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## Research Article

# Clinical aspects and endoscopic findings of caustic ingestions in children in Dakar, Senegal

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## Abstract

**Introduction:** Caustic ingestion is a rare event, most often accidental in children, which can lead to lesions of varying severity in the digestive tract. The aim of this study was to describe the clinical aspects and endoscopic findings of caustic ingestions.

**Methods:** This is a retrospective, descriptive, and analytical bicentric study carried out at the Albert Royer Children's Hospital and the Dalal Jamm Hospital in Dakar. Children who had ingested a caustic product and undergone upper gastrointestinal endoscopy during the period May 1, 2020, to July 31, 2023, were included. Lesions were classified according to the Zargar classification.

**Results:** A total of 35 children (23 boys; 65.7%) were included. The mean age was  $25.1 \pm 19.03$  months, with a predominance of the 12-23 months age group (53.13%). Bleach (55.88%) was the most ingested caustic, followed by soda (26.47%). Oral erythema (29%) and erosions (22.5%) were the main physical signs; most often in the case of soda ingestion (90%;  $p = 0.004$ ). Esogastroduodenal endoscopy showed lesions in 37.14% of children classified as stage I (17.14%), stage IIa (14.29%), and stage III (5.71%). The presence of labial or oral lesions was not significantly associated with the occurrence of digestive lesions ( $p = 0.37$ ).

**Conclusion:** Caustic ingestion is an accidental event in children. Bleach was the most ingested caustic. Caustic lesions of the digestive tract were dominated by erythema and ulceration.

## Introduction

Caustic ingestion is a rare event, most often accidental in children [1]. It can cause damage to the upper digestive tract, the severity of which depends on the nature, quantity, concentration, and condition of the caustic, and the duration of contact with the digestive mucosa [2]. The most common agents are strong alkaline bases with a pH of up to 12 (e.g., sodium hydroxide or potassium hydroxide), acidic substances with a pH as low as 2 (e.g., hydrochloric acid, sulfuric acid, and phosphoric acid), and oxidizing substances with a pH of around 7 [3].

Strong acids generally cause coagulative necrosis lesions of the stomach and duodenum with limited tissue penetration and superficial scarring, while strong alkaline produce liquefaction necrosis with deep ulceration and a subsequent risk of developing esophageal stricture and/or perforation [1,4]. Esogastroduodenal endoscopy remains the most effective examination for assessing the severity of lesions, but recommendations for early endoscopy and treatment remain controversial. Symptoms after caustic ingestion do not predict the presence or severity of esogastroduodenal damage. However, patients with several signs and symptoms are at higher risk of esophageal damage, and severe stage III damage is rare in the absence of signs and/or symptoms [5,6].

In our developing countries, very few hospitals have digestive endoscopy units, and the cost of the procedure is high enough that most families cannot easily afford it. The aim of this study was to assess the clinical aspects and presence and severity of oeso-gastroduodenal lesions in children who have ingested a caustic product, in order to guide the prescription of a digestive endoscopy.

## Materials and methods

### Study design

This is a bicentric retrospective study, carried out during the period from January 1, 2020, to February 29, 2020, at the Albert Royer Children's Hospital in Fann and the Dalal Jamm Hospital's pediatric department. The Albert Royer Children's Hospital is the largest pediatric hospital in Senegal and is of the highest standard for our country with medical and surgical wards. Dalal Jamm National Hospital Center is the highest public hospital located in the suburbs of Dakar. The pediatric department is the reference for pediatric gastrointestinal and liver diseases with a pediatric digestive endoscopy unit. Esogastroduodenal endoscopy is performed in the operating block under general anaesthetic, by a pediatric gastroenterologist. Procedures were done by Olympus video endoscopes with a diameter of less than 6 mm for neonates and infants under six months; 7 and 9 mm are used for small children. Children of all ages are referred to it from secondary or peripheral health facilities as well as from other hospitals of the same standing (level III).

