

## The Relationship between Clinical Findings and Esophageal Injury Severity in Children with Unintentional Ingestion of Caustic Agents

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### 1. Abstract

**1.1. Background:** Corrosive ingestion can produce severe upper gastrointestinal tract injury with long-lasting suffering and even death. Early assessment of the extent of damage is important for deciding about the necessity of hospitalization and type of treatment. The present study has investigated the clinical indicators of corrosive esophageal injury severity in children.

**1.2. Methods:** Data from children who accidentally ingested corrosive substance over a five-year period in two tertiary care university hospitals were reviewed. Patients were divided into two groups as low-grade and high-grade esophageal injuries according to the findings of endoscopic evaluation. Statistical correlations of common signs and symptoms and with low- and high-grade esophageal injury were analyzed.

**1.3. Results:** A total of 47 consecutive children with a caustic ingestion who underwent diagnostic endoscopy were included in our study. Endoscopies revealed low-grade injury in 80.9% of cases. There were no significant differences in age, sex and type of corrosive substance between low-grade and high-grade injury groups ( $p > 0.05$ ). The majority of patients (83%) had at least one symptom at the initial examination. Endoscopies in all of the asymptomatic patients revealed low-grade injuries, but no significant relation was found between symptomatic and grading of the injury in endoscopic examination ( $P = 0.323$ ). The mean WBC counts did not differ significantly between the two grading groups.

**1.4. Conclusion:** Our study showed a significant correlation between having no clinical symptom and low grade esophageal injury in endoscopic examination of children with corrosive substance ingestion and appears to confirm that in limited resourced centers, endoscopy could be deferred in asymptomatic patients.

**2. Keywords:** Corrosive; Esophagus; Caustic agent; Endoscope; Pediatric

### 3. Introduction

Unintentional ingestion of corrosive continues to be a significant public health issue in children despite regulatory and other preventive efforts. These injuries are more common in developing countries due to social, economic, and educational variables [1-4]. Household cleaning products containing alkali, acid, and detergents have variable biological damage patterns. Alkaline substances cause saponification or liquefaction necrosis, whereas acid causes coagulation necrosis. Clinical presentation in children differs from asymptomatic to severe complications and is influenced by a number of elements such as type of substance, concentration, physical form, amount, and intent [5]. However, no definite clinical sign or laboratory test is offered to specify the severity of esophageal injury [6]. Since prompt assessment of the degree of injury is imperative for deciding about the necessity of endoscopy, hospitalization and treatment, many studies have attempted to validate the correlation between clinical characteristics and the severity of esophageal caustic injury [7-15]. In this study, we aimed to explore the predictive value of clinical symptoms and signs of our pediatric patients in estimating the severity of their esophageal injury after corrosive agent ingestion.

### 4. Materials and Methods

In this study, from January 2012 to January 2017, pediatric cases of corrosive ingestion managed in two tertiary care hospitals in two different cities of Iran, Shohadaye Khalije Fars Hospital in Bushehr and Shahid Sadoughi hospital in Yazd, formed the study group. The characteristics of patients including age, sex, symptoms, and types of corrosive agents were recorded. Physical examinations, as well as complete blood counts were evaluated. Flexible endoscopic examination was performed under local anesthesia in all patients within 12 to 36 hours after admission. The severity of upper gastrointestinal injury was classified according to ZARGAR [16]: grade 0 (negative finding), grade 1 (edema and hyperemia of the mucosa), grade 2 (non-circumferential [2A] or circumferential [2B] friability, hemorrhage, erosion, blisters, whitish membrane, exudates and superficial ulcer), and grade 3 (multiple ulcerations and areas of necrosis).

Patients were divided into two groups as low-grade (grade 0, 1 and 2A lesions) and high-grade (grade 2B and 3 lesions). The relations between signs, symptoms and

WBC count and the severity of esophageal injury were analyzed statistically.

The correlations were analyzed using Chi-square or Fisher exact test or unpaired t-test as applicable. A p-value of <0.05 was considered statistically significant.

Statistical analysis was performed using SPSS 23.0 for Windows. The study was performed after obtaining appropriate informed consent.

