

Accidental Poisoning in Children with Special Reference to Kerosene Poisoning

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This study on accidental poisoning in children is the result of a review of cases admitted to the Kapiolani Children's Hospital over a five year period from August 1945 to May 1950. The purpose of this study was to determine the most frequent types of poisoning so that an emergency room could be set up at the Children's Hospital to meet the most common needs. No attempt has been made to determine the best method for managing any one particular type of poisoning, because when the cases were admitted there was no unified study made with this in mind.

The cases presented are those that were admitted to the Children's Hospital, and do not necessarily reflect the most common types that may be seen in private practice or at the local Emergency Hospital.

Observations

The total number of cases admitted was 221 with 3 deaths, a mortality rate of 1.3%. The deaths were due to one each of the following: kerosene, oil of eucalyptus, and water color paint. The age range was from 10 days to 12 years with an average (median) age incidence of 3.8 years. The mode was 2 years: 40 cases occurred at this age, an incidence of 17.8%. The other ages in the order of frequency were: 1.5 years, 24 cases or 10.7%; 1 year, 20 cases or 8.9%; 3 years, 18 cases or 8.03%; 2.5 years, 17 cases or 7.6%. One hundred and forty-nine boys and 72 girls were admitted. There were 3 cases who ingested poisons twice. One was a 2-1/2 year old female who ingested phenolphthalein in the form of "Ex-lax" twice 4 months apart. Another was a 3-year-old male who was first admitted for ingestion of oil of eucalyptus and fourteen months later was admitted for kerosene ingestion. The third case was a one-year-old male who ingested kerosene twice five months apart.

There were 59 types of poisons encountered. To facilitate the discussion of the different types of poisoning, they have been divided into four major groups, namely, medications, chemicals, foods, and plants. The individual poisons encountered are as follows:

A. Medications

1. Oil of eucalyptus, 13 cases; phenolphthalein, 7 cases; barbiturates, 7 cases; salicylates, 6 cases; camphorated oil, 5 cases; rubbing alcohol, 4 cases; thyroid tablets, 3 cases.
2. There were two cases of each of the following: Benadryl; iodine; "Vapor Cresoline"; benzedrine; ethyl alcohol; aconite.
3. There was one case of each of the following: "Antistine;" potassium permanganate; stilbestrol; morphine; mercury; atropine; sulfonamide; mercurochrome.

B. Chemicals

1. Kerosene, 69 cases; arsenic, 17 cases; pine oil, 7 cases; turpentine, 4 cases.
2. There were three cases of each of the following: Cigarette lighter fluid; carbon tetrachloride; ant poison (unidentified).
3. There were two cases of each of the following: Phosphorus, gasoline, water color paint, nicotine, "Clorox," "Flit," lye, inhalation of "Chemtox" (termite fumigation fluid), creosol.
4. There was one case each of the following: Vanilla extract, witch hazel, creoline, "Tintex" dye, nail polish remover, incense sticks, D.D.T., shoe polish, "Borax," "trupine," denatured alcohol, lacquer thinner, camphor crystals, lead, weed poison (unidentified).

C. Foods (spoiled)

1. Butter fish, 7 cases; black sea bass, 1 case; cream puff, 1 case; corned beef, 1 case.

D. Plants

1. Berries (unidentified), 2 cases; nuts (unidentified), 3 cases; fruit (unidentified), 1 case; Dieffenbachia (dumb cane), 1 case.

The most common general treatment employed for the ingested poisons was gastric lavage. Out of the 221 cases admitted, 167 were so treated. Thirteen had vomited prior to the lavage, and of these, it was induced in 7 by home remedies of milk, egg and milk, egg white, or mustard water. Ten were given emetics at home with no success. Most of the cases were treated by the Emergency Hospital before being admitted to the Children's Hospital.

On reviewing the cases, it was found that in most instances, the exact amount of ingested poisons was unknown. The time interval before the patient was seen was usually from one-half hour to one hour. The following is a discussion of the more commonly encountered poisons:

Commonest Poisons

Of the 13 cases of *oil of eucalyptus* ingestion, in 5 it was given as cough medicine by mistake. The most common symptom reported was convulsion, which occurred in 6 cases. Respiratory depression occurred in 3 cases; in 5, no common signs or symptoms were recorded. The symptoms appeared to be related not to the amount ingested but to how soon after ingestion therapy was started. It was noted that those treated within one-half hour presented no unusual findings. The treatment was mainly lavage. The one fatal case of oil of eucalyptus ingestion occurred in an 8 month old infant who was said to have ingested 1 ounce and was not treated till two hours later.

