

## Caustic ingestion in children in south of Iran. Retrospective study from Shiraz - Iran

Ingestión de cáusticos en niños del sur de Irán. Estudio retrospectivo de Shiraz - Irán

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### ABSTRACT

Caustic ingestion is a major health concern in both developed and developing countries, that may lead to serious esophageal injury. The clinical presentation of caustic ingestion in children vary from asymptomatic to serious and fatal sequelae, such as perforation and stricture formation. **Objective:** Due to the lack of a comprehensive study in our area, this study has evaluated clinical and endoscopic manifestations and complications of caustic ingestion in children in south of Iran. **Materials and methods:** In this retrospective study, we reviewed 75 children with caustic ingestion who admitted in Nemazee Hospital of Shiraz University of Medical Science during 6 years (2006-2011). Sign and symptoms were recorded for each case. **Results:** The most common symptoms were dysphagia, oral lesions, vomiting, and drooling. Esophageal injuries were detected in both acid and alkali ingestion, but gastric injuries was significantly more in acid ingestion. During follow up period, 20% of all cases developed esophageal stricture. **Conclusion:** Dysphagia, oral lesions, vomiting, and drooling were the most common findings. Esophageal stricture was found in 20% of cases during 3 months of follow up.

**Keywords:** *Acids; Alkalies; Esophagus; Caustics (source: MeSH NLM).*

### RESUMEN

La ingestión de cáusticos es una gran preocupación de salud tanto en países desarrollados como en vías de desarrollo, que puede llevar a lesiones esofágicas graves. La presentación clínica de la ingestión de cáusticos en niños varía desde asintomática hasta tener secuelas fatales, como perforación y/o estenosis. **Objetivo:** Debido a la ausencia de estudios en nuestra área, este estudio ha evaluado las manifestaciones clínicas, endoscópicas y las complicaciones de la ingesta de cáusticos en niños en el sur de Irán. **Materiales y métodos:** En estudio retrospectivo, revisamos 75 niños con ingesta de cáusticos que ingresaron al Nemazee Hospital of Shiraz University of Medical Science durante 6 años (2006-2011). Los signos y síntomas fueron recolectados para cada caso. **Resultados:** Los síntomas más frecuentes fueron disfagia, lesiones orales, vómitos y salivación. Las lesiones esofágicas se detectaron tanto en ingestión de ácido como de álcali, pero las lesiones gástricas fueron definitivamente más frecuentes con la ingestión de ácidos. Durante el periodo de seguimiento el 20% de los casos desarrolló estrechez esofágica. **Conclusión:** La disfagia, lesiones orales, vómitos y salivación fueron los hallazgos más comunes. La estrechez esofágica se encontró en el 20% de los casos durante los tres meses de seguimiento de los pacientes.

**Palabras clave:** *Ácidos; Álcalis; Esófago; Cáusticos (fuente: DeCS BIREME).*

### INTRODUCTION

Caustic ingestion is a major health concern in both developed and developing countries, that may lead to serious esophageal injury<sup>(1)</sup>. For example, the incidence in U.S.A. is between 5 000 to 15 000 cases per year<sup>(2)</sup>. In children, the majority of caustic ingestion are accidental and occurs before 5 years and male to female ratio seems to be 1.2 to 1.4/1<sup>(3,4)</sup>.

The clinical presentation of caustic ingestion in children vary from asymptomatic to serious and fatal sequelae, such as perforation and stricture formation<sup>(5)</sup>.

The most common type of caustic ingestion in children are alkalis that can penetrate deeply with full thickness burn and resulted in serious complications<sup>(5)</sup>. There were few reports about caustic ingestion among Iranian children<sup>(6,7)</sup> in Pubmed and Scopus.

Due to the lack of a comprehensive study in our area, this study has evaluated clinical and endoscopic manifestations and complications of caustic ingestion in children in south of Iran.

### MATERIALS AND METHODS

In this retrospective study, we reviewed 75 children with caustic ingestion who admitted in Nemazee

Hospital of Shiraz University of Medical Science during 6 years (2006-2011).

Age at presentation, gender, nature of the caustic substance ingested, circumstances of injury (accidental or intentional), clinical presentations, endoscopic findings, early and late complications and prognosis were reviewed.

Exclusion criteria were age more than 18 years and incomplete data (including refusal to endoscopy and/or follow up).

The patients were treated with acid suppressors (proton pump inhibitor [PPI] or histamine antagonist) except 6 children with Vitex ingestion who were asymptomatic and discharged without upper endoscopy. Upper gastrointestinal endoscopy was done during 24 to 48 hours of admission.

