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Case Report

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Case Reports Of Acute Fluoride Toxicity

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Abstract
With the increased use of various fluoride preparations for caries prevention, all dental personnel should know their potential toxicity and the margins of safety associated with their use. If their use is abused, there is a risk of illness or even death. Frequent ingestion of low but excessive quantities of fluoride during the period of tooth formation can lead to dental fluorosis. Particular concern is warranted for the ingestion of fluoride-containing toothpastes by young children and the inappropriate use of dietary fluoride supplements in communities with sufficient fluoride already present in drinking water. Parents should brush the teeth of preschool children or, at the very least, dispense only small amounts of toothpaste for them (a pea-sized portion). In this article, two case reports of acute fluoride toxicity are discussed.

Key Words
Probable toxic dose (PTD), acute fluoride toxicity, fluoride preparations.

Introduction

Dentists and physicians should know the fluoride concentration of a patient's water supply before prescribing fluoride supplements. Fluoride preparations should be dispensed in appropriate quantities; labeled with suitable cautionary statements; packaged, when appropriate, with child-proof closures or in tear-proof materials; and stored in safe locations.[1]

Since the 1950s, fluoridation proponents have steadfastly maintained that the safety factor of water fluoridation (1 ppm) in relation to the acutely lethal dose is 2,250- to 4,500-fold in adults (represents 5 to 10 grams NaF), and about 250- to 500-fold in a child. In other words, the amount of sodium fluoride (NaF) required to result in acute poisoning causing fatality was 5 to 10 grams (NaF is 45% fluoride ion). This range for toxicity was provided by Harold C. Hodge, the same man who was responsible for erroneously reporting that it would take a daily fluoride intake of "20-80 mg" before skeletal fluorosis would occur in the average individual.Based on several occurrences of water fluoridation over-feeds and individual poisoning reports, It is now known that fluoride's "Probably Toxic Dose" which "should trigger therapeutic intervention and hospitalization -- is 5 mg/kg of bodyweight." This means that many dental products found at home contain more than enough fluoride to kill or seriously harm a small child if ingested.[2]

The currently accepted estimate for the minimum lethal dose of fluoride is 5 mg/kg

Minimum Dose of Fluoride that can Kill - "The Probably Toxic Dose"

This does not mean that doses lower than 5.0 mg F/kg should be regarded as innocuous.[3]

Thus we could easily calculate the toxic doses for an individual.

PTD = 5 mg F/kg

PTD for 1-2 year old child, ~ 10 kg = 50 mg F

PTD for 5-6 year old child, ~ 20 kg = 100 mg F

PTD for adult, ~ 60 kg = 3000 mg F (3 g)

Some calculations of fluoride concentration

The most popular unit: ppm = part per million

Water with 1 ppm F = 1 g of F- per 106 g of water

Water density = 1 g/ml

Therefore, water with 1 ppm F = 1 g of F- per 106ml of water

= 1 g of F- per 103litre of water

= 1 mg of F- per 1 litre of water

Therefore, water with 1 ppm F = 1 mg/L

At higher concentration, usually use %

(F-containing products)

1 % = 10,000 ppm

0.1 % = 1,000 ppm

0.05 % = 500 ppm

Note that the concentrations can be either F-salt or F ions

The most common F-salt is NaF, which has 45 % F ions

(Na = 23; F = 19 ; MW NaF = 42; F = 45 %)

e.g. A mouth rinse with 0.05 % NaF = 500 ppm NaF ~
230 ppm F

Table-1 : Minimum Lethal Dose Of Fluoride Contained In One Tube Of "Colgate For Kids" Toothpaste [4]

Age of Child	Average Weight*	Dose of fluoride which could kill child	Percent of "Colgate for Kids" toothpaste which, if swallowed, could kill child**
2 years	~12 kg	60 mg	42% of tube
3 years	~15 kg	75 mg	53% of tube
4 years	~16 kg	80 mg	56% of tube
5 years	~ 18 kg	90 mg	63% of tube
6 years	~20 kg	100 mg	70% of tube
7 years	~22 kg	110 mg	77% of tube
8 years	~25 kg	125 mg	87% of tube
9 years	~28 kg	140 mg	98% of tube

Can ingestion of Optimally fluoridated(1ppm)water cause acute toxicity?

PTD (Probably Toxic Dose) = 5 mg/kg

Optimal fluoridation 1 ppm = 1 mg/L

10 kg child has to drink 50 L of water with 1 ppm to reach PTD.

