis is contraindicated though lavage can be done if oral and esophageal erosions are mild. 10% calcium gluconate is given intravenously. Symptomatic and supportive treatment is given as required.

Washing powder, Clinitest tablets Paint removers, and Drain cleaners contain strong

alkalis. House hold bleach and home made soap contain mild alkalis. Children experience burning from mouth to stomach whereby swallowing becomes progressively difficult. Mucus membranes are brown and ulcerated; bloody mucoid vomitus may be present. And a patient may collapse with deteriorating vital signs. Large quantities of milk or water can be given immediately. A lavage or emesis is not done. Corticosteroids are given to prevent esophageal stenosis in upto 4 yrs of age. Prednisolone is started at 60mg/kg in 4 divided doses and is tapered to and maintained at 20mg/kg for 3 weeks or until the esophageal lesion is healed.

Table 1: Common household agents and their compounds

Household Agent	Chemical
1. Toilet and Tile cleaner	Hydrochloric acid
2. Floor cleaner	Sulphuric acid
3. Household cleaner	Ammonia
4. Bleaches	Sodium Hydroxide
5. Toilet Cleaner	Phosphoric acid
6. Matches, rodenticide	Phosphorus
7. Bleach	Oxalic acid
8. Bleach	Sodium Hypochlorite

Toilet Bowl cleaners contain Sodium Acid sulfate, an acid corrosive that causes superficial skin destruction. With production of initial gases e.g. chlorine, ammonia, cough dyspnea, respiratory tract irritation and pulmonary edema may be a presenting scenario. Treatment includes administering oxygen and artificial respiration if needed. Further symptomatic and supportive treatment is given as required.

2. Barbiturates:

Barbiturates are another source of childhood poisonings. Excitement, hallucinations, mental depression, deteriorating vital signs leading to shock is seen. Lavage is useless due to rapid absorption of barbiturates. Activited charcoal is administered. Forced diuresis and urine alkalization is also done. Airway is established if required and supportive therapy provided.

Tranquilizers cause deep sleep, decreasing vital signs and tonic clonic convulsions and coma. If the child is sleeping, then administer i/v fluids only. Norepinephrine is given for shock and barbituates may be administered carefully for terminating tonic clonic convulsions.

3. Salicylates

Salicylates are one of the most commonly "available" drugs to children at home. Physicians must be knowledgeable about the distribution of salicylates in the body because the site of the lethal effect is the CNS. Vomiting, thirst, profuse sweating, fever, confusion leads onto multi system decompensation. Bleeding in salicylate toxicity can occur as a result of diminished platelet aggregation². Meta-bolic acidosis may also be seen. Gastric emptying by either emesis or lavage with a large bore tube placed orogastrically, not nasogastrically and the administration of activated charcoal followed by a cathartic may prevent further absorption of aspirin in the stomach³. Blood is sent immediately for bicarbonates, pH and electrolytes, salicylate levels. Rehydration is started to cover the electrolyte loss by persistent vomiting. Alkalinization of urine with sodium bicarbonate is helpful (urine pH above 7.5). In life-threatening intoxication in infants, exchange transfusion and peritoneal dialysis may be done.

4. Bicarbonate

Bicarbonate is present in some house cleaning agents. Children usually present with burning sensation in mouth and throat; corrosion of the mucus membranes of the oral cavity and coffee ground vomitus may be also seen. Large amounts of milk and water are given immediately. Lavage is contraindicated in ingestion greater than an hour. Supportive treatment is initiated as required.

5. Paracetamol

Toxic symptoms of paracetamol ingestion begin within hours starting with nausea, vomiting and diaphoresis. The patient progresses to deranged liver enzymes prothrombin time and hepatomegaly. Oliguria due to dehydration, renal damage and the antidiuretic action of

acetaminophen may ensue. Within 7-8 days hepatic necrosis and renal failure can set in.

Mortality results due to hepatic necrosis. Greater than 5 gm ingestion is taken as toxic dose, and grounds for hospitalization. The drug is removed by emesis and copious lavage and by administration of a cathartic. Forced diuresis is helpful but renal function is monitored carefully to watch out for acute renal shutdown. In preventing hepatic damage total 10gm methionine 2.5gms 4 times and has proved to be effective; if given within the first 10 hrs. Acetylcysteine orally in a dose of 140 mg/kg initially, followed by 70 mg/kg for additional 4 days is also useful. Once hepatic damage has set in, treatment is supportive only.

