

CLASSIFICATION OF CLINICAL MANIFESTATIONS AND MACROSCOPIC  
ENDOSCOPIC FINDINGS IN PATIENTS WITH CAUSTIC INGESTION ATTENDING  
LATTAKIA UNIVERSITY HOSPITAL<sup>1</sup>\*Hiner Abdo, <sup>2</sup>Souad Sakkour and <sup>3</sup>Ali Ibrahim<sup>1,2,3</sup>Department of Pediatric, Lattakia University, Faculty of Medicine, Lattakia, Syria.

\*Corresponding Author: Hiner Abdo

Department of Pediatric, Lattakia University, Faculty of Medicine, Lattakia, Syria.

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## ABSTRACT

**Background:** Caustic ingestions represent a source of significant morbidity and mortality in pediatric population.**Aims:** The aim of the current study was to determine the clinical and endoscopic manifestations of caustic ingestions. **Patients and Methods:** An observational descriptive study was conducted for the period one year (2024-2025) at Lattakia University Hospital in Syria. The study included all children with a history of caustic ingestions who underwent full clinical assessment as well as upper gastrointestinal endoscopy to detect macroscopic findings. **Results:** Patients ranged in age from 1.2 to 13 years old with an average age was  $4.58 \pm 3.3$  years and 62.4% of the study sample were males. Sodium hypochlorite represented the most frequent ingested substances in 47.1% and the amount of ingested substance was  $\leq 20$  ml in 49.4%. Majority of cases (76.5%) occurred accidentally and emesis represented the most frequent symptom in 68.2%. Endoscopy was performed in 47 cases and abnormal findings distributed as follows; esophagus (38.3%), gastric (48.9%) and in both gastric and esophagus (29.8%). Presence of esophageal findings increased significantly with increasing number of symptoms ( $p:0.04$ ) and absence of oral injuries not excluded esophageal burns. Ingestion of acids was associated significantly with stomach findings whereas alkalis associated with esophageal burns ( $p<0.05$ ). Strictures were detected in 8 cases (4 in gastric, 4 in esophagus) and all esophageal cases were managed successfully by dilation. **Conclusion:** The current study revealed that caustic ingestion is common among children, so taking preventive measures might lead to significant impact on reducing caustic injuries.**KEYWORDS:** Caustic, clinical, endoscopic, features, ingestion, Syria.

## 1. INTRODUCTION

Caustic agents are defined as substances, typically a chemical that can cause severe damage to tissue upon contact with mucosal surfaces, and they are classified broadly into strong acids that cause injury at  $\text{PH} < 2$  and alkalis at  $\text{PH} > 12$ .<sup>[1,2,3]</sup> Caustic ingestion by children is still a serious medical issue, especially in developing countries due to factors such as inadequate labeling, improper storage and lack of parental supervision.<sup>[4,5]</sup> Majority of ingestions occur in children younger than 6 years old, more common in boys and the true prevalence is not known.<sup>[6,7]</sup> Annually, approximately 5000 to 15000 cases of caustic ingestion in children are reported in USA, with documentation around 29748 and 13800 cases of acid and alkalis exposure respectively in 2010.<sup>[8]</sup> Majority of ingestions by children are accidental and the common substances are household cleaning products. Risk and severity of injury depends on the properties of ingested substance, amount, concentration and physical

form of the substance, as well as duration of contact with mucosa.<sup>[9,10,11,12]</sup>

Alkalis results in liquefactive necrosis in which injury extends rapidly through mucosa and wall of esophagus towards to mediastinum, whereas ingestion of acids produces a superficial coagulation necrosis and thereby limited injury.<sup>[13,14]</sup> Clinical symptoms and signs of caustic ingestion are variable and absence of oropharyngeal injuries not excluded presence of significant esophageal gastric injury.<sup>[15,16]</sup>

Gastroendoscopy represents the effective method for assessment of mucosal membrane in upper gastric system after caustic ingestion, and the optimal time for performing the procedure is from 6 hours after ingestion until 24 hours.<sup>[17]</sup> Acute complications occurs in 39% of the cases, in which short term complications include infection, perforation and death whereas long term complications include strictures and increased risk of

esophagus cancer.<sup>[18,19]</sup> Therefore, the objectives of the current study were to: 1- categorize clinical features and endoscopic findings, 2- to investigate the association between endoscopic findings and demographic characteristics.

