

A study of the intermediate- to long-term outcome of corrosive ingestion in Sawanpracharak Hospital.

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Abstract

Background/Aims: The ingestion of corrosive substances is linked to enduring consequences, particularly in cases with high-grade mucosal damage. This study aimed to examine the correlation between the severity of mucosal injury grading and the intermediate (more than one-month follow-up) to long-term outcomes (more than 12 months) following corrosive ingestion.

Methods: Patients who presented with corrosive ingestion between January 2017 and December 2022 were included consecutively. A comprehensive review of medical records was conducted to gather information regarding the substance ingested, intent, symptoms, amount, injury grade at endoscopy, and clinical during follow-up.

Results: During the study period, a total of 106 patients were admitted with corrosive ingestion, out of which 72 underwent esophagogastroduodenoscopy (EGD). Among the patients who underwent

EGD, 19 (26.4%) were found to have high-grade esophageal lesions. The severity of gastrointestinal mucosal injury was not found to be related to the volume of ingestion or time to EGD, but upper gastrointestinal hemorrhage was significantly associated with high-grade esophageal injury and mortality. Three patients died during the index hospitalization, and the remaining patients were followed up for a median period of 821 days (14-1295), during which 18 patients were lost to follow-up before one year. During the intermediate-term follow-up, three patients with high-grade injuries died as a result of corrosive ingestion (length of hospital stay 45, 325, and 350 days, respectively), and four patients had significant esophageal strictures. Neither group exhibited any adverse consequences of corrosive ingestion during the long-term follow-up.

Conclusions: Patients with high-grade esophageal mucosal lesions experienced significant morbidity and mortality during the intermediate-term follow-up. On the other hand, patients with low-grade esophageal injury did not exhibit any adverse consequences during the follow-up period. Therefore, after an endoscopy shows a low-grade esophageal mucosal lesion, patients can be treated as outpatients. The follow-up is not necessary after one year if the patients did not experience any adverse event.

Keywords: corrosive ingestion, high-grade esophageal injury, esophageal stricture

วันที่รับ (received) 18 เมษายน 2566

วันที่แก้ไขเสร็จ (revised) 8 พฤษภาคม 2566

วันที่ตอบรับ (accepted) 9 พฤษภาคม 2566

Published online ahead of print 26 มิถุนายน 2566

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doi:

Introduction

Corrosive substance ingestion is still an important health issue, causing significant morbidity in both developing and developed countries. In the United States, there are approximately 5,000 to 15,000 reported cases per year, with some states reporting more than 100,000 cases per year, especially in children¹. Data from the Ministry of public health's Bureau of Epidemiology in Thailand in 2000, which reported a rate of 10.2 attempted suicides per 100,000 population,^{2, 3} demonstrated that corrosive substances ingestion, particularly household cleaning agents, ranking as the third most common method after sleeping pills and insecticides⁴. The severity of the corrosive damage depends on the type, concentration, and quantity of the ingested substance and the reason for ingestion, with suicide attempts resulting in higher amounts ingested than accidental ingestion⁵. Abnormalities from corrosive ingestion can occur not only in the esophagus and stomach but also in the mouth and small intestines⁶. The abnormalities caused by corrosive substance ingestion start within the first minute that the mucous membrane comes in contact with the corrosive substance. The mucous membrane becomes inflamed, bleeds, and experiences mucosal sloughing, and there may be bacterial infection complications^{7,8}. Afterward, wound healing processes occur within three weeks of corrosive substance ingestion. During this time, the esophagus may become thickened and contracted, leading to long-term consequences for the patient^{9, 10}. The severity of corrosive substance ingestion damage can be classified using the modified Zargar classification, ranging from grade 0 to IIIb¹¹. Grades less than or equal to IIa are considered low-grade mucosal injuries. The grades greater than or equal to IIb are considered high-grade mucosal injuries and may lead to various complications.^{12, 13} Swanpracharak Hospital is a referral center for patients who have ingested corrosive substances from community hospitals and provincial

hospitals in the surrounding area, and therefore, a large number of such patients are treated there. However, there is still a lack of research on the intermediate to long-term outcome of corrosive agent ingestion, particularly when compared to results obtained through endoscopy.