### 5. Results

A total of 47 consecutive children with a caustic ingestion who underwent diagnostic endoscopy were included in our study. Among them, 28 cases were referred to Shohadaye Khalije Fars Hospital in Bushehr and 19 cases were referred to Shahid Sadoughi hospital in Yazd. The clinical characteristics and mean WBC count of patients are offered in (Table 1). Male-to-female ratio was 1.4:1, and mean age was 35.8 months. The most common caustic substance was alkaline, reported in 51.1% patients, followed by acid (48.9%). Endoscopies revealed low-grade injury in 80.9% of cases, among which 55.3% were due to acid agents. Among patients with high-grade injury, 77.8% of cases were due to alkaline agent ingestion. Analyzing clinical characteristics according to groups, there were no significant differences in age and sex between low-grade and high-grade injury groups ( $p > 0.05$ ). The majority of patients (83%) had at least one symptom at the initial examination. Endoscopies in all of the asymptomatic patients revealed low-grade injuries, but no significant relation was found between symptomatic and grading of the injury in endoscopic examination ( $P = 0.323$ ). The most common symptom was vomiting (48.9%). The presence of vomiting in children with high-grade injury was more frequent but there was no statistically significant difference ( $P = 0.286$ ). Drooling saliva and oral lesions were found 44.7% of cases and had no significant relation with grading of the injury ( $P = 0.263$ ). The mean WBC count was  $10.49 \times 10^3/\mu\text{L}$  and it did not differ significantly between the two grading groups. The presence of symptoms has a high sensitivity (100%) but low PPV. On the other hand, having no symptom was associated with low specificity but high NPV (100%). The predictive values of initial symptoms and mean WBC count are shown in (Table 2).

**Table 1:** Data of Patients with Different Degrees of Esophageal Injury

Demographic Data	Severity of esophageal injury, n (%)		P-value
	Low grade (N=38)	High grade (N=9)	
Gender (male: female)	22 (58%) : 16 (42%)	6 (66%) : 3 (34%)	0.120
Age (month)	33.4±17.4	45.11±37.8	0.400
Caustic agents (alkali: acid)	17 (45%) : 21 (55%)	7 (78%) : 2 (22%)	0.137
Vomiting	17 (44.7%)	6 (66.6%)	0.286
Drooling saliva & Oral lesion	15 (39.5%)	6 (66.6%)	0.263
Respiratory symptom	5 (13%)	0	0.567
WBC count (X10 <sup>3</sup> /μL) (mean ±SD)	13 (35.1%)	5 (55.6%)	0.284

**Table 2:** Sensitivity, specificity, positive predictive value, and negative predictive value for symptoms and WBC count

Value	Sensitivity	Specificity	PPV	NPV
Vomiting	0.66	0.60	0.26	0.78
Drooling saliva & Oral lesion	0.66	0.60	0.28	0.88
Respiratory symptom	0	0.6	0	0.78
WBC count (X10 <sup>3</sup> /μL) (mean ±SD)	0	0.64	0.27	0.85

## 6. Discussion

Corrosive ingestion is a common public health issue across the globe mostly seen in developing countries[6]. When unintentional caustic ingestion in children occurs, an spectrum of chemical upper gastrointestinal tract injury could ensue, ranging from no apparent injury to hazardous outcomes due to respiratory and gastrointestinal burns, lifelong complications and potentially fatal SEQUELAE[17]. In general, in order to evaluate the degree of injury, consultation with a specialist for endoscopic evaluation would be compulsory. However, particularly when signs and symptoms are absent, the consultant faces a dilemma in deciding about performing endoscopy, hospitalization and the necessity of treatment strategies. Historically, most experts advised routine endoscopic evaluation for all patients after presumed caustic ingestion. Endoscopy performed soon after the corrosive ingestion is considered helpful to assess the extent of injury, to plan for appropriate management and to predict the OUTCOME[18]. However, recent studies suggest that endoscopy in children who have no signs and symptoms could be deferred[8, 19, 20,].

Our present study included 47 pediatric cases of corrosive ingestion over a period of 5 years in order to decide whether endoscopy could be suspended in asymptomatic patients or not. We observed that endoscopies in all of the asymptomatic patients revealed low-grade esophageal injuries. However, as other studies have ADVOCATED[21-23], we did not find significant relation between being symptomatic and the degree of esophageal

harm in endoscopic examination.

In a study by Lamireau et AL[10]. it was recommended not to perform endoscopy for asymptomatic children living in developed countries. Betalli et AL[12]. proposed that the risk of severe esophageal injury increases proportionally with the number of the signs and symptoms. Kaya et AL[13]. revealed that an association was found between drooling saliva and oral lesion and high-grade esophageal injury and similar to our study, they proofed that absence of clinical findings indicated no or low-grade esophageal injury.

It is offered that as an inflammatory corrosive response to esophageal injury, mobilization of the leukocyte marginal pool could happen and an increase in WBC level could potentially occur due to bacterial translocation. A small number of studies have revealed a significant correlation between WBC count and the degree of upper gastroesophageal INJURY[11, 24]. In our study, mean WBC counts did not differ significantly between the two injury grading groups.

In conclusion, accidental caustic ingestion continues to be a major concern for pediatric emergency department clinicians. The present study showed a significant correlation between having no clinical symptom and low grade esophageal injury in endoscopic examination of children with corrosive substance ingestion. Our study appears to confirm earlier works that in limited resourced centers and developing countries where endoscopy is not readily available, clinical features can help estimate the degree of injury and endoscopy could be deferred in asymptomatic patients. There is a pressing prerequisite for non-invasive diagnostic modalities to evaluate the complications associated with corrosive ingestion in pediatric population.

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