## 2. PATIENTS AND METHODS

### 2.1. Study population

An observational descriptive study(cross-sectional) was conducted in all children of different ages attending department of pediatrics at Lattakia university hospital in Syria during one-year period (June 2024-June 2025) with a history of caustic ingestion. Demographic characteristics of the patients as well as clinical features were recorded and endoscopic findings were classified according to Zargar grading system; grade 0: normal mucosa, grade 2 A: no deep focal or circumferential ulcers, 2B: with deep focal or circumferential ulcers, grade 3 A: small scattered areas of focal necrosis, 3B: extensive necrosis.

**2.2. Ethical consideration:** All patients were provided a complete and clear informed consent after discussion about the study. This study was performed following the Declaration of Helsinki.

### 2.2. Statistical Analysis

Statistical analysis was performed by using IBM SPSS version 25. categorical variables were reported as numbers and percentages and continuous variable were presented as mean± standard deviation(SD). Chi-square test was used to examine the comparisons between the two groups. All the tests were considered significant at a 5% type I error rate( $p < 0.05$ ),  $\beta$ :20%, and power of the study:80%.

## 3. RESULTS

A total of 85 children with a history of caustic ingestion who fulfilled inclusion criteria were included in the current study. Ages ranged from 1.2 to 13 years and age group 2-6 years represented the most frequent age group(52.9%), followed by 6-12 years(25.9%), < 2 years (20%) and > 12 years (1.2%). Males constituted 62.4% of the study sample with presence of  $\leq 3$  children in the family in 74.1%.

**Table 1: Demographic characteristics of the study population.**

Variables	Result
<b>Age (years)</b>	4.58±3.3
<b>Age groups(n,%)</b>	
<2	17(20%)
2-6	45(52.9%)
6-12	22(25.9%)
>12	1(1.2%)
<b>Gender(n,%)</b>	
Male	53(62.4%)
Female	32(37.6%)
<b>Number of children(n,%)</b>	
$\leq 3$	63(74.1%)
>3	22(25.9%)

Caustic substances were strong bases in 45 cases(52.9%) and acids in 40 cases(47.1%). Sodium hypochlorite represented the most frequent type of ingested substances in 40 cases, followed by hydrochloric acid in 23 cases, concentrated acetic acid in 7 cases, sulfuric acid in 6 cases, sodium hydroxide in 5 cases, hydrogen peroxide in 3 cases and potassium hydroxide in one cases.

Amount of swallowed substance was  $\leq 20$  ml in 42 cases(49.4%), >20 ml in 19 cases(22.4%) with uncertain amount in 24 cases(28.2%). Ingestion was more frequent in spring(35.3%), followed by fall(27.1%), winter (18.8%) and summer(18.8%).

**Table 2: Characteristics of the swollen substances.**

Variables	Result
<b>Type of caustic substances</b>	
Alkalis	45(52.9%)
Acids	40(47.1%)
<b>Chemical(common name)</b>	
Sodium hypochlorite(Javelle water)	40(47.1%)
Hydrochloric acid(Spirits of salt)	23(27.1%)
Concentrated acetic acid(Spirit of vinegar)	7(8.2%)
Sulfuric acid(Battery acid)	6(7.1%)
Sodium hydroxide(Lye)	5(5.9%)
Hydrogen peroxide(Hydrogen peroxide)	3(3.5%)
Potassium hydroxide	1(1.1%)
<b>Amount of ingested substances</b>	
Undetermined	24(28.2%)
$\leq 20$ ml	42(49.4%)
>20 ml	19(22.4%)
<b>Seasonality</b>	
Winter	16(18.8%)
Spring	30(35.3%)
Summer	16(18.8%)
Fall	23(27.1%)

Majority of the cases occurred in the kitchen(76.5%) and initial interventions were as follows; attending emergency department in 55 cases(64.7%), giving milk or water in 14 cases(16.5%), induction of vomiting in 10 cases(11.8%) and giving milk or water with induction of vomiting in 6 cases(7.1%). Emesis represented the most frequent symptom (68.2%), followed by mouth ulcers(37.6%), respiratory symptoms(28.2%), drooling(20%), hematemesis(20%), abdominal pain(16.5%), stridor(15.3%) and dysphagia(8.2%). Upper gastrointestinal endoscopy was performed in 47 cases which revealed abnormal findings as follows; esophagus in 18 cases(38.3%), gastric in 23 cases(48.9%) and in both gastric and esophagus in 14 cases(29.8%).