Methods

This study is a retrospective cohort study that has been approved by the Human Research Ethics Committee of Swanpracharak Hospital under approval number COA. 11/2023. The study involves retrieving data from electronic medical records of both inpatients and outpatients who were administered with corrosive agents from January 1, 2017, to June 31, 2022, at Swanpracharak Hospital.

The inclusion criteria for the study are patients over 18 years old who intentionally or unintentionally ingested corrosive agents. Data collected from medical records include basic demographic information, details of the nature of substance and volume of ingestion, symptoms at presentation, endoscopic findings, treatment outcomes, and follow-up data were analyzed. The patients were followed up prospectively by a telephone interview and electronic medical record, during which symptoms and treatment history were recorded. Mucosal injuries with grades less than or equal to IIa are regarded as low-grade mucosal lesions, while those with grades greater than or equal to IIb are considered high-grade mucosal lesions. The intermediate-term outcome refers to the follow-up period of more than one month after corrosive ingestion, while the long-term outcome refers to the follow-up period of more than twelve months after corrosive ingestion.

Statistical analysis

The data analysis involved descriptive statistics, the data with normal distribution would be described using the mean, while data with non-normal distribution would be described using the

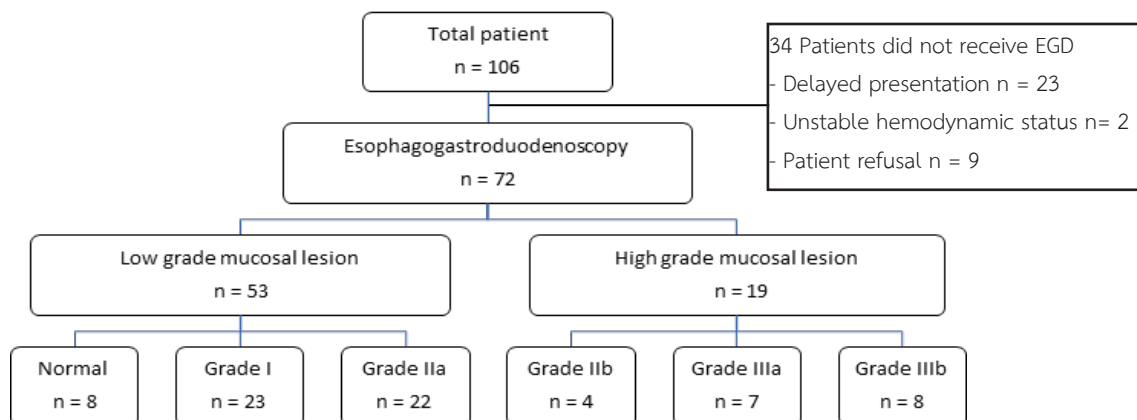
median. Chi-square and Fisher’s exact tests were applied to discrete variables to compare low-grade and high-grade mucosal lesion groups. Survival analysis was conducted using a Kaplan-Meier analysis. Statistical significance was considered when the *p*-value < 0.05. The statistical calculations were performed using SPSS version 21 (SPSS Inc., Chicago, IL, USA).

Result

During the study period, 106 patients who had ingested corrosive substances were enrolled. Among them, 34 patients (32.1%) did not receive an

esophagogastroduodenoscopy (EGD) due to delayed presentation after 24 hours in 23 patients (21.7%), unstable hemodynamic status in 2 patients (1.9%), and patient refusal in 9 patients (8.5%) (figure 1). The baseline characteristics of the patients are listed in Table 1. the mean age of the patients was significantly lower in the low-grade mucosal lesion group when compared to the high-grade mucosal lesion group, 31.3 years and 44.2 years, respectively (*p*-value <0.01). Attempted suicide was found to be the most common reason for corrosive substance ingestion in both groups.