On admission, the child was cyanotic, convulsing, and comatose. The temperature was elevated and he died nine and one-half hours after admission without regaining consciousness. The essential findings at autopsy were "hydrothorax, hydroperitoneum, and acute hemorrhagic peritonitis."

Of the 7 cases of *phenolphthalein* ingestion, 5 were due to "Ex-lax" and 2 to "Feen-a-mint." The symptoms were confined to mild diarrhea. Treatments considered of lavage and, in only 1 case, kaopectate and paragoric.

The 7 cases of *barbiturate* ingestion showed drowsiness as the most common symptom. Five were treated by lavage, one case was given caffeine, and one other was given benzedrine.

Of the 6 cases of *salicylate* poisoning, 2 were due to oil of wintergreen, and 4 to aspirin. The 2 cases of oil of wintergreen poisoning showed signs of acidosis on admission and were treated with glucose water and lactate solution parenterally. The one other case showing signs of acidosis on admission gave a history of ingesting 5 grains of aspirin once or twice every hour for one week, through a mistake in following directions. He had a salicylate level of 21.7 mg% on admission.

Of the 5 cases of *camphorated oil* poisoning, only one showed signs of intoxication. The child convulsed shortly after ingestion of the poison and had two more convulsions after admission to the hospital. She was treated by lavage only and given sulfadiazine for an associated nasopharyngitis. The next day she was free of symptoms.

Thirteen of the 17 cases of *arsenic* ingestion were due to cockroach powder and paste containing lead arsenate as the main ingredient. One other was due to rat poison and the three others occurred simultaneously in siblings who drank a garden spray solution containing an arsenic compound. The exact amount ingested and whether the poison was actually swallowed could not be determined with certainty in all the cases. Only those three siblings who drank the garden spray solution showed toxic effects. They complained of vomiting and abdominal pains and were treated with BAL.

There were 7 cases of *pine oil* ingestion. Spiking fever a few hours after ingestion and lasting for about twelve hours was reported in 4 cases. One case had hyperemia and swelling of the mucous membrane of the oropharynx and signs of croup. Every case was treated by gastric lavage.

Three of the 4 cases of *turpentine* ingestion developed abnormal signs and symptoms, including fever of short duration. One of them had pneumonia, which was confirmed by x-ray. The other had convulsions, became cyanosed, and had urinary retention. He also developed polymorphonuclear leukocytosis.

Two of the 3 cases of *cigarette lighter fluid* ingestion developed fever for three days. One of the cases also showed lethargy and had findings of pneumonia both by physical examination and x-ray. Blood counts on this patient taken on admission and two days later were normal. Four days after admission, he had an anemia of 2.9 million red cells and 9 gram of hemoglobin which responded favorably to blood transfusion.

Two of the 3 cases of *carbonyl tetrachloride* ingestion had fever and leukocytosis on admission. One of them became extremely ill with jaundice and anemia of 1.11 million red cells, 19% hemoglobin, 21% nucleated red cells, and 59,000 leucocytes. The urine

showed 3+ albumin and was normal six days later. The anemia was corrected with two blood transfusions. There was no record of any liver function tests.

Of the 7 cases of poisoning due to spoilage of butter fish, 5 involved children who were at the same party. The outstanding symptoms were nausea, vomiting, and diarrhea. No specific treatment was employed. The 2 other cases were siblings who had similar symptoms and were admitted a day before the other five. The other cases of food poisoning due to spoilage all had similar symptoms of nausea, vomiting, and diarrhea.

The fatal case of *water color paint* ingestion involved a 17-month-old girl who ingested an unknown quantity of yellow, green, and blue water color paint. She was admitted to the hospital eight hours later in a semicomatose condition, having rapid and shallow respirations, vomiting, and bloody diarrhea. She was treated with parenteral fluids but failed to respond and died five hours later following an attack of convulsions. The only significant finding from the coroner's report was acute pulmonary edema. The one other case of water color paint ingestion showed no unusual symptoms. He was lavaged within an hour after ingestion of the water color paint.