6. Digitalis

Digitalis poisoning occurs due to the attractive looking and the sweet taste of the glycoside tablets. Though infrequently seen, children present with GI upsets, drowsiness, and concurrent cardiac arrhythmias ranging from sinus tachycardia to Ventricular tachycardia and ventricular fibrillation. Immediate lavage and emesis is done. Potassium chloride is administered under ECG monitoring. Atropine may also be used.

7. Cough Medicine

Occasionally children ingest excessive cough medicine containing morphine and codeine. Respiratory depression, cyanosis and respiratory collapse may occur. Pupils may become dilated later due to asphyxia. Potassium permanganate lavage is done. Efforts to keep the patient conscious are maintained and naloxone 0.01mg/kg I/V may be given and repeated as required.

8. Petroleum Distillates

Petroleum distillates are frequently found at home stored in unmarked containers; due to their pleasant aroma, it is not surprising that they are often accidentally ingested by young children^{5,6}. Due to the low surface tension of a majority of petroleum products especially kerosene ingestion or intoxication involves multiple systems, respiratory, GI, CNS. Aspiration is by far the most important clinical

problem. Chemical pneumonitis, massive pulmonary edema and pulmonary shock are some modes of presentation. Hemoptysis occurs in younger children who may be sicker. Cyanosis sometimes develops very quickly due in part to the displacement of alveolar gas by hydrocarbon vapours⁸ Chemical pneumonitis is typically bilateral and generally involves multiple lobes, most severely the lower lobes^{9,10}. Aspiration on occasion may not be recognised due to depressed cough and choking response. Lavage is not indicated. Emesis may be tried in an alert patient with a large amount of ingestion. Ipecac can also be used.

9. Carbon Monoxide

Carbon monoxide is a relatively frequent source of poisoning usually seen in incomplete combustion, especially of coal. Headaches, vomiting, bounding pulses, dusky skin and convulsions are typical presentations, Coma signifies fatal intoxication. Artificial respiration with pure oxygen is instituted immediately to reduce the carboxy hemoglobin.

10. Alcohols

Ethyl alcohol and methylalcohol intoxication is infrequent in children. Gastric lavage and sodium bicarbonate is given in ethyl alcohol whilst in methanol toxicity ethanol can be administered. It is important to recognise and treat acidosis as well.

11. Naphthalene (Moth Balls)

Naphthalene is not very soluble in water and remains in garments for long periods of time. Interesting to note, it is soluble in oil and may be absorbed through the skin. The most significant toxicity is hemolytic. It involves a Heinz Body hemolytic anemia leading to a sharp fall in hemoglobin Hct and red blood cell count^{11,12}. Ingestion of mothballs can cause abdominal cramps, dyspnea brown black urine and convulsions. The brown or black urine occurs due to hemoglobinuria or methemoglobinemia^{13,14,15}. Emesis and lavage is done immediately. Cathartics are administered next. Alkalinization of urine and forced diuresis also helps prevent renal tubular damage.

Interesting to note is that newborns have been

poisoned by diapers stamped with aniline dye products. They become apathic, dyspneic and may develop convulsions. Circulatory and respiratory failure may ensue.

12. Lead

Chronic lead poisoning by inhalation and ingestion of water from old lead pipes is another serious form of poisoning. Hypochromic microcytic anemia, GI upsets, cranial nerve palsies and unexplained hypertension are some presentations. Lead greater than 0.08mg/100ml in blood is indicative of toxicity. For immediate poisoning, lavage is indicated. Later lead is removed by edetate disodium calcium (EDTA) I/V or I/M for 5 days.

13. Mercury

Metallic mercury as present in thermometers is a common source of ingestion in children but it is nontoxic as it is not absorbed.

14. Insecticides

Insecticides consist of two groups, a) chlorinated hydrocarbons and b) organophosphates.

a) *Chlorinated hydrocarbons*: include DDT In co-ordination, muscle spasm, GI upsets, respiratory collapse and tonic clonic convulsions can occur leading to death. Lavage and epsom salts are used. Skin is washed if it had come in contact with the toxin. Although infrequently, significant dermal absorption can occur if the skin and clothing become contaminated by a liquid formulation¹⁶ Convulsions are controlled by barbituates and if required airway is maintained.

b) *Phosphorus*: Organo phosphates can also be absorbed through the skin and severe intoxication can follow spillage of the compound on the body^{17,19}. Organophosphates cause GI upsets, salivation, pinpoint pupils and if severe cause pulmonary edema, coma and death. After lavage, atropine can be given I/V or I/M 1-2mg every 15min till improvement. Airway is maintained and the patient stabilized. Pralidoxime iodide, the specific antidote to organo phosphate poisoning is used as an adjunct to atropine.

