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The role of endoscopy in caustic ingestion in the pediatric population: experience in a tertiary center

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ABSTRACT

Introduction: caustic ingestion in children is rare but has potentially serious consequences.

Aim: to analyze the clinical and endoscopic features and the type of caustic ingested in our population.

Methods: the upper endoscopies performed in this setting, as well as the characteristics of patients and caustics, were analyzed from 2010 to 2018.

Results: fifty-one endoscopies were performed (48 cases of witnessed intake or high suspicion and three with a low suspicion) in patients with a mean age of 2.55 years. Alkali ingestion was more frequent (88.2 %) and 56.9 % of the endoscopies were normal, which was more frequent among those who ingested bleach (72 %). Alkali tended to produce more esophageal injuries (31.1 %) and acids tended to produce esophageal (20 %) and esophageal-gastric injuries (20 %). Four patients developed

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esophageal stenosis during follow-up.

Discussion: even though more than half of the studies were normal, endoscopy is important in the diagnosis and prognosis of these patients.

Keywords: Caustics. Pediatric emergencies. Digestive endoscopy. Esophageal stenosis.

INTRODUCTION

Caustic ingestion (CI) in pediatric patients is a rare phenomenon (0.1 % of consultations in children's emergencies) that occurs especially in children of 1-3 years of age (1). However, it is relevant due to the serious potential immediate (necrosis, perforation, etc.) and delayed complications (stenosis, development of neoplasms, etc.) (2). Endoscopy plays a fundamental role in this entity, both for diagnosis and to estimate the prognosis and subsequent management of these patients. Endoscopy is considered as a safe technique in children, although it may be associated with certain complications (3). There is not much evidence supporting a definite management of CI due to the heterogeneity in the design of the published studies.

The aim of the present study was to analyze the experience of a reference center for this entity and thus better define clinical and endoscopic features of the patients and the characteristics of the caustics ingested in our population.

METHODS

This was an observational, descriptive and retrospective study of endoscopies performed in children after caustic ingestion was witnessed, a high suspicion of ingestion (not witnessed but with the characteristic oral lesions) or low suspicion (not witnessed and without oral injuries) in a tertiary hospital, between 2010 and 2018. Experienced endoscopists (both adult and pediatric gastroenterologists) performed the upper endoscopies in an operating room with deep sedation administered by an anesthesiologist (the type of sedation and orotracheal intubation was according to the anesthesiologist's criteria). All patients underwent an upper gastrointestinal endoscopy in the first 24 hours after the ingestion and the Zargar classification was used to estimate the severity of the lesions (3). Further endoscopic studies were performed in those patients with Zargar ≥ IIa, except in one case that was lost to

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follow-up due to individual reasons. Legal representatives of all the patients signed an informed consent. Different models from the manufacturers Olympus and Pentax were used in the period of time analyzed, including both conventional and pediatric gastroscopes depending on the weight and height of the children.

The analyzed variables were age, sex, type of caustic (acid/alkali), type of product, extent of endoscopic lesions (esophageal, gastric, esophagogastric or esophagogastroduodenal) and the presence or absence of esophageal stenosis.

All continuous variables had a normal distribution, so they were expressed as the mean and standard deviation. Categorical variables were expressed by the number of cases and percentages. The Student's t-test was used for the comparison of means and the association between variables was analyzed using the Pearson's Chi^2 test. A confidence interval (CI) of 95 % and $p < 0.05$ were considered as significant. Statistical analysis was performed with the SPSS® V.25 software.

RESULTS

A total of 51 cases were included: 48 with witnessed CI or a high suspicion and three with a low suspicion of CI. The mean age was 2.55 ± 2.56 years. There were no differences (p: 0.58) in the mean age between boys (2.59 [1.60-3.59; 95 % CI] ± 2.758 years) and girls (2.47 [1.39-3.56; 95 % CI] ± 2.245 years]. The mean follow-up time was 27 (9-35) months.

Alkaline products were the most frequently ingested caustic with 45 cases (88.2 %), acid intake happened in five cases and there was one case where the type of product was unknown. Twenty-two patients (43.1 %) presented endoscopic lesions, all from the group of witnessed or high suspicion of CI (45.8 %). In this subgroup, only two patients were asymptomatic. Table 1 shows the extent of the lesions according to the pH of the ingested product. Among those who ingested alkaline substances, the most frequent involvement was esophageal (31.1 %). Among those who ingested acid substances, the most frequent was esophageal (20 %) or esophageal-gastric (20 %) involvement. Significant differences were observed between these percentages (p = 0.045).

Table 2 shows the extent of the lesions according to the ingested product. It is important to point that 72.7 % of those who ingested bleach had no endoscopic

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lesions. Furthermore, among those who ingested ammonia, approximately half of the patients had lesions and these were mostly esophageal. Statistically significant differences were also found in this analysis (p: 0.001) but the real impact of these data may be limited by the large number of products included and the limited number of cases in some subgroups.

Table 3 summarizes those patients who presented endoscopic lesions according to the type of caustic. Among these, eight patients required further endoscopies and secondary esophageal stenosis occurred in four cases. All these patients were in the alkali group. No statistically significant differences were observed (p = 0.487), probably due to the low number of patients. A mean of 10 ± 10,967 (1-33) endoscopies per patient were performed, mainly revision procedures and hydropneumatic dilation sessions for esophageal stenosis in these four patients. There were no significant differences (p: 0.658) in the number of endoscopies between those who ingested acids (1.60 [0.70-3.27; 95 % CI] ± 1.342) and alkali (2.69 [0.93-4.45; 95 % CI] ± 5.846).

