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Frequency of Caustic Ingestion in Children Referred to Pediatric Medical Center

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ABSTRACT

Background and Objective: One of the most dangerous pediatric emergencies is the ingestion of caustic substances, which causes serious damage to the digestive and respiratory systems. The highest prevalence of this incident is seen in toddlers, especially under the age of three. The present study was conducted to investigate the frequency of caustic ingestion in children referred to pediatric medical center.

Methods: This cross-sectional study was conducted on 128 children who had ingested caustic substances and referred to pediatric medical center over a 2-year period. Data involving age, gender, type of caustic substance, location of the incident, diagnostic and therapeutic measures, time of referral to medical centers, location of involvement in the gastrointestinal tract, and degree of endoscopic mucosal injury were collected and reviewed using electronic medical records.

Findings: Of the 128 children who referred with caustic ingestion, 97 hospitalized children were studied, which included 45 boys (46.4%) and 52 girls (53.6%). The mean age of the children was 2.90±2.89 years. 47 patients (45.5%) underwent endoscopy, 22 underwent surgery after endoscopy, and 31 patients were treated without any specific procedure. Among the patients who underwent endoscopy, the most common injury categories were grade I and grade IIa injuries (19 each). The number of patients with alkaline substance ingestion was significantly higher than that of acidic substance ingestion (80 vs. 17) ($p<0.05$). The location of the accident was at home in 90 (92.8%) of the patients. 35 patients (36.1%) had esophageal injury, 57 (58.8%) had no burns, and 5 (5.1%) had burns in the pharynx, mouth, and stomach. As the patients' age increased, the burn site was closer to the mouth, but this was not statistically significant. Furthermore, the average time between swallowing and referral to medical centers was 2 hours and 45 minutes.

Conclusion: The results of this study showed that most caustic ingestions in children occurred at home and involved alkaline substances and required interventional treatments, including endoscopy and surgery.

Keywords: *Caustic Ingestion, Children, Ingestion of Alkaline Substances, Ingestion of Acidic Substances, Endoscopic Classification, Burns, Esophagus.*

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Introduction

With the introduction of chemical cleaners and detergents into the market for home use, we are witnessing an increase in the incidence of caustic ingestion (1). Accidental caustic ingestion can cause serious damage to the gastrointestinal tract, especially the esophagus, which is the most delicate tissue and has the greatest contact with ingested caustic substances (2). Despite extensive efforts to reduce the corrosiveness of household chemical cleaners and the warnings placed on them, we continue to see these incidents and the resulting psychosocial and economic impacts (3).

Caustic substances include a wide range of chemicals that cause tissue destruction and damage to adjacent tissues (4). Caustic substances are actually either acidic or basic, and in terms of prevalence, the ingestion of alkaline substances is more common than acidic substances because acid is very pungent and foul-smelling, so the ingestion of acid occurs in a smaller volume. Ingestion of caustic substances occurs more often in children under 6 years of age, who are extremely vulnerable, which can cause serious damage to the gastrointestinal tract (5). According to previous studies, most children at the age they start walking tend to explore (6).

The prevalence of caustic ingestion has increased over the past 50 years with the increased use of chemical cleaners, bathroom disinfectants, cosmetics, hair dyes, etc. The most common alkaline liquids that cause deep burns in the esophagus and stomach of children include liquid drain opener, cooktop cleaners, and dishwasher tablets (7). The true prevalence of caustic ingestion in children is unknown (8). In the United States, the prevalence is between 5000 and 15,000 per year (9). Clinical signs range from no damage to fatal cases (10). Clinical manifestations can be divided into acute and chronic categories based on the course of time. In the acute phase, the degree of tissue damage varies from simple burns to visceral rupture, and in the chronic phase, in the long term, it increases the risk of gastrointestinal strictures and cancers (11).

Important factors affecting the severity of tissue damage include the nature of the caustic agent, the amount of caustic agent swallowed, the concentration, and the duration of contact with the mucosa (12). Strong acids cause coagulative necrosis, which reduces acid penetration into the tissue. Alkali cause necrosis, which results in severe immediate damage at all surfaces of the gastrointestinal tract (13). Esophageal stricture is considered a short-term effect, but esophageal perforation and obstruction, and cancer can be some of the long-term effects of caustic agent ingestion (14, 15). The aim of this study was to investigate the frequency of caustic ingestion in children referring to a pediatric medical center.

