

# Corrosives Ingestion In Children: A single Center Review

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## ABSTRACT

**Objective:** The objective of this review is to evaluate the clinical and endoscopic findings in addition to the outcome of corrosives ingestion in children.

**Methods:** This retrospective review was carried out at Queen Rania Hospital for Children between Jan 2015 and Aug 2017. Children aged less than 14 years with a history of corrosives ingestion and underwent upper endoscopy up to the second part of the duodenum within the first 24 hours were included in the study. A barium swallow was performed for all children within the 3<sup>rd</sup> week after corrosive ingestion. Different corrosives, Clinical state, endoscopic findings, methods of treatment and outcome were evaluated for all children.

**Results:** A total of 266 children aged six months to five years were included in the study. The mean and median ages were 3 and 2 years respectively; 171 (64.3 %) were males and 95 (35.7 %) were female. Chlorine bleach ingestion was seen in 166 (62.4 %), alkali ingestion in 50 (18.8 %), acidic ingestion in 23 (8.6 %), paint thinner ingestion in 5 (1.9 %) and button battery ingestion in 22 (8.3 %). Symptoms and signs at presentation include vomiting (47.9%), oral lesions (34.2%), drooling of saliva (26%), strider (12.3%) and abdominal pain (8.2%). Abnormal endoscopic findings were encountered in 25 patients. Two out of 166 children who ingested chlorine bleach had oral lesions, but esophageal injuries were absent among this group.

**Conclusion:** most children ingest corrosives accidentally or unintentionally. Vomiting was the most common complaint. The esophageal stricture was developed in 2% of cases which was lower than some studies. Early clinical and endoscopic evaluation is of great help in improving the outcome for children with a history of corrosives ingestion.

**Keywords:** Acids; Alkalies; Esophagus; Corrosive.

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## Introduction:

Corrosives ingestion and its gastrointestinal sequels are an important public health issue all over the world. Worldwide; accidental or unintentional caustic substances ingestion in children accounts 68% of the cases while other cases were reported in adults with psychiatric disturbances, suicidal attempt, or alcoholics [1, 2]. The pattern of injury seen in children is relatively less severe than adults due to a smaller amount of corrosive substance ingested. [3,4]. The extent of tissue injury caused by corrosive substances ingestion depends on the duration of contact, the amount and state (liquid, solid) of the substance involved, and the substance's physical properties (pH, concentration, ability to penetrate tissue, and its titratable reserve).

The principle in the past that acid licks the esophagus and bites the stomach has been challenged by many authors who had shown that esophageal injuries are common even with

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acid ingestion [5]. In contrast to acids; alkali materials cause almost no irritation to the oral cavity which leads to a larger amount of alkali ingested. In addition, alkali materials are viscous which leads to longer duration of tissue exposure. In this study, we will review the different caustic substances ingested, clinical findings and complications.

## Methods

This retrospective review was conducted at the Pediatric Gastroenterology Department of Queen Rania Hospital for Children; tertiary teaching hospital for children in Amman, Jordan. The medical records for children aged less than fourteen years, with a history of caustic substances ingestion were reviewed during the period from Jan 2015 and Jan 2018.

Data including the history, clinical examination and endoscopic findings were collected from the records in the pediatric gastrointestinal endoscopy unit and Computerized Patient Record System (CPRS) of our hospital. Children who had button batteries in the esophagus underwent upper gastrointestinal endoscopy up to the second part of the duodenum within two hours, while other children within 24 hours after ingestion. Patients with a suspicion of gastrointestinal perforation, necrosis of oral cavity and compromised airway were excluded.

Pentax endoscope (model PMK, Endoscope Pentax EG 2770 K, EG 2490 K) was used for endoscopy. Endoscopic findings were classified according to classification reproduced by Zargar et al [6]; grade 0: normal, grade 1: superficial mucosal edema and erythema, grade 2a: superficial ulcerations, erosions, exudates, grade 2b: deep discrete or circumferential ulceration, grade 3a: focal necrosis, grade 3b: extensive necrosis and grade 4: perforation. Data were analyzed by using statistical package for the social science (SPSS) software version 17.

## Results

A total of 266 children aged six months to fourteen years were included in the study. The mean and median ages were 3 and 2 years respectively; 171 (64.3 %) were males and 95 (35.7 %) were female. Chlorine bleach (sodium hypochlorite 5.5 – 6 %) ingestion was seen in 166 (62.4 %), alkali ingestion in 50 (18.8 %), acidic ingestion in 23 (8.6 %), paint thinner ingestion in 5 (1.9 %) and button battery ingestion in 22 (8.3 %) (Table I).