DISCUSION

According to our results, a high percentage of endoscopies performed due to CI or suspected CI will not present lesions. In addition, there is a tendency for alkaline substances to cause more injuries at the esophageal level. Demographically, the mean age was 2.55 years, which is in line with the 2017 report of the American Association of Poison Control Centers (AAPCC). Focusing on the sex of our population, we have found that this phenomenon was more frequent in males (62.7 %), which is also congruent with two recently published large series (5,6).

In our sample, alkaline substances ingestion was more frequent. In this regard, there is heterogeneity of results depending on the continent and the socioeconomic level of the country (7). In a meta-analysis published in 2015, the alkali intake rate was clearly higher in continents such as America and Oceania compared to the rest of the continents (8). If we focus on studies from developing countries, there is a clear predominance of acid substances (7,9).

Most of our patients presented esophageal lesions, while gastric or gastroduodenal involvement was less frequent. In addition, we see how acid ingestion tends to produce more gastric lesions while alkalis tend to produce esophageal lesions. Only a few of the published series have analyzed the distribution of the lesions according to

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the type of caustic and these studies were performed in countries with very different socioeconomic characteristics from those of Western Europe. The tendency of acids to produce gastric lesions had already been described (6,10). These authors hypothesize that acids could produce pyloric spasticity, conditioning a longer retention time of these products in the gastric cavity. The most frequently ingested product varies greatly in the published series (5,6,10,11) and the 2017 AAPCC report does not include these data. In our case, the most frequent caustics were ammonia, bleach and caustic soda.

We also observed a high rate of normal endoscopies, which is in agreement with other authors (1,3). This is especially frequent among patients who ingested bleach. This data has not been previously reported in the literature because the available studies did not assess findings based on the type of product ingested. It would be possible to consider not performing an upper endoscopy in cases of bleach ingestion in asymptomatic patients and those without oral lesions. However, the number of patients in our study is limited so as to reach a definite conclusion. In addition, possible consequences of not making an early diagnosis of injuries is potentially serious. More evidence with a greater number of series would be necessary to be able to make such a recommendation. Regarding complications, 8 % of patients developed esophageal stenosis during follow-up, which is in line with the results of other authors (5,12).

The present study has certain limitations. It is a retrospective single-center analysis, patient follow-up varied over time and the number of patients who had ingested acidic substances was low. Thus, making it difficult to compare these patients with those who had ingested alkaline products.

In conclusion, CI is a phenomenon that occurs more frequently in 2-3 year-old males. In our environment, alkaline substances were more frequent. Alkali tends to cause esophageal lesions, while acids tend to cause gastric lesions. Although a significant number of patients will not present lesions after CI, the performance of an upper digestive endoscopy is important to establish the diagnosis and prognosis. A small percentage of patients will present long-term complications and will require multiple endoscopic procedures, with stenosis as the prominent lesion in this group.

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Table 1. Lesions location according to the pH of the ingested caustic

	Normal	*Esophageal*	*Gastric*	*EG*	*EGD*	*Total*
Alkaline pH product	26 (57.8 %)	14 (31.1 %)	4 (8.9 %)	0	1 (2.2 %)	45 (100 %)
Acid pH product	3 (60 %)	1 (20 %)	0	1 (20 %)	0	5 (100 %)
Unknown	0	1 (100 %)	0	0	0	1 (100 %)
Total	29 (56.9 %)	16 (31.5 %)	4 (7.8 %)	1 (1.9 %)	1 (1.9 %)	51 (100 %)

EG: esophagogastric; EGD: esophagogastric and duodenal. Values are expressed as the absolute number and percentage.

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Table 2. Lesions location depending on the type of product ingested

	Normal	*Esophageal*	*Gastric*	*EG*	*EGD*	*Total*
Ammonia (alkali)	9 (52.9 %)	7 (41.2 %)	1 (5.9 %)	0	0	17 (100 %)
Bleach (alkali)	8 (72.7 %)	2 (18.2 %)	1 (9.1 %)	0	0	11 (100 %)
Caustic soda (alkali)	4 (57.2 %)	2 (28.5 %)	1 (14.3 %)	0	0	7 (100 %)
Others	9 (52.9 %)	5 (29.4 %)	1 (5.9 %)	1 (5.9 %)	1 (5.9 %)	17 (100 %)

EG: esophagogastric; EGD: esophagogastric and duodenal. Values are expressed as the absolute number and percentage.

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Table 3. Zargar classification in patients with endoscopic lesions, according to the type of caustic and the type of product

Patient	*pH*	*Type of caustic*	*Zargar*		
			E	G	D
1	Alkali	Rinse aid	0	IIIB	0
2	Alkali	Bleach	0	I	0
6	Alkali	Ammonia	IIA	0	0
7	Alkali	Ammonia	I	0	0
9	Alkali	Caustic soda	IIA	0	0
14	Alkali	Rinse aid	IIA	IIIA	IIA
22	Alkali	Hydrochloric acid	I	IIA	0
26	Alkali	Ammonia	I	0	0
27	Alkali	Degreaser	I	0	0
28	Alkali	Ammonia	I	0	0
29	Alkali	Bleach	IIA	0	0
30	Alkali	Antioxidant	I	0	0
31	Alkali	Caustic soda	I	0	0
32	Alkali	Ammonia	I	I	0
33	Alkali	Ammonia	I	0	0
36	Alkali	Ammonia	I	0	0
37	Unknown	Unknown	IIA	0	0
41	Alkali	Bleach	I	0	0
45	Alkali	Caustic soda	IIIB	IIIB	0
47	Alkali	Ammonia	I	0	0
50	Alkali	Degreaser	I	I	0
51	Alkali	Degreaser	IIA	0	0

E: esophageal; G: gastric; D: duodenal.

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