Figure 1



Out of the total study population, 72 individuals (67.9%) underwent EGD. The majority of the patients who underwent EGD showed low-grade lesions, with 53 patients (73.6%) identified as such, while 19 patients (26.4%) had high-grade mucosal lesions.

When comparing mucosal grading lesions, we did not find any correlation between the presence of symptoms or oropharyngeal mucosal injury and the grade of gastroesophageal mucosal injury. However, it was noted that there was a significant difference in the upper gastrointestinal hemorrhage at presentation (42.1%) in patients with high-grade mucosal lesions (*p*-value <0.01). The median duration from acid ingestion to esophagogastroduodenoscopy (EGD) was comparable in both groups, with 12.2

hours for the low-grade mucosal lesion group and 12 hours for the high-grade mucosal lesion group. None of the patients with low-grade lesions died during the study, whereas 15.8% of patients with high-grade lesions died during the index presentation from acute respiratory failure (table 1). The median length of hospital stay was significantly shorter for patients with low-grade lesions (2 days) than those with high-grade lesions (7 days). Supportive treatment without any specific management was administered to both groups, and none of the patients required surgery. However, all three patients who died in the high-grade mucosal group required mechanical ventilation support at the time of admission.

Table 1: Baselines characteristics of the low-grade mucosal lesion and the high-grade mucosal lesion group (n=72)

Baseline characteristic	Low grade mucosal lesion (n=53)	High grade mucosal lesion (n=19)	p-value
Age, mean (SD)	31.3 (1.7)	44.2 (4.3)	<0.01
Gender male, n (%)	20 (37.7)	8 (42.1)	0.79
Underlying major depressive disorder, n (%)	9 (17.0)	1 (5.3)	0.27
Attempted suicide	51 (96.2)	17 (89.5)	0.85
Symptom at presentation			
Abdominal pain	21(39.6)	5 (26.3)	0.38
Upper gastrointestinal bleeding	0	8 (42.1)	<0.01
oral burn	29 (54.6)	6 (31.6)	0.43
hoarseness of voice	1(1.9)	0	1.0
The volume of ingestion, median (range), ml	15 (5-450)	30 (10-200)	0.14
Time to Esophagogastroduodenoscopy (EGD), median (range), hours	12.2 (2-23)	12 (3-21.3)	0.59
Death, n (%)	0	6 (31.6)*	<0.01
Stricture, n (%)	0	4 (26.7)	<0.01
Range of hospital stay, median (range), days	2 (1-23)	7(1-51)	<0.01
Time to follow up, median (range), days	646 (15-1252)	525 (14-1295)	0.37

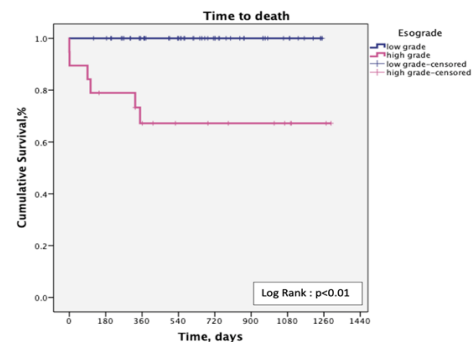
* 3 patients (15.8%) died during the index presentation

Data on follow-up. The median duration of follow-up was comparable in both the low-grade mucosal and high-grade mucosal lesion groups, with 646 days and 525 days, respectively. During the intermediate-term follow-up period (after one month) showed that none of the patients with low-grade mucosal lesions died during the study, while 15.8% of patients with high-grade mucosal lesions died, with a range of 45 to 950 days from aspiration pneumonia. Additionally, none of the patients with low-grade mucosal lesions developed strictures, whereas 26.7% of patients with high-grade lesions did. Based on Kaplan-Meier analysis, the 12-month cumulative survival rate in the high-grade mucosal lesion group was significantly lower than that in the low-grade mu-

cosal lesion group, with rates of 67.2% and 100%, respectively (figure 2).

During the long-term follow-up period (more than one year), there were no reported cases of stricture or death related to corrosive ingestion in either group.