Less Common Poisons

It might be of interest to mention briefly some of the outstanding findings of the other cases of poisoning that were less frequently encountered.

One of the cases of *iodine* poisoning had a mild burn of the lip. The 2 cases of *benzedrine* poisoning showed hyperexcitability which was controlled with barbiturates. Whiskey and beer accounted for the 2 cases of *ethyl alcohol* poisoning. Inebriation was the presenting symptom. Two of the 4 cases of *rubbing alcohol* poisoning were drowsy, flushed, and had fever. One of them ingested the alcohol, and the other had the alcohol given as an enema by accident. One of the patients who had no symptoms was a 10 day old infant who had the alcohol poured into his mouth by an older sibling. The 1 case of *morphine* poisoning received 1/2 grain by accident and became extremely drowsy. The case of *sulfonamide* poisoning developed urinary obstruction from precipitation of the sulfonamide crystals in the urethra. He was successfully treated by catheterization.

One of the cases of *ant poison* ingestion had a temperature elevation of 102° for eight hours. The 2 cases of *gasoline* ingestion had temperature elevations. One of them had transient rales in the chest. One of the cases of *nicotine* ingestion was admitted in a collapsed condition. He was successfully treated by gastric lavage. Both cases of "Clorox" ingestion had second degree burns of the oropharynx. No systemic effect was noted. One of the cases of "Flit" ingestion was admitted in a shocked condition with heavy grunting respirations. The other case had no systemic effects but experienced coughing and choking. Only one of the cases of *lye* ingestion was reported to have burns of the oropharynx with febrile reaction. No further complication developed. The two siblings who were involved in the termite fumigating fumes (*Chemtox*) had fever, wheezing, labored respirations, and polymorphonuclear leukocytosis. Inebriation was the only symptom noted with the *vanilla extract* ingestion. The child who ingested the *nail polish remover* was said to have had difficulty in breathing immediately after the accident but had no unusual symptoms when seen at the hospital an hour later. Cyanosis of the nail beds and slight temperature elevation resulted

from the ingestion of unknown quantities of *shoe polish*. The patient was lavaged on admission and on discharge two days later was entirely well. The child ingesting the "Borax" complained of a stomach ache but was symptom free after the gastric lavage. The case of *lead* poisoning occurred in a 1-1/2-year-old boy who gave a history of ingesting paint over a period of time. He was admitted because of convulsions. X-rays showed deposition of heavy metal at the ends of long bones. Sodium luminal was used for controlling the convulsions. No specific deleading procedure was carried out.

On of the cases of *berry* poisoning had nausea and vomiting on admission but was not severely ill. The cases of *nut* poisoning involved 2 brothers and a friend. They all had vomiting and diarrhea immediately after ingesting the nuts. The case of *fruit* poisoning had nausea and vomiting. The case of *dieffenbachia* poisoning had abdominal pains only.

The cases not discussed presented no abnormal signs and symptoms. This in itself does not mean that the poisons were harmless. Many factors are responsible for this, such as, the small amounts taken, the poisons not being actually swallowed, and the early institution of treatment, mainly, gastric lavage.

Kerosene poisoning

There were 69 cases of kerosene ingestion, an incidence of 31.3%. The age range was from 11 months to 8 years with an average age of 21 months. The mode was 2 years—14 cases occurred at this age group, an incidence of 20.3%. The other ages in the order of frequency were: 1.5 years, 13 cases or 18.8%; 1 year, 11 cases or 15.9%. There were only two children over 3 years of age, a 4-year-old and an 8-year-old. The age incidence emphasizes the fact that children at the "age of exploring" are the ones most likely to get into trouble. In most instances, the accident occurred when the kerosene was kept carelessly in open cans, soda pop bottles, or containers with leaking spigots. The exact amount of kerosene ingested could not be determined accurately in most instances; estimates varied from a sip to a mouthful.