### Populations

**Eligibility criteria:** All children and adolescents aged 0 - 15 years received in the Emergency Department at Albert Royer Children's Hospital and pediatric department in Dalal Jamm National Hospital Center for caustic ingestion for which medical observation records and esogastroduodenal endoscopy were available were included.

**Data collection:** Data were collected from the children's medical observation records. We collected socio-demographic data (sex, age, address, occupation, and level of education of the mothers), clinical data (symptoms and oral lesions), and endoscopic findings which were classified according to the Zargar classification [7].

### Statistical analysis

Statistical analysis was carried out using Epi Info software, version 7.5.3.3. Variables were first described using univariate analysis, with frequencies and percentages calculated for qualitative variables, and means and standard deviations calculated for quantitative variables. A bivariate analysis was then performed, comparing proportions. Pearson Chi-square tests were used, according to their applicability conditions, for significant  $p$  - values less than or equal to 0.05.

### Ethics approval and consent to participate

Participation in the study was free and voluntary. Study objectives were provided to the child's parents or guardians.

All information obtained from children for this research project was confidential. Coded extinct data and children's names were not used in any report. There were no physical or psychological risks involved in participating in this research. Informed consent was obtained verbally without being registered.

## Results

### Socio-demographic characteristics

During the study period, 35 children who had ingested a caustic product and undergone esogastroduodenal endoscopy were included. The mean age of the children was  $25,1 \pm 19,03$  months. Children aged between 12 and 23 months were predominant (53.13%). Socio-demographic characteristics are shown in Table 1.

### Clinical aspects after caustic ingestion

The median consultation time was 1.5 hours, and in 41.67% of cases, the parents consulted within an hour of the ingestion. In 66.67% of cases, the parents had performed certain actions prior to the consultation, notably administering milk (39.96%) or attempting to induce vomiting (16.66%). Bleach was most frequently used (62.8%), followed by soda (25.7%) (Table 2). Children were symptomatic in 59% of cases, with vomiting (47.45%), hypersialorrhea (9.68%), and epigastric pain (3.13%). In 41% of cases, the children were asymptomatic.

**Table 1:** Socio-demographic characteristics.

Characteristics	Frequency (n)	Percent (%)
Sex		
Male	23	65,71
Female	12	34,29
Age (months)		
0-11	3	8,57
12-23	19	54,30
24-35	6	17,14
36-48	3	8,57
49-60	2	5,71
≥ 60	2	5,71
Position in siblings		
1st	9	25,72
2-3 <sup>rd</sup>	17	48,57
4-5 <sup>rd</sup>	7	20
≥ 6	2	5,71
Mother's occupation		
Income-generating activity	8	22,86
Official	7	20
Housewife	17	48,57
Student	3	8,57
Place of residence		
Urban	17	48,57
Suburban	11	31,43
Rurale	7	20

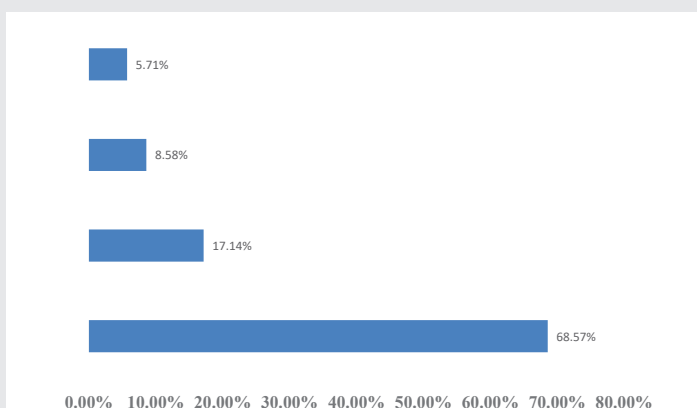
On examination, erythema (30.1%), erosions (22.58%), and bronchial rales (5.71%) were the main physical signs found on admission. The presence of oral lesions was higher in cases of soda ingestion ( $p = 0.004$ ).