The severity of caustic ingestion was classified according to endoscopic appearance, according to accepted Estreta system into 4 grades<sup>(8)</sup>. Table 1.

After discharge, all of the patients had follow up for at least 12 weeks. When dysphagia, odynophagia, abdominal pain, or suspected esophageal stricture was present, more evaluation was done.

Ethical approval for the study was granted by Shiraz University of Medical Sciences Institutional Review Board. Because in our study the patients were evaluated retrospectively in a period of time, patient consent was not required.

Correlation between data were analyzed by SPSS 16 (Chicago, IL, USA) software using chi-square test and T test.

## RESULTS

A total of 75 consecutive children were studied over the 6-year period. There were 51 (68%) boys and 24 (32%) of girls. The age of cases ranged from 1 to 17 years with a median age of 36 months. Of these

children, 45% were from Fars province and others from outside of Fars province. In 72 children, 96% were attributable to accidental injury and 4% of them had intentional ingestion.

In our study, 47 (63%) of the agents were alkali and 18 (24%) were acidic agents, and 10 (13%) of them were unknown substances. The most frequent agent ingested was sodium hydroxide (caustic soda used for cleaning air conditioning) in 25 (33%) cases. In 51 patients (68%), caustic agents were liquid, while 24 (32%) of them had ingested caustic substances in powders or granule forms. Of 75 children with caustic ingestion 6 cases had vitex ingestion (a weak alkaline) and because they were asymptomatic, upper endoscopy were not done for them and after 3 months of follow up again they were asymptomatic.

In other 69 children with caustic ingestion all of them were symptomatic. The most common symptoms were dysphagia (72%) oral lesions (68%), vomiting (60%) and drooling (44%). Table 2.

The presence of oral lesions, vomiting, cough and stridor were significantly more frequent in the high grade injury group ( $p < 0,05$ ), but for drooling and abdominal pain, there were not statistically significant differences between the 2 groups ( $p > 0,05$ ). On admission time, treatment protocol started with H2 blocker or proton pump inhibitor.

Also, antibiotic and corticosteroid therapy was began for 88% and 65% of cases respectively.

Except one case (2-year-old boy with intentional ingestion and suspicious of esophageal perforation that unfortunately expired), the other patients went to esophagogastroduodenoscopy within 48 hours of admission.

Upper endoscopy with general anesthesia were done for 4 cases (5%) and in other children due to inaccessibility to anesthesiologist and limitation of time, upper gastrointestinal endoscopy with light sedation with midazolam.

**Table 1.** Classification of caustic ingestion according to endoscopic appearance.

Grade	Lesion
0	No detectable mucosal change
1	Erythema of mucosa
2	Erythema, sloughing, ulceration and non-circumferential exudates
3	Deep mucosal ulceration and circumferential mucosal sloughing
4	Eschar, full thickness changes and perforation

**Table 2.** Clinical manifestations of caustic ingestion.

Symptoms	Cases (percent)
Dysphagia	54 (72%)
Oral lesions	51 (68%)
Vomiting	45 (60%)
Drooling	33 (44%)
Irritability	27 (36%)
Fever	10 (13.5%)
Cough	8 (11%)
Abdominal pain	7 (9%)
Stridor	5 (7%)
Hematemesis	4 (5%)

Of 47 children with alkali ingestion, upper endoscopy were done in 41 cases (6 of them had vitex ingestion and were asymptomatic). Table 3.

Of 18 cases with acid ingestion, 33% of them had significant esophageal injury (at least grade 2) and about 39% of them had normal esophagus.

For alkali ingestion, the rate of significant esophageal injury and normal esophagus were 53,5% and 29% respectively.

On the other hand, gastric injury was detected in 11 (61%) cases with acid ingestion and 13 (32%) with alkali ingestion ( $p < 0,05$ ).

Four children developed mediastinitis, pneumothorax, pneumomediastinum, and aspiration pneumonia, and all of them had alkaline ingestion.

The rate of esophageal injury in acid ingestion was less than of alkali ingestion ( $p > 0,05$ ). Also in our study, gastric injury was significantly more common in acid ingestion ( $p < 0,05$ ).

After follow up for at least 3 months, 15 (20%) cases developed esophageal stricture, 10 of them had alkaline ingestion and 5 had acid ingestion ( $p > 0,05$ ).

In 10 patients, surgery including gastrostomy, jejunostomy, surgical dilatation, colon interposition and esophagoplasty was done, the rate of acid or alkaline ingestion was not significant ( $p > 0,05$ ).

## DISCUSSION

Caustic ingestion remains a significant problem worldwide, especially in developing countries<sup>(6)</sup>. The incidence of corrosive ingestion worldwide including our country is increased due to more available cleaners<sup>(9,10)</sup>.