Gastric lavage was employed in 62 of the 69 cases. Three had spontaneous vomiting prior to admission and in four others there was no record of either lavage or vomiting. Sixteen patients received penicillin for prophylaxis and for treatment of pneumonia; one received sulfonamide alone, and two patients received both penicillin and sulfonamide. Plain water was used for gastric lavage in 54 cases and the other 8 were lavaged with sodium bicarbonate solution. In 12 cases, the gastric lavage was followed by the instillation of some medication—8 received milk of magnesia, 2 each received mineral oil and plain milk, and 1 each received olive oil and magnesium sulfate.

The most frequent complications are as listed in Table 1. An attempt has been made to group them into cases who were lavaged and those who were not. Because of the insufficient number of cases in the group not lavaged, no conclusions can be drawn from study as to the frequency of complications between those who were lavaged and those who were not. There were 12 cases (17.3%) who presented no symptoms, and these were all in the group of cases who were lavaged.

The fever was observed usually after the child had been in the hospital from four to eight hours and was of short duration, lasting twelve to twenty-four hours. The temperature varied from 101° to

104°. Those cases with pneumonia had longer duration of fever lasting from three to five days.

The coughing and choking recorded were those observed at the time of hospitalization. More detailed histories might have revealed

Table 1.—Complications from Kerosene Poisoning

Complications	Total No.	Percent of Total (69)	Lavaged (Total 62)		Not Lavaged (Total 7)	
			No.	%	No.	%
1. Fever	52	75.3	44	70.9	7	100.0
2. Coughing & Choking	15	21.7	11	17.7	4	57.0
3. Pneumonia	13	18.8	10	16.1	3	42.8
4. Vomiting	10	14.4	10	16.1	—	—
5. Lethargy	9	13.0	9	14.5	—	—
6. Elevated WBC & Polys	6	8.6	5	8.0	1	14.3
7. Death	1	1.4	1	1.6	—	—

these symptoms to be prevalent in the other cases also.

In 9 instances, the pneumonia was confirmed by x-rays, which showed a peribronchial infiltration in the lower lobes. The physical findings recorded were slight impairment to percussion and moist rales over the involved areas.

Most of the cases of vomiting occurred spontaneously after ingestion of the kerosene, though some were induced at home with emetics.

The lethargy ranged from drowsiness of short duration to unconsciousness of two to four hours' duration. One case was reported as begin semi-comatose for eight hours.

Every case had a routine CBC on admission. Only 6 showed an elevated white count, ranging from 15,000 to 33,000, neutrophilias ranging from 52 to 76%. Only 1 case developed anemia which occurred six days after the ingestion of kerosene and responded well to blood transfusion.

The one fatal case of kerosene ingestion occurred in a 1-1/2-year-old child. The exact amount ingested was not known. She was lavaged at the Emergency Hospital about an hour after the onset of the accident and on admission to the Children's Hospital, the child was unconscious and gasping for breath. She expired forty minutes after admission.

Discussion

It is beyond the scope of this paper to discuss all the different types of poisoning as each type would deserve a full paper discussion. The reader is referred to the excellent discussion of this subject by Dr J. M. Arena in the *Ciba Clinical Symposia*.¹ However, since kerosene was the most common one encountered, a brief review of the literature on kerosene poisoning may be in order.

The subject of pulmonary manifestations following kerosene ingestion is always of considerable interest. Pneumonia occurs more frequently than we are led to believe. Lesser et al.² x-rayed 22 patients following kerosene ingestion and found 77% had signs of pneumonia. Of these, only 24.2% showed physical signs which appeared about four hours after ingestion. Reed et al.³ followed 19 cases of pneumonia due to kerosene for six months to four years. They found no evidence of residual damage to the respiratory

systems. The pulmonary changes resolved in two weeks. The cases at the Kauaikeolani Children's Hospital were not x-rayed routinely, hence, the incidence of pneumonia may have been higher than 18.8%.