Methods

After approval by the Ethics Committee of Tehran University of Medical Sciences with the code IR.TUMS.CHMC.REC.1399.033, this cross-sectional study was conducted over a two-year period among children with caustic ingestion referred to Pediatric Medical Center. All children experiencing caustic ingestion who referred to the medical center were included in the study, and children diagnosed with foreign body ingestion and patients with a history of structural problems in the gastrointestinal tract, such as esophageal atresia, were excluded from the study. Acidic substances with pH=2 or less and alkaline substances with pH=12 or more were considered as substances with significant caustic properties (16). Data on demographic characteristics of the parents, gender and age of the children, type of caustic substance, site of ingestion, container used to store the substances, time interval from ingestion to hospital admission, site of injury in the gastrointestinal tract, and treatment measures performed on the patients were collected and reviewed using their electronic medical records.

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The data were analyzed after review by two physicians and approval by a pediatric gastroenterologist. Statistical analysis of the data was performed by SPSS software using Mann-Whitney, Kolmogorov-Smirnov, and Chi-square statistical tests, and $p<0.05$ was considered statistically significant.

Results

A total of 128 patients with caustic ingestion were referred to the pediatric medical center. Of these, 97 hospitalized patients were evaluated. The mean age of the children was 2.90±2.89 years, 45 (46.4%) were boys and 52 (53.6%) were girls. More than 75% of the patients were younger than 3 years of age (Figure 1).

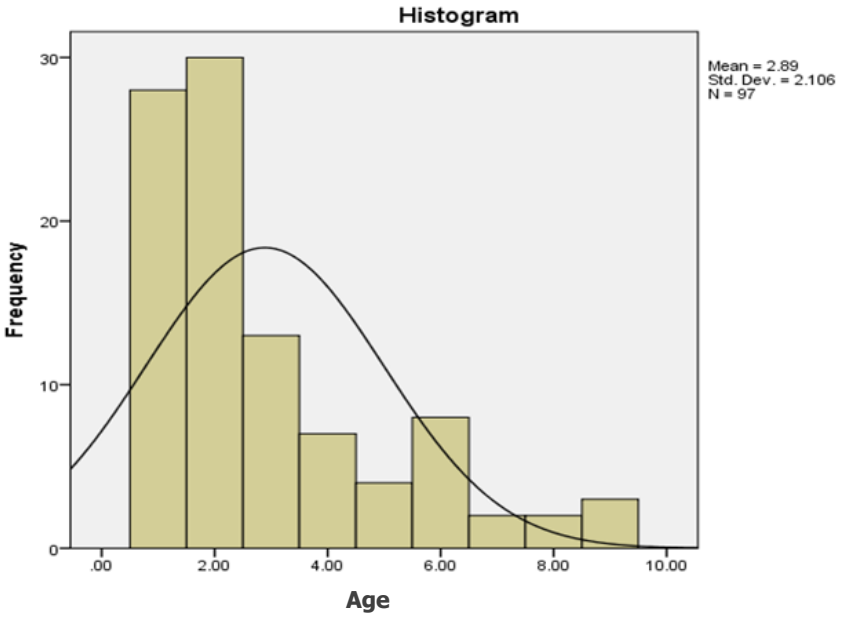

Figure 1. Population frequency of patients experiencing caustic ingestion

88 (90%) of the parents had academic education and 9 (10%) were illiterate. The caustic substance was kept in a standard container in 70 cases (72%). In terms of the location of the incident at home or kindergarten, 90 cases (92.7%) of the patients experienced this incident at home. In terms of the nature of the swallowed substance, patients who swallowed acidic substances were about a quarter of those who swallowed alkaline substances (17.5% acidic versus 82.5% alkaline). More detailed studies indicated that the most common substances swallowed by children were liquid drain opener with 42 cases (44%) and surface disinfectant with 27 cases (29%). According to the obtained information, the average time between swallowing the caustic substance and the patient visit was about 2 hours and 45 minutes. Moreover, in examining the patients in terms of burn location, more than half of the patients were without any burn marks (58.8%), and among the injured patients, the most common injury site was the esophagus with 36.1%, the tongue with 3.1%, and the pharynx and stomach with 1% each (Table 1). Based on the obtained results, 66 children (68.2%) underwent endoscopy, of which 22 (22.7%) underwent surgery. Furthermore, no special interventional measures were performed for 31 (32%) cases. Based on the endoscopy results of 66 patients who underwent endoscopy alone or endoscopy and surgery, the most frequent grades of mucosal damage were grade I (19 patients, 28.73%) and grade IIa (19 patients, 28.73%) (Table 2).