**Table I:** different corrosive substances ingested and the rates of esophageal injury.

Caustic material	Number of patients & (%) <i>Total=266</i>	Sex		Esophageal injury	
		Male N & % <i>Total=171</i>	Female N & % <i>Total=95</i>	Number & % <i>Total=25</i>	% for type of corrosives
<b>Chlorine bleach (Sodium hypochlorite)</b>	166 (62.4%)	108 (65%)	58 (35%)	0	0
<b>Lipid dissolver (alkaline sodium silicate, Glycol ethers)</b>	32 (12%)	19 (59.4%)	13 (40.6%)	11 (44%)	34.4%
<b>Pipe opener granules (NaOH, KOH)</b>	14 (5.3%)	9 (64.3%)	5 (35.7%)	2 (8%)	14.3%
<b>Limescae</b>	15 (5.6%)	7 (46.7%)	8 (53.3%)	5 (20%)	33.3%

<b>dissolver (HCL (10-15%), HNO<sub>3</sub>, H<sub>3</sub>PO<sub>4</sub>)</b>					
<b>Disinfectant (Chloroxylonol)</b>	2 (0.75%)	1 (50%)	1 (50%)	1 (4%)	50%
<b>Disinfectant (Hydrogen peroxide)</b>	1 (0.38%)	0	1 (100%)	0	0
<b>Button battery</b>	22 (8.3%)	16 (72.7%)	6 (27.3%)	3 (12%)	13.6%
<b>Washing powder</b>	1 (0.38%)	1 (100%)	0	0	0
<b>Carpet cleaner (Sulfuric acid, hydrogen peroxide, and others)</b>	2 (0.75%)	2 (100%)	0	0	0
<b>Aluminum polisher (sulphonic acid, texapon, soda, formaline)</b>	5 (1.9%)	3 (60%)	2 (40%)	1 (4%)	20%
<b>Vinegar</b>	1 (0.38%)	1 (100%)	0	1 (4%)	100%
<b>Paint thinner</b>	5 (1.9%)	4 (80%)	1 (20%)	1 (4%)	20%

Majority of children included in the review ingested chlorine bleach; 1.2% had mild oral lesions, but others were asymptomatic at presentation.

Accidental or unintentional corrosive ingestion was encountered in all children involved in the study. Corrosives were ingested either directly from the bottle or diluted. Immediately after ingestion, parents tried to induce emesis while others gave either milk or water for their children. All children were hospitalized initially in the pediatric ward and kept nil per os till upper gastrointestinal endoscopy was performed for them. None of our children had severe respiratory symptoms or care in the PICU. Children with a history of button battery or paint thinner ingestion were asymptomatic at presentation.

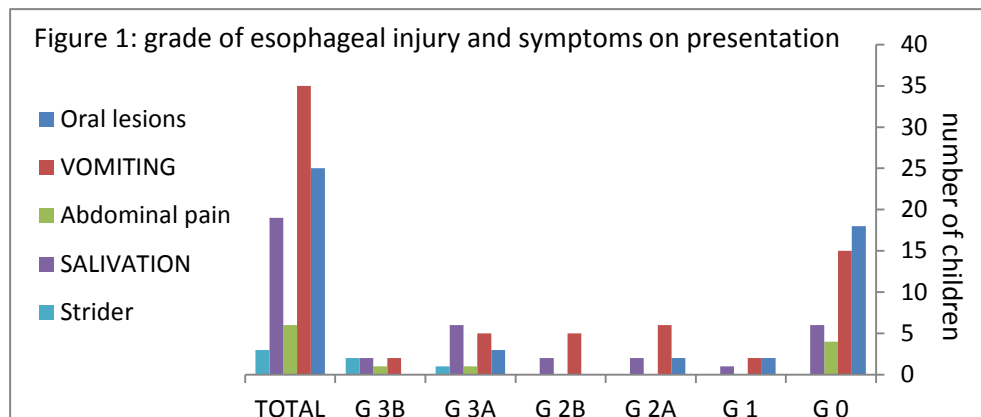
Symptoms and signs at presentation in children who ingested acid or alkali (chlorine bleach, button batteries and paint thinner were excluded) were vomiting either induced by parents or not in 47.9%, oral lesions in 34.2%, drooling of saliva in 26%, strider in 12.3%, and abdominal pain or irritability in 8.2%. Esophageal injuries were reported in 25% of children; 28% alkali ingestion, 30.4% acid ingestion, 13.6% button battery ingestion and 20% paint thinner ingestion. Gastric injuries were reported just in four (17.4%) children who ingested acids.

