Communications

Toxicity Related to Acute Low Dose Sodium Fluoride Ingestions

David G. Spoerke, RPh, MS, Don L. Bennett, RPh, and Demaris J-K. Gullekson, PharmD
Salt Lake City, Utah

Sodium fluoride preparations intended for oral use as a decay preventative are readily available in many homes in areas where the water is not fluoridated. Most of these preparations contain 0.5-1.0 mg of fluoride per dosage unit and are available in pleasant tasting solid and liquid forms. Dentists, family physicians, and pediatricians who recommend fluoride are often asked how serious the risks are regarding household exposures, and what type of symptoms might be expected from the amounts dispensed for home use. These health care professionals are involved in the treatment of overdoses as well.

Literature review reveals little about the dangers of acute, low dose fluoride ingestions. Most case reports concern the ingestion of powdered sodium fluoride products such as roach powders or industrial exposures of hydrofluoric acid.[1-3] These cases indicate that 5 to 10 gm have been lethal in adults, but symptoms occur at much lower levels than even 1 gm.[4] Symptoms of acute fluoride intoxication range from the local effects of nausea, vomiting, and diarrhea, to the more systemic manifestations of salivation, epigastric pain, decreased body calcium levels, muscle spasms, tetany, and convulsions.[4] Death is usually due to respiratory paralysis.

Estimates of serious toxicity vary considerably, but all lie between 50 and 225 mg/kg. In the author's experience, local symptoms occur at levels considerably lower than this. A main concern is the amount of sodium fluoride being dispensed. Although current recommendations[5] are that no more than 264 mg of sodium fluoride (approximately 120 tablets) be dispensed, many homes end up with bottles of 1,000 tablets, because it is more economical. This communication concerns the dose at which the first local symptoms occur, the frequency of these symptoms, and various epidemiologic factors involved with these ingestions.

Methods

One hundred fifty cases were gathered from review of Intermountain Regional Poison Control Center (IRPCC) reports between October 1978 and January 1979. Since fluoride alone was to be studied, all ingestions where fluoride was in combination with other agents or involved with mixed ingestions were excluded from the study. Epidemiologic data were gathered at the time of the call and symptom onset and type were noted at 1, 4, and 24 hours post ingestion.

Results

The majority of the 150 cases (53.3 percent) involved less than 1 mg/kg elemental fluoride, and all but two were less than 6 mg/kg. Thirty-six (26

From the Intermountain Regional Poison Control Center, and the Department of Pharmacy Practice, University of Utah College of Pharmacy, Salt Lake City, Utah. Requests for reprints should be addressed to Mr. David G. Spoerke, Intermountain Regional Poison Control Center, 50 North Medical Drive, Bldg 428, Salt Lake City, UT 84132.

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Table 1. Symptom Type and Incidence Correlated with Total Elemental Fluoride Ingested

Total Amount	Total Cases	Symptoms (%)	Symptom		
			Nausea	Vomiting	Diarrhea
<5 mg	31	0 (0)	0	0	0
5–9 mg	29	3 (10.3)	0	3	0
10–19 mg	38	8 (21.1)	2	6	0
20–29 mg	27	13 (48.1)	1	10	2
30–39 mg	3	3 (100)	0	2	1
40–49 mg	10	2 (20)	0	2	0
≥50 mg	12	7 (58.3)	2	5	0

percent) children exhibited symptoms which included nausea (5 cases, 13.9 percent), vomiting (28 cases, 77.8 percent), and diarrhea (3 cases, 8.3 percent). There were no symptoms more serious than these local effects.

The incidence and type of symptoms as correlated with total elemental fluoride amounts ingested are shown in Table 1. There seems to be good correlation between the amount of elemental fluoride taken and symptoms seen regardless of body size, although this relationship becomes less clear when large amounts are involved. Although the number of cases was small, ingestions of liquid fluoride preparations resulted in a higher average total fluoride, higher mg/kg fluoride, and increased frequency of symptoms. The average amount of liquid product ingested was 46.9 mg or 5.2 mg/kg. Most symptoms occurred within the first hour post ingestion.

Twenty-four of 36 (67 percent) symptomatic cases became asymptomatic in less than one hour, 8 (22 percent) in less than three hours, and 4 (11 percent) took 3 to 24 hours to have symptoms clear. Of these last four cases, two continued to have nausea through the night, and two had mild diarrhea until the next day.

Epidemiologically, it was found that the majority (85 percent) of ingestions were in the one- to three-year-old children, of which 81 (54 percent) were females and 69 (46 percent) were males. The time of day in which the incidence of ingestions was highest was 8:00 AM to 12:00 noon.

Comment

These case histories seem to indicate that sodium fluoride preparations used for dental caries prevention present a small toxicological risk when taken in the normal household overdose. Usually the amounts taken are in the 1 to 5 mg/kg range, and seldom result in more than nausea, vomiting, and/or diarrhea. Treatment by inducing vomiting is seldom necessary unless more than 5 mg/kg has been ingested. Below this, the symptoms of the poisoning are less than or equal to that of ipecac. Prolonged vomiting or diarrhea may occur in doses greater than 5 mg/kg. All fluoride preparations should be dispensed in child resistant packaging, and special care taken with both the use and storage of liquid and solid preparations.

References

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