Therefore, ingestion of optimally fluoridated water(1ppm) cannot cause acute toxicity.

Case Report 1

We received a call from a hygiene conscious patient few months back that his 2 year old son(11kg body weight) had accidently drank ¾ bottle of fluoride rinse (100ml) having 0.2% sodium fluoride. He wanted to enquire, what level of medical care or attention his son would require.

1. Calculate the concentration of fluoride (e.g., in ppm): (It's easier to do in steps)

1 % = 10,000 ppm ; 0.1 % = 1000 ppm ; 0.2% =2000 ppm

NaF has ~ 45 % F ; therefore the concentration of

F is ~ 900 ppm F

2.Then calculate the amount of fluoride

We know that 1 ppm = 1 mg/L, therefore 900 ppm = 900 mg F/L

The boy drank 75 ml (.075L) , therefore he got (900x.075) = 67.5 mg of fluoride

5. What is the boy's weight? His father says about ~ 11 kg

Calculate PTD for the boy = 5 mg/kg x 11 kg = 55 mg

So, the amount of mouth rinse he drank is more than PTD!

Therefore, his son needs immediate medical treatment and poison control.

Case Report 2

Two months before, on 11th Feb., 2012 one of the employee of our dental college, came along with his two years old daughter having symptoms of vomiting, abdominal pain and excessive salivation. He stated that by mistake his child had ingested some toothpaste (Colgate for Kids) while she was playing in bathroom. He had also brought the empty toothpaste tube along with him. Seeing the child's condition and the fluoride content on the tube, fluoride toxicity came into our mind. We asked whether he was sure that his child had ingested the tube fully or she had spat or vomited a part of it. But according to him she might have ingested more than half of the tube.

Now it was confirmed that she had ingested more than probable toxic dose and the symptoms were suggesting that it was a case of acute fluoride toxicity. The child was admitted and emergency treatment was started immediately.

Vomiting was induced mechanically by stimulation of tongue.To decrease the absorption of fluoride, fluoride binding liquids like calcium hydroxide liquid and milk were administered. Stomach was thoroughly washed with additional lime water and other safety measures were carried out. The symptoms got subsided and the patient was kept under observation.

Discussion

Fluoride Supplements are no longer recommended for new born children. The American Dental Association and a growing number of dental researchers recommend that children under 12 months of age should not consume fluoridated water.

Infant foods mixed with optimallyfluoridated water pose a special problem. The infants, bottle-fed with optimally fluoridated water-diluted preparations, may mean for the development of the brain and other organs. There is reason to be aware of the possibility that fluoride may affect the somatic and mental development of the child.[5]

According to some other investigators, infant formulas reconstituted with higher fluoride water can provide 100 to 200 times more fluoride than breast milk, or cows milk.[6],[7]

There are certain recommendations for parents regarding the use of fluoride supplements.

- Don't use fluoride-containing toothpastes and mouthwashes in children below the age of two, since toddlers tend to swallow toothpaste.
- If your child uses a fluoridated toothpaste, allow only a pea-sized dab a day. This will provide the daily dose of recommended fluoride without risking overdose.
- Don't allow your children to use the generous amounts of toothpaste they see in TV commercials.
- Ready-to-feed formulas should not be made with fluoride- supplemented water.
- Breastfed babies do not need additional supplies of fluoride. The American Academy of Pediatrics recommends that fluoride supplements not be given to infants younger than six months of age because of the concern about fluorosis in this age group.

Conclusion

Parents should be advised that they may be able to protect their children from dental fluorosis by breastfeeding their

infant and by extending the duration for which they breastfeed. When infants are formula-fed, reconstitute or dilute infant formula with deionized water (reverse osmosis, distilled, or low-fluoride bottled water) in order to reduce the amount of systemically ingested fluoride.[10],[11]

To reduce the risk of fluorosis, the use of higher concentration of fluoride dentrifices, by preschool children should be avoided, that only small quantities of paste be used under parental direction and supervision, that further development and testing of lower concentration fluoride dentrifices be encouraged, and that dentifrice tubes dispense smaller quantities so that inappropriate eating of fluoride dentifrice is avoided. [6]

Parents are warned to keep out these dentrifices, out of reach of children under 6 years of age. Ifthey accidentally swallow more than used for brushing, seek professional help or contact a poison control center immediately." - FDA Mandated Warning on Fluoride Toothpaste Labels Sold in U.S.

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