Guide to specific antibiotic therapy

<i>Antidote</i>	<i>Dose</i>	<i>Poison</i>	<i>Reaction (to antidote) & comments</i>
Acids, weak e distension from Magnesium oxide (perferred) Sodium bicarbonate	100 to 200ml liter) 5% solution (50 g/ liter)	alkali, caustic sodium hypochlorite	liberated CO (from use of NaHCO)
Ammonium acetate	5 ml in 500 ml water for lavage	formaldehyde (formalin)	forms relatively harm- less methenamine
Ammonium hydroxide	0.2% solution, for lavage		
Atropine sulfate	1 to 2 mg 1M and repeat in 30 min for organic phosphate ; esters: 0.5 mg for other cholinesterase inhibitors	organic phosphate esters: gluthion, malathion, para- thion, mushroom, tetraethyl pyrophosphate, trithion, etc;	atropinization
BAL (dimercaprol)	severe intoxication: day 1: 3 mg/kg every 4 hr (6 injections); day 2: 2 mg/kg every day 3: 3 mg/kg every 6 hr (1 injections); days 2 mg/kg every day 3; (or until recovery); 3 mg/kg every 12 hr (2 injections) mild intoxication: day 1: 2.5mg/kg every 4 hr (6 injections); day 2: same; day 3: 2.5 mg/kg every 12 hr; days 4 to 13 (or until recovery): 2.5 mg/ kg daily (1 injection)	antimony, arsenic, bismuth gold, mercury (acrodynia), nickel, lead (combined therapy with edetic acid for encephalitis); contra- indicated for iron	flushing myalgia, nausea and vomiting nephrotoxic effects, hypotension, pulmonary edema, salivation and lacrimation, fever
Bromobenzene EDTA	adult: 1g Child: 0.25 g (in lavage solution)	selenium	
Calcium lactate	10% solution (in lavage solution)	chlorinated hydrocarbons fluoride, oxalates	
Chlorpromazine	0.5-1 mg/kg every 30 min	amphetamine	drowsiness, hypotension neuromuscular (parkin- sonian) effects
Copper sulfate	0.25 to 3 g in glass of water	phosphorus	forms insoluble copper phosphide
um nitrite Sodium thiosulfate	in 2 to 4 min, and 25% solution (50ml) in 10 min through same needle and vein; repeat with 1/2 doses if necessary	iodine	sodium thiosulfate used alone for iodine; forms harmless sodium iodide

15. Nicotine

Childhood nicotine poisoning occurs accidentally where children bite and swallow cigarettes. Since nicotine cannot be readily absorbed in this form, it causes little havoc except vomiting. Once absorbed it can cause cardiac arrest and respiratory failure. Immediate lavage with potassium permanganate is done and activated charcoal or tannic acid administered.

16. Cyanide

Cyanide is present in insecticides, rodenticides, apple, peach and apricot seeds. Characteristically the breath has a bitter almond odour. Blood tinged foam can be seen on the lips. Convulsions and death may ensue. Gastric lavage and sodium thiosulphate form the immediate line of management. Rarely children can present with ingestion of chemical depilator creams. Lavage is done immediately.

Common poisons and their anti dotes

Poison	Antidote
Acid	Weak alkalis
Alkalis	Weak acids
Alkaloids	Potassium permanganate
Barbituates	No sp drug
Organophosphates	Atropine
Codeine	Narcotic antagonist
Diazepam	Physostigmine
Lead	Dimercaprol, EDTA
Iron	Desferoxamine
Mercury	Dimercapral
Methanol	Ethanol
Organic compounds	Potassium permanganate

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The Authors:

Aysha Maqbool,
Student on elective
Agha Khan University Hospital,
Karachi.

Huma Maqbool,
Student on elective,
Mt. Holyoke College, MASS,
USA

Sajid Maqbool
Professor & Head
Department of Paediatrics,
Shaikh Zayed Postgraduate Medical Institute,
Lahore.

Address for Correspondence:

Sajid Maqbool
Professor & Head
Department of Paediatrics,
Shaikh Zayed Postgraduate Medical Institute,
Lahore.