Poisoning in children 2: Painkillers
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Poisoning

Painkillers and antipyretics are the largest group of toxins encountered by children.

In this, the second of a series of articles on the management of poisoning, we deal with the largest group of toxins encountered by children—painkillers and antipyretics.

**PARACETAMOL**

Children are more resistant to paracetamol induced liver damage than adults. Chronic overdose is more likely to result in harm than the acute effects of paracetamol ingestion are based on experience in adult practice. The validity of this extrapolation is questionable. Children seem less sensitive to the hepatoxic effects of paracetamol than are adults.

Possible explanations for this include metabolic differences and a greater propensity to vomit following acute ingestion. In addition, almost 80% of children consume a liquid paediatric paracetamol preparation (see fig 1).

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Phenylbutazone elimination may be enhanced by use of repeated doses of activated charcoal. Phenylbutazone poisoning is also amenable to treatment with haemoperfusion.11

**COMPOUND ANALGESICS AND OPIOIDS**

Compound analgesics are mixtures of paracetamol or aspirin combined with a variety of opioids and other active ingredients. When assessing overdose of these compounds each active constituent must be considered separately.

In overdose, opioids cause nausea, vomiting, convulsions, central nervous system depression, and respiratory compromise. Dextropropoxyphene may also cause cardiac arrhythmias.

Activated charcoal should be administered if the maximum daily dose of opioid has been exceeded. Asymptomatic children require observation for six hours. Symptomatic children should be admitted to hospital. Management measures for other active ingredients of compound preparations must not be overlooked.

Naloxone, a pure opioid antagonist, effectively reverses opioid induced coma and respiratory depression. Given intravenously its effects are immediate, although its duration of action is short lived (two hours).

Pentazocine and buprenorphine are mixed opioid agonist-antagonists. In overdose they cause dysphoria and less respiratory depression than morphine. Naloxone remains effective in treating coma and respiratory depression caused by these drugs.

Certain adverse effects are induced by mechanisms other than opioid receptor binding. Many opioid drugs cause the release of histamine from mast cells, resulting in hypotension. This effect will not be reversed by naloxone, and intravenous fluids or isotropes may be required. Dextropropoxyphene acts directly on cardiac tissue to slow inward calcium current and depress myocardial contractility. Experimental data suggest that resulting arrhythmias may not respond to naloxone, although this remains first line therapy. Other therapeutic options include sodium bicarbonate, phenytoin, or atenolol. Class I antiarrhythmic agents should be avoided.4

Opioids are also encountered in anti-motility drugs, prescribed most frequently for the treatment of diarrhea. Co-phenotrope (as Lomotil) is the most commonly encountered and the most dangerous. It consists of diphenoxylate, with a small amount of atropine added to discourage abuse. In overdose atropine produces symptoms within a few hours of ingestion. However, the absence of initial anticholinergic symptoms does not exclude significant poisoning. Both drugs delay gastric emptying and symptoms of severe opioid poisoning may be delayed for 24 hours or more. Hospital admission is required if more that the maximum daily therapeutic dose has been ingested. A minimum period of 36 hours observation is recommended. Naloxone is an effective antidote. Repeated doses, or an infusion, are likely to be required. Consider gastric decontamination if large quantities of tablets have been consumed.

Loperamide is less toxic. Asymptomatic children who have ingested less than 0.4 mg/kg are unlikely to require treatment. Symptomatic children should receive treatment with naloxone.

Kaolin and morphine mixture is of moderate toxicity. Doses of less than 10 ml are unlikely to produce symptoms. Asymptomatic children should be observed for six hours. Naloxone is an effective antidote.

**ASPIRIN**

In 1977, Craft and Sibert observed that aspirin accounted for 25% of all childhood poisonings. The incidence of salicylate toxicity has declined considerably since the withdrawal of paediatric aspirin preparations from the market in 1986.

Salicylates are also encountered in cough and cold powders, topical preparations (for example, Oil of Wintergreen), creams, and wart treatments.

In overdose salicylates stimulate respiration by a direct action on the respiratory centre. In adult patients the ensuing hyperventilation may produce an initial respiratory alkalosis, but this pattern is less common in children. Other symptoms include tinnitus, dizziness, decreased hearing, nausea, and vomiting. Salicylates uncouple oxidative phosphorylation in skeletal muscle, leading to pyrexia and metabolic acidosis. Acidosis enhances transfer of salicylate across the blood-brain barrier. Initial central nervous system stimulation, with excitement or agitation, is followed by respiratory depression and coma.

Asymptomatic children who have consumed less than 120 mg/kg of aspirin do not require treatment.

Children who have consumed more than 120 mg/kg of aspirin should receive activated charcoal. Repeated doses may be of some benefit. A plasma salicylate level should be checked at four hours post-ingestion. Blood should also be obtained to check electrolytes, renal function, blood glucose, clotting, and acid-base balance.

Aspirin is poorly soluble in acid and tablets tend to adhere, forming a mass that dissolves slowly. If large numbers of tablets have been consumed, gastric lavage should be considered up to four hours post-ingestion. In such circumstances, the plasma salicylate level should be repeated at three hourly intervals, until a declining trend is observed, because of the possibility of ongoing absorption.

Vomiting, pyrexia, and renal attempts to compensate acid-base disturbance result in significant dehydration. If present, this must be corrected vigorously. Dehydration artificially increases plasma salicylate concentrations and may lead to renal failure.

Children with symptoms other than nausea and vomiting, or evidence of metabolic disturbance, require urinary alkalisation. These effects are most commonly seen in patients with plasma salicylate concentrations in excess of 400 mg/l.14

Salicylate enters the nephron by filtration and proximal tubular secretion. At neutral urine pH salicylate is extensively reabsorbed in the distal nephron. If the pH of the distal nephron is raised to more than 7.5, the salicylic acid is trapped in the nephron and drug excretion increases fourfold.19 20

Intravenous sodium bicarbonate (1–2 mmol/kg/day in maintenance fluid) should be administered. Urine pH should be maintained above 7.5. Blood pH and electrolytes should be monitored closely. Because of the reciprocal relation between potassium and hydrogen ions, alkalosis produces hypokalaemia. It can be difficult to achieve adequate urinary alkalisation when serum potassium is low. Early and adequate intravenous supplementation is important.

In the past forced diuresis was used in combination with urinary alkalisation. While renal clearance of salicylate increases with urine flow, this effect is diminished as urine pH rises.22 Forced diuresis is no longer recommended.

Patients with unresponsive acidosis, seizures, coma, renal failure, or progressive deterioration should be considered for haemodialysis. These effects are likely to be seen in patients with plasma salicylate concentrations in excess of 700 mg/l. While haemoperfusion removes salicylate it fails to restore metabolic and fluid homeostasis, and is not recommended.

**SEEKING FURTHER ADVICE**

Specific, expert advice on all aspects of poisoning is available to medical professionals in the United Kingdom via the National Poisons Information Service (NPIS). The regional centres that make up this service have recently introduced a single national enquiry number: 0870 600 6266

A wide range of easily accessible and highly practical advice is available through the NPIS website. This free service is restricted to medical professionals. On line registration is available at http://www.spib.axl.co.uk/toxbase/.

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