Caustic ingestion occurs more commonly in children especially those less than 5 years of age, and are primarily incidental<sup>(11)</sup>. In our study, the median age of caustic ingestion was 36 months, similar with other studies.

**Table 3.** Esophageal endoscopic manifestations in children with caustic ingestion.

Grade	Acid	Alkali	Unknown substance
0	7	12	5
1	5	7	2
2	3	11	2
3	3	11	1
4	-	-	-

Male to female ratio was 2 to 1 like in other studies<sup>(5,12,13)</sup>. In another study, male was the predominant sex affected by caustic ingestion<sup>(14)</sup>. In the study by Karaman *et al.*, male was the predominant affected sex<sup>(15)</sup>.

Similar to other reports<sup>(5)</sup> the rate of accidental injury in our study was 96%. In another study by Ekpe and Ette, 100% of caustic ingestion was accidental<sup>(16)</sup>.

In our study the majority of children had alkaline ingestion. In another study, an alkaline product was ingested by 58,3% of cases<sup>(14)</sup>. In the study by Riffat and Cheng, about 74% of caustic injury was due to alkali ingestion<sup>(5)</sup>. This result is due to availability of alkaline agents for multiple uses among cleaning of air conditioning in summer and to open tubes<sup>(2)</sup>. In another study, among Arab children, acidic agents were the most common cause while in Jewish children, alkaline was the most common cause of esophageal burns<sup>(17)</sup>.

According to multiple studies, the presence or absence of symptoms does not correlate with severity of injury to the gastrointestinal tract and the most common symptoms are dysphagia, drooling, feeding refusal, retrosternal pain and vomiting<sup>(18,19)</sup>.

In our study the most common symptoms were dysphagia, oral lesion, vomiting, drooling. In another study from Turkey, vomiting was the most common finding<sup>(13)</sup>. Alkali are usually odorless and tasteless and result in large volume consumption (in accidental caustic ingestion)<sup>(2)</sup>.

Alkali with a PH between 9 and 11, including many household detergents usually is asymptomatic without serious injury, but alkali with a PH above 11 may cause severe burn, even with small quantities.

Alkali ingestion with a PH more than 12.5 (including sodium hydroxides and sodium phosphates) will cause injury regardless of concentration<sup>(3,20)</sup>.

In our study, 6 cases had vitex ingestion (PH between 9 and 11) and because they were asymptomatic, they observed without upper endoscopy and after 3 to 6 months they did not develop any complications.

On the other hand, in 25 cases with sodium hydroxide ingestion, 22 (88%) had grade 2 or 3 of esophageal injury and in follow up 10 (40%) of them developed esophageal stricture. This result that the majority of Caustic ingestions are with sodium hydroxide is due to this fact that in southern provinces of Iran, for cleaning of air conditioning in summer, sodium hydroxide is used, that is one of the most powerful alkaline agent with PH > 12 and cause injury regardless of concentration.

Because this agent is odorless and tasteless and is easily dissolved in water, usually is drunk by children in large volume which ultimately cause severe injury to GI tract and especially to esophagus.

Acidic material has bitter taste and develops pain with ingestion that finally results in lower volume of ingestion especially in accidental injury. For this reason, acid ingestion in comparison to alkali ingestion have lower rate of accidental esophageal injury<sup>(21)</sup>.

In acid ingestion, gastric injury is more common, that is due to low viscosity and specific gravity of acid agents<sup>(22)</sup>. Also in our study, gastric injury was significantly more common in acid ingestion.

In the current study, 20% of cases developed esophageal stricture which was higher than Riffat and Cheng study<sup>(5)</sup>. In earlier studies, the frequency of esophageal stricture after caustic ingestion were between 2 to 75%<sup>(12,13,23)</sup>. In another study, esophageal stricture occurred in 48.9% of cases<sup>(24)</sup>. In another study in Iran, there was more stricture formation by acid ingestion<sup>(6)</sup>.

However, our study showed that esophageal stricture is generally due to strong alkali (sodium hydroxide) ingestion that cause has described previously. In our study, of 10 children with esophageal stricture, esophageal dilatation with Savary dilatation was done in all of them except in a 16 months infant with severe esophageal injury due to sodium hydroxide ingestion who underwent colon transposition.

In our study, one boy (2-year-old) died as a result of caustic ingestion with unknown agent. In another study from Nigeria among 16 cases, mortality occurred in 1 case<sup>(16)</sup>.

In conclusion, dysphagia was the most common complaint. Esophageal stricture developed in 20% of cases which was higher than some studies. Mortality in our study was low. However, more preventive measures are recommended.

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