The institution of gastric lavage as treatment in kerosene ingestion is controversial. The issue is about the mode of developing pneumonia. Lesser et al.², Waring,⁴ and Reed et al.³ have shown by experiments with rabbits that pneumonia is caused by direct aspiration of kerosene into the lungs and that no pneumonia was observed when kerosene was instilled directly into the stomach. Rabbits were used in the experiment because they do not vomit. Deichman et al.⁵, on the other hand, have shown that pulmonary changes can occur without direct aspiration of kerosene into the pulmonary system. When kerosene is introduced directly into the stomach, pulmonary changes can occur from absorption into the blood stream.⁵

In the above experiments, all mentioned that drowsiness occurred when large amounts of kerosene were instilled into the stomach. Degenerative changes in the liver, kidneys, lungs, and heart have also been described.⁵ At a recent clinical conference at the St. Louis Children's Hospital,⁶ the occurrence of mediastinal and subcutaneous emphysema and pneumothorax in kerosene poisoning have been pointed out as not being unusual.

The observations made on the complications of kerosene poisoning in this study are similar to those made by others. Leukocytosis is the only exception. While this study reported an incidence of 8.6%, Reed et al.³ report leukocytosis in 65% of their cases.

Lead Poisoning

Because lead poisoning in children is unlike that in adults, brief mention will be made of another case of lead poisoning which occurred after this study was completed. The case was that of a 2-year-old girl admitted because of an acute onset of convulsions not associated with fever. A careful history revealed the fact that the child had been eating paint off the wall over a period of 2 months. A flat x-ray of the abdomen showed scattered dense shadows in the shape of paint peelings. Blood level for lead was 0.8 mg%.

Increased intracranial pressure and cerebral edema are the outstanding features of lead poisoning in children. Therefore, it is hazardous to do lumbar punctures on patients with acute lead encephalopathy. In the chapter on lead poisoning in Mitchell and Nelson's *Textbook of Pediatrics*⁷ it is stated that approximately one-half of the infants and small children have encephalitic manifestations and among these the mortality is about 25%. Of those who recover, about one-third are left with permanent neurologic sequels. Encephalitis with convulsions may be precipitated in a quiescent case by the release of the lead from the bones during an intercurrent acute infectious or metabolic disturbance. Because of the permanent residual effects that may develop from lead poisoning, the public should be educated to use lead-free paint in all house interiors and toys.

General Measures

At the Conference on Poisoning at the Duke Hospital⁸ in 1947, it was said that 400 different types of poisons kill over 500 children in America annually. Caustic alkali poisoning was said to be the most frequent followed by kerosene. It was emphasized that many of the cases of poisoning were preventable and the responsibility is with

the parents. They suggested the following emergency measures in handling acute poisonings.

1. Identify the poison as soon as possible.
2. Evacuation of the poison from the stomach by lavage or emetic except in cases of kerosene and caustic alkali poison.
3. Antidoting the residual poison in the stomach when possible.
4. Antagonist when available.
5. Symptomatic treatment when indicated.
6. When the nature of the poison is unknown, give universal antidote of: pulverized charcoal 2 parts, tannic acid 1 part, magnesium oxide 1 part. The pulverized charcoal may be given in the form of burnt toast, the tannic acid in the form of strong tea, and the magnesium oxide in the form of milk of magnesia. The first will absorb phenol and strychnine, the second will precipitate alkaloids, glucosides and metals, and the last will neutralize acids.

Summary

A study of 221 cases of accidental poisoning admitted to the Kauaikeolani Children's Hospital over a 5 year period is presented. Fifty-nine different poisons were encountered.

There were twice as many boys as girls admitted.

The age of greatest frequency was 2 years, followed by the age groups of 1-1/2 years, 1 year, 3 years, and 2-1/2 years.

Kerosene poisoning is the most common, and 69 cases of kerosene poisoning are presented in detail with a brief discussion of the literature.

Other more common types of poison are: arsenic compounds, oil of eucalyptus, phenolphthalein, barbiturates, pine oil, salicylates, and camphorated oil.

There were 3 deaths, due to one each of the following: kerosene, water color paint, and oil of eucalyptus.

Conclusions

This study probably does not give a complete picture of the most common poisons encountered in the Hawaiian Islands. In order to have this study complete, further information should be obtained from the practicing physicians and the cases of poisoning admitted to the Emergency Hospital should be reviewed.

There are, however, two important points this study emphasizes:

1. Many of the cases of accidental poisoning are preventable.
2. We must never underestimate the 18 month to 3-year-old child's knack for getting into trouble, and we recognize his natural curiosity for exploring the unknown through his mouth.

References

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