## Endoscopic lesions

Esogastroduodenal endoscopy was performed 6–24 hours after ingestion. Digestive lesions were found in 31.43% of cases (Figure 1). In 72.73% of cases, children with digestive lesions were symptomatic, and only 3 children (27.27%) were asymptomatic. Asymptomatic children had no endoscopic lesions or at most minimal digestive lesions classified as stage I. Stage III caustic lesions were noted in one child who had ingested sulfuric acid and another who had taken soda. In the first patient, the stomach and duodenum were affected, while in the second, the lesions concerned the esophagus only. Esogastroduodenal lesions occurred most frequently in cases of soda ingestion. Children without oral lesions had fewer esogastroduodenal lesions. In bivariate analysis, there was no significant association between the presence of esogastroduodenal lesions and the age of the child, the nature of the product, and the presence of oral lesions (Table 3).

**Table 2:** Ingested caustic.

Caustic	Frequency (n)	Percent (%)
Bleach	22	62,85
Soda	9	25,71
Chlorhydric acid	1	2,86
Sulfuric acid	1	2,86
Detergent	1	2,86
Cosmetic	1	2,86



**Figure 1:** Caustic injuries.

**Table 3:** Bivariate analysis of factors associated with endoscopic lesions.

Characteristics		Esogastroduodenal caustic injuries		p
		Yes; n (%)	No; n (%)	
Caustic	Oxydant	5(23,81)	16(76,19)	0,24
	Alkalines	7(53,85)	6(46,155)	
	Acids	1(50)	1(50)	
Age (months)	0 - 24	7(35,0)	13(65,0)	0,37
	> 24	6(40,0)	9(60,0)	
Oral lesions	Yes	8(40,0)	12(60,0)	0,54
	No	5(33,33)	10(66,67)	

## Discussion

Our study has shown that ingestion of caustic products is a potentially serious situation, leading to lesions of the digestive tract in just over a third (31.43%) of cases. These lesions varied in severity, most often stage I or IIa, and rarely (5.71%) stage III. Boys predominated (65.7%). The mean age of the children was  $25.1 \pm 19.03$  months and children aged 13–24 months accounted for more than half (53.13%) of caustic ingestion. The vulnerability of infants and young children has been reported in other studies. In the Ben Rabeh study in Tunisia, the mean age of children was  $41.4 \pm 31.9$  months [8]. In Ghana, 56.1% of children who had ingested caustic soda were aged between 2 and 3 years, with a predominance of males [9].

According to literature data, the majority of victims are mainly unsupervised preschoolers, and in most cases, they taste or drink household cleaning products out of curiosity or because they're looking for something to eat or drink [10].

In 2008, of 2,491,049 cases of human exposure to caustics reported to the US National Poison Database, 38.7% of exposures occurred in children under 3 years of age [11]. In Guadalajara, Mexico, the mean age of children was  $3.2 \pm 2.4$  years, with a predominance of males (62.8%). According to Sanchez-Ramirez, et al. , caustic ingestion was associated with a higher family socio-economic level, a lower level of education in the mother, a higher proportion of professional fathers, an extended family, the mother's younger age (under 30 years) and the fact that the mother worked outside the home. Alkaline products were more frequently ingested (85.1%) in the study by Sanchez-Ramirez, et al. [12]. These results are almost identical to those of Maria Losada, et al. who reported a mean age of 3.8 years, with a male predominance (58.8%). Alkaline products accounted for 58.3% of the caustics ingested [13]. In Galicia, alkaline products were ingested more often than acids. Bleach was the substance ingested in 73% of cases [14]. In the Temiz study, caustics were acidic in 72 cases (34.9%), alkaline in 56 cases (27.2%), liquid bleach in 62 cases (30.1%) and unknown in 16 cases (7.8%). [15].