**Table 3: Distribution of the study population according to the clinical manifestations and endoscopic findings**

Variables	Result
<b>Clinical manifestations</b>	
Emesis	58(68.2%)
Mouth ulcers	32(37.6%)
Respiratory symptoms	24(28.2%)
Drooling	17(20%)
Hematemesis	17(20%)
Abdominal pain	14(16.5%)
Stridor	13(15.3%)
Dysphagia	7(8.2%)
<b>Endoscopy</b>	
Present	47(55.3%)
Absent	38(44.7%)
<b>Endoscopic findings</b>	
<b>1-Gastric</b>	
Present	23(48.9%)
Absent	24(51.1%)
<b>2-Esophagus</b>	
Present	18(38.3%)
Absent	29(61.7%)
<b>3-Gastric and esophagus</b>	
Present	14(29.8%)
Absent	33(70.2%)

Esophageal burns were categorized into three grades; grade I in one case(2.1%), grade IIa in 6 cases(12.5%) and grade IIb in 13 cases(27.1%). As shown in table(4), there were no significant correlation between the type of

swallowed corrosive substance and number of symptoms(p:0.3), in which symptoms were absent in 15.6% of alkalis substances versus 12.5% of acids.

**Table 4: Association between symptoms and type of caustic substances.**

Number of symptoms	Alkalis	Acids	p-value
None(12 cases)	7(15.6%)	5(12.5%)	0.3
One(24 cases)	16(35.6%)	8(20%)	
Two(21 cases)	9(20%)	12(30%)	
Three or more(28 cases)	13(28.9%)	15(37.5%)	

As shown in table(5), there were significant correlations between presence of oral burns and esophageal findings, in which oral burns were absent in 38.9% of patients with esophageal injury, p:0.04. In addition to, presence

of esophageal findings increased significantly with increasing number of symptoms as follows; none(0%), one (11.1%), two(16.7%) and three or more(72.2%), p:0.04.

**Table 5: Association between esophageal injury and oral burns and number of symptoms.**

Variable	Esophageal findings		p-value
	Present	Absent	
<b>Oral and pharynx burns</b>			
Present	11(61.1%)	10(34.5%)	0.04
Absent	7(38.9%)	19(65.5%)	
<b>Number of symptoms</b>			
None	0(0%)	3(10.3%)	0.04
One	2(11.1%)	9(31%)	
Two	3(16.7%)	8(27.6%)	
Three or more	13(72.2%)	9(31%)	

Stomach findings were detected more frequently with acids(66.75 vs.23.8% in alkalis, p:0.003), whereas esophageal findings were observed more frequently with alkalis(47.6% vs. 29.6%, p:0.04).

**Table 6: Association between endoscopic findings and nature of caustic substance.**

Endoscopic findings	Alkalis	Acids	p-value
Stomach	5(23.8%)	18(66.7%)	0.003
Esophagus	10(47.6%)	8(29.6%)	0.04
Stomach and Esophagus	2(9.5%)	12(44.4%)	0.008

Strictures were developed in esophagus in 4 cases(8.5%) which managed successfully by dilation, and in pylorus in 4 cases(8.5%) that required surgery in two cases.