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Table 1. Frequency of the type of treatment, type of caustic substance, and location of injury in the gastrointestinal tract

Variable	Number(%)
Treatment method	
Endoscopy alone	44(45.5)
Surgery after endoscopy	22(22.7)
No treatment	31(32)
Type of substance swallowed	
Acidic substance	17(17.5)
Alkaline substance	80(82.5)
Site of injury in the digestive tract	
No damage	57(58.8)
Esophagus	35(361)
Mouth	3(3.1)
Pharynx	1(1)
Stomach	1(1)

Table 2. Frequency of different grades of mucosal injury in endoscopy

Injury grade	Number(%)
0	2(3.03)
I	19(28.78)
II_a	19(28.78)
II_b	18(28.27)
III_a	6(9.09)
III_b	2(3.03)

The two groups that had ingested acidic and alkaline substances were similar in terms of the time taken from ingestion to referral to medical centers, and no statistically significant difference was evident. The number of female patients in both groups was higher than the number of male patients, but the demographic distribution of girls and boys in these groups was not statistically significant. As the children grew older, the burn site was closer to the mouth, but this negative correlation was not statistically significant.

Discussion

In this study, 45 (46.4%) of the patients were boys, and the mean age of the children was 2.90±2.89 years, which is consistent with the study of Rafeey et al. (4). In a systematic review, Rafeey et al. estimated the mean age of the patients to be 2.78 years, which is consistent with the results of our study (4). In the study of Gholami et al., the mean age of the patients was 31.33±20.38 months. Also, in this study, 68.5% of the patients were boys (17). In the study of Abou et al., 65.7% of the patients were boys, and the mean age of the patients was 25.1±19.3 months. In this study, 55.88% of the patients had alkali ingestion. The most common type (14%, 17 patients) was grade I mucosal injury in endoscopy (18). In the present study, the most frequent grades of mucosal injury were grade I with 19 patients (28.73%) and grade IIa with 19 patients (28.73%).

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According to previous studies and the results of the present study, most children referred to the clinic are children who are at the age they start walking and tend to explore (6). According to the findings of the present study, in 92.8% of cases, this incident occurred at home. Therefore, more attention from parents to children and placing detergents in a safe place, as well as educating parents in this regard by the government and the media, can play a key role in reducing the occurrence of these incidents (19).

Otçu et al. showed that 58% of the children were boys and 42% were girls, which was consistent with the findings of the present study (20). By dividing the patients into two groups of acid ingestion and alkaline ingestion, we observed a higher number of boys than girls in both groups, but the population distribution of boys and girls in these groups was not statistically significant. In the study of Mahdizadeh et al., the rate of poisoning in women was higher than in men (21). Of course, they studied adults with various intentional and unintentional causes.

In a study by Huang et al., 74% of the incidents involved one type of alkaline liquid (1), which was consistent with our study. Moreover, in a study by Gholami et al., 86.1% of patients reported consuming alkaline substances (17). Despite the faster onset of symptoms in the case of acidic substances, there was no statistically significant difference between the two groups in terms of time from ingestion to referral to the medical center. In a study by Lupa et al., 18–46% of caustic ingestions were associated with esophageal injury (22). Based on the results of the present study, 36.1% of patients suffered some degree of esophageal burns (23), which is consistent with the results of previous studies.

In this study, 44 patients underwent diagnostic endoscopy alone, 22 underwent surgery after endoscopy, and 31 did not undergo any specific procedures. In general, physical examination, invasive and non-invasive techniques, especially endoscopy, are performed in almost all patients to detect lesions and assess the severity of the injury. In various studies, endoscopy is recommended in the first 28-48 hours based on the diagnosis of the physician (23). Also, performing endoscopy as soon as possible to determine the severity of the injury and choosing the best treatment method usually prevents extensive surgery (24).

According to the findings of the present study, in 92.8% of cases, this incident occurred at home. Therefore, more attention from parents to children and placing detergents in a safe place, as well as education of parents in this regard by the government and the media, can play a key role in reducing the occurrence of these incidents.

One of the limitations of this study was incomplete or missing data in some cases, and the strength of this study was the large number of cases examined and the diversity of cases in the country's referral center. Considering the results of the present study and the greater prevalence of these incidents in children under 3 years of age, ingestion of caustic substances is considered one of the most important emergencies in pediatric centers. The present study also shows the greater prevalence of these incidents at home and the role of parents in reducing the occurrence of this incident. Therefore, education of parents by advertising agencies and consideration of more safety rules for companies manufacturing household detergents are necessary to reduce their corrosive power.

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