The physical signs found in our patients are identical to those reported by Hoffman, et al [16]. In Dehghani's study in Iran, 75.7% of children were symptomatic, and the main signs were hypersalivation (34.14%), dysphagia (26.8%), and oral ulcerations (24.3%) [17]. In a study by Rafeey in Pakistan, symptoms were dominated by vomiting, followed by nausea, burning of the oral cavity, abdominal pain, hypersialorrhea, dysphagia, odynophagia, and dysphonia [18]. In the study by Lamireau, et al. of children who had ingested caustic products, 57% had no symptoms, and 43% had experienced vomiting, hematemesis, hypersalivation, severe respiratory distress, and/or oropharyngeal lesions [19]. In our study, children who were asymptomatic or had no oral lesions rarely presented with endoscopic lesions. In the Crain, et al. study, only children who presented with both vomiting and hypersalivation or stridor alone had clinically significant lesions [20]. According to the literature, approximately 20% – 40% of patients ingesting caustic substances may develop esophageal lesions [10].

Classically, bases are associated with a higher risk of digestive lesions. In the Maria Losada study, endoscopy showed caustic lesions in 41.6% of children. Among children who ingested an alkaline product, 2 patients (16.6%) showed lesions, including one stage IIb and one stage 3 esophagitis. For those who ingested acid, 4 (33.3%) patients showed lesions: one stage I-IIa esophagitis, two acute non-erosive gastritis, and one acute hemorrhagic gastritis [13].

In Tunisia, digestive endoscopy showed esophageal and gastric lesions in 11.5% and 5.3% respectively, and the presence of digestive lesions was significantly associated with soda ingestion ( $p < 0.001$ ; OR: 17.9; 95% CI: 8.4–38.1) and the presence of symptoms after caustic ingestion ( $p = 0.02$ ; OR: 2.4; 95% CI: 1.1–5.4) [8]. In Di Nardo's study, soda ingestion was more associated with a poor endoscopic score [21]. As for the severity of digestive lesions, Niedzielski reported 84.7% grade I endoscopic lesions, 8% grade IIa, 2.6% grade IIb (2.6%), and 4.7% grade III [22]. In the South African study population, all 30 asymptomatic patients (60%) had no positive endoscopic findings, regardless of clinical signs. Among symptomatic patients ( $n = 20$ ), 15 (75%) had esophageal lesions ( $p = 0.01$ ) [23]. In the Lamireau, et al. study, endoscopy revealed no serious lesions in 63 cases (group A, 74%): normal endoscopy in 40 cases, minimal lesions in 23 cases, and severe digestive lesions in 22 cases (group B, 26%) [19]. A very high frequency (84.6%) of stage II or III endoscopic lesions has been reported by Sanchez-Ramirez in Mexico [12]. In Dehghani's study, endoscopy was normal in 34.1% of children and showed grade I lesions in 14.6%, grade II in 29.3%, and grade III in 19.5% [17].

Some studies have shown, on the one hand, the absence of endoscopic lesions, or the presence of minimal lesions in children who have ingested caustic soda and have no symptoms. However, in highly symptomatic children with dyspnea, dysphagia, hypersalivation, or hematemesis, endoscopy revealed stage III digestive lesions [24]. The lack of correlation between the nature of the caustic, the presence of symptoms or oral lesions, and esophageal and/or gastric lesions has been confirmed by Temiz [15]. In his study, he reported severe gastric lesions in 38 patients (18.5%).

The rate of development of gastric lesions was significantly higher in the acid group (14%) than in the alkaline group (2.9%) ( $P = 0.001$ ). This is rarely reported in the literature. He also found that of the 149 patients with clinical signs, 49 (32.9%) had no esophageal lesions and 117 (78.5%) had no gastric lesions. Severe esophageal and gastric lesions were detected in 20 (35.1%) and 8 (14%) of patients with no clinical signs, respectively.

## Conclusion

Ingestion of caustic products in children is most often an accidental event. It leads to digestive lesions of varying severity. Digestive lesions are not associated with the age of children, oral lesions, or caustic ingested. Caustic soda and sulfuric acid are the most dangerous caustics to cause severe digestive lesions, and acid substances also lead to digestive lesions. Esogastroduodenal endoscopy should be performed if possible for more safety.

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