#### 4. DISCUSSION

Ingestion of caustic substances is a common potential medical emergency encountered in pediatrics with significant morbidity and mortality. Current study showed the main findings: number of caustic ingestions was 85 cases, of them 45(52.9%) were due to alkalis and this finding is in agreement with Giovanni et al<sup>[18]</sup> and Carlos et al<sup>[19]</sup>, whereas ingestion of acids was more frequent in the following studies; Seyed et al<sup>[20]</sup> and Didem et al.<sup>[21]</sup> Alkalis have no noticeable taste or smell especially in dilute solutions, thereby ingested in larger amounts with higher frequency. Males constituted 53 cases and females 32 cases and this finding is in agreement with Giovanni et al<sup>[18]</sup>, Carlos et al<sup>[19]</sup>, Seyed et al<sup>[20]</sup> and Didem et al<sup>[21]</sup>, whereas frequency of females was higher in Pietro et al study.<sup>[22]</sup> Higher prevalence among males might be related to more motor activity and tendency to exploration in male children. Age group 2 to 6 years represented the most frequent group and this finding is in agreement with Giovanni et al<sup>[18]</sup>, Seyed et al<sup>[20]</sup> and Didem et al<sup>[21]</sup>, whereas ingestion was more frequent in children younger than 2 years in Pietro et al<sup>[22]</sup> which might be related to exploration and identification of the surrounded environment and not knowing the seriousness of ingestion. Sodium hypochlorite represented the most frequent ingested substances which agree with Giovanni et al.<sup>[18]</sup>

In addition to, exposure was observed more frequently in kitchen, which might be related to easy access to household cleaners that might be stored in water bottles and this finding is in agreement with Giovanni et al<sup>[18]</sup> and Seyed et al.<sup>[20]</sup> According to the seasons, high frequency of ingestions was in spring followed by fall which might be related to using of Spirit of vinegar and Lye in pickling in fall as well as widespread consumption of household cleaners in spring, and this finding is in agreement with Carlos et al.<sup>[19]</sup> Majority of cases in the current study were in families with number of children less than 3 members, whereas occurrence was common in families with higher number of children in Carlos et al study.<sup>[19]</sup> Furthermore, approximately two third of cases attended emergency department with giving water or milk by parents in the remaining cases. Upper endoscopy was performed in 47 children and endoscopic findings were more frequently in gastric (48.9%), followed by esophagus(38.3%) with presence of combined findings in 29.4%. Giovanni et al<sup>[18]</sup> observed esophageal findings in 52.3% and gastric in 25%, whereas Seyed et al<sup>[20]</sup> found esophageal findings

in 48.2% and in gastric 26.3%. Asymptomatic children constituted 14.1% of the cases and this finding is in agreement with Giovanni et al<sup>[18]</sup> and Seyed et al.<sup>[20]</sup> Emesis represented the most frequent symptom, followed by oral burns, respiratory symptoms and dysphagia was the less frequent symptom. By comparison with previous studies, drooling was observed more frequently by Seyed et al<sup>[20]</sup>, emesis by Giovanni et al<sup>[18]</sup> and oral burns as well as perioral skin by Didem et al.<sup>[21]</sup> Variable degrees of esophageal burns were detected as follows; grade I(4.2%) and II(39.6%). By comparison with previous studies: Seyed et al(I:14.6%,II:29.3%,III:19.5%), Giovanni et al(I:15.9%,II:18.2%,III:18.2%) and Carlos et al(I:44%,II:17%, III:19%). Endoscopic findings increased significantly with increasing number of clinical manifestations and this finding is in agreement with Giovanni et al<sup>[18]</sup> and Pietro et al.<sup>[22]</sup> There were significant correlation between volume of ingested substance and its type, which was less in cases of acids compared to alkalis and esophageal burns were observed more frequently with alkalis and stomach burns with acids and this finding is in agreement with Seyed et al.<sup>[20]</sup> In addition to, there were no significant association between presence of clinical features and grades of esophageal burns and the type of swallowed substance,  $p>0.05$ .

Eight children in the current study developed strictures which distributed equally in esophagus and pylorus, in which esophageal strictures were observed in patients with grade IIb. Dilation was performed successfully in all esophageal cases as well as two cases of pylorus and this finding is in agreement with Giovanni et al<sup>[18]</sup> and Seyed et al<sup>[20]</sup> in which strictures were observed with grade III and in Carlos et al<sup>[19]</sup>, Didem et al<sup>[21]</sup> and Pietro et al<sup>[22]</sup> with grade II and III.

#### LIMITATIONS

Quarantine period related to COVID-19 that affected negatively on number of patients attending gastroendoscopy unit.

#### 5. CONCLUSION

It is crucial to educate family about the risks associated with caustic substances and to prevent ingestion via secure storage and proper labeling.

#### Competing of Interests

All the authors do not have any possible conflicts of interest.

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