Although vomiting was considered as a nonspecific symptom in our patients, because in many cases it was induced by parents, there is a significant association between vomiting and esophageal injury. Drooling of saliva was also significantly associated with esophageal injuries, while oral lesions, strider, and abdominal pain were not [table II].

**Table II:** Association between symptoms and development of esophageal injury

	<b>Esophageal injury present</b>	<b>Esophageal injury absent</b>	<b>Z-score</b>	<b>P value</b>
<b>Strider</b>	3	6	0.3232	0.7489
<b>Vomiting</b>	20	15	5.1	0.00001
<b>Oral lesions</b>	7	18	-0.11	0.9203
<b>Drooling saliva</b>	13	6	4.44	0.0001

Oral lesions were present in 78.6% of children who ingested pipe opener granules, while esophageal injuries were present in 14.3% ( $P > 0.05$ ). There was no significant association between symptoms at presentation and grade of the esophageal injury ( $P > 0.05$ ), but children with grade 3 esophageal injury had at least two or more symptoms [figure 1].



The esophageal stricture was developed in 2% of children due to alkaline substances ingestion, while esophageal strictures not developed in patients who ingested acids, button batteries or paint thinner.

Esophageal injuries encountered in this review include; 4% grade 1, 64% grade 2, and 32% grade 3. Children with grade 0 and 1 esophageal injuries were discharged home, while grade 2 and 3 were kept in the hospital for 7 to 14 days. Grade 2 and 3 esophageal injuries were treated with intravenous antibiotics (Cefotaxime 100 mg/kg/day), H<sub>2</sub> blocker (Ranitidine 2 mg/kg/day), and steroid (Hydrocortisone 10 mg/kg/day) in the pediatric ward. Oral fluids and soft diet were offered for all children in the first 3 days then regular diet if tolerated till discharge.

## Discussion

In developing countries; unintentional or accidental ingestion of caustic substances is relatively common especially among people with poor socioeconomic status [7-9] while it is declining in developed countries. According to the American Association of Poison Control (AAPCC), household cleaning substances are the second most frequently substance classes which account for 7.54% of all human exposures [10]. In developing countries, a large number of cases are underreported and so in our country.

In this review, alkaline agents were ingested more than acids similar to studies in western countries [11]. Chlorine bleach or Sodium hypochlorite is largely found in household bleaching agents. Children may expose to chlorine bleach accidentally or intentionally, and poisoning related to chlorine bleach usually results in a benign clinical course [12-15]. Severe complications due to chlorine bleach were reported in a few studies such as esophageal stenosis or perforation [12]. In our study, chlorine bleach was the most common corrosive agent ingested (62.4% children) and had a benign clinical course.

In this review, initial endoscopy was performed for all children within 24 hours after ingestion except in patients who ingested button batteries. Initial endoscopy after 48 h of ingestion is not advised to avoid the risk of perforation [16]. In this review, 2% of cases developed esophageal stricture. This low rate of esophageal stricture development may be due to accidental or unintentional ingestion of diluted and small amount of corrosives. In previous studies; the rates of esophageal strictures were variable between 2% and 75% [17-19].

Accidental or unintentional corrosives ingestion was encountered

Recent evidence concluded that acids in comparison to alkalis were more likely to cause gastric injury (31 vs. 13 %,  $p = 0.042$ ), but similar damage to the esophagus (14 vs. 12 %,  $p = 0.98$ ) [20]. In this study, the rates of esophageal injuries were 28%, 30.4%, 13.6%, 20% in children who ingested alkalis, acid, button battery and paint thinner respectively, while gastric injuries were reported just in four children 17.4% who ingested acids.

In this review, we found that vomiting and drooling saliva had a significant association with the presence of esophageal injuries, but oral lesions, abdominal pain, and strider were not. We found that the presence of three or more symptoms was associated with grade 3 esophageal injury. This data support the previous data in the literature [21].

In conclusion, most children ingest corrosives accidentally or unintentionally. Vomiting was the most common complaint. The esophageal stricture was developed in 2% of cases which was lower than some studies. Early clinical and endoscopic evaluation is of great help in improving the outcome for children with a history of corrosives ingestion. Hospitalization and endoscopic evaluation for children with a history of accidental chlorine ingestion are not necessary unless the patient is symptomatic or there is a suspicion of suicidal attempt.

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