Figure 2



Discussions

The issue of suicidal attempts remains a concern in developing countries, with corrosive agents being one of the most common means used². The ingestion of these substances can result in severe injuries with significant short- and long-term consequences. The motivation for ingestion can be either accidental or deliberate, with intentional self-harm being the most common reason among the adult population studied². In our investigation, toilet cleaner was the most frequently ingested substance. These cleaners typically contain powerful acids or alkalis that can cause significant damage to the mucosal lining upon direct contact. The primary reason for ingestion was found to be a deliberate act of self-harm, with individuals using toilet cleaning products containing varying concentrations of hydrochloric acid. In patients with accidental ingestion in our study, we observed that household detergents and toilet cleaners were occasionally stored in empty containers, which resulted in mislabeling and inadvertent ingestion. We did not find a significant difference between the volume of ingestion and the grading of mucosal lesions. However, it is worth noting that sometimes the patient may not be able to provide an accurate estimate of the volume ingested.

There is ongoing debate regarding the reliability of symptoms and signs as predictors of mucosal injury following corrosive ingestion. Havanond et al. conducted a study that showed that drooling of saliva and buccal mucosal burns were independent predictors of mucosal injury grade¹⁴. However, in our study, we did not find any correlation between the presence of symptoms or oropharyngeal mucosal injury and the grade of gastroesophageal mucosal injury. The only factor that was significantly associated with high-grade mucosal injury was upper gastrointestinal bleeding (42.1%, p -value<0.01).

Most studies have indicated that endoscopy can be performed safely in patients within 48 hours of corrosive substance ingestion^{15,16}. However, it should

be noted that many patients are unable to reach the hospital within this time frame, which can hinder the feasibility of performing EGD. Furthermore, our study found that the time elapsed before performing EGD was not associated with the degree of mucosal injury. The study conducted by Chang HT et al. reported that grade IIIb injuries, according to Zargar's endoscopic classification of mucosal injury following caustic ingestion, were the most frequent type of injury observed ($n = 82$, 30.04%), followed by grade IIb injuries¹⁶. However, our study showed contrasting results, where grade I was found to be the most common injury, followed by grade IIa. This difference in findings may be attributed to differences in the concentration of hydrochloric acid used in the ingested substance¹⁷. In our study, we did not observe any adverse events such as stridor or perforation following EGD, indicating that it is generally safe to perform EGD after corrosive ingestion.

In the group with high-grade mucosal lesions, there were cases of mortality observed, while in the group with low-grade mucosal lesions, there were no reported deaths at the time of diagnosis. This suggests that the severity of the mucosal lesion may be a critical factor in determining the overall health outcomes of the individual.

According to the Kaplan-Meier analysis, during the intermediate-term follow-up period of 1 to 12 months, three patients in the high-grade mucosal lesion group died as a result of corrosive ingestion (specifically, aspiration pneumonia), while no deaths were reported in the low-grade mucosal lesion group. The 12-month cumulative survival rate in the high-grade mucosal lesion group was significantly lower than that in the low-grade mucosal lesion group, with rates of 67.2% and 100%, respectively. Similar to the findings of the study conducted by Bharath Kumar C et al., the results indicate that mortality is more likely to occur in the group with high-grade mucosal lesions¹⁸. The incidence of esophageal stricture was significantly higher in the high-grade

mucosal lesion group, with one out of four individuals developing the condition during the intermediate-term follow-up period; compared to the low-grade mucosal lesion group, no patient in this study developed. All four patients developed esophageal stricture within 28-31 days. Two patients had Zargar's endoscopic classification grade IIIb, and the other two had grade IIa.

The main limitation of this study is that it is a retrospective study, which means that the researchers did not have control over the selection of the study population and data collection. Additionally, the data were collected from medical records, which may contain incomplete or inaccurate information. Finally, there is a selection bias in the study, as some patients did not undergo EGD due to delayed presentation, unstable hemodynamic status, or patient refusal, which may affect the accuracy of the study's results.

Conclusions

Patients with high-grade esophageal mucosal lesions experienced significant morbidity and mortality during the intermediate-term follow-up. On the other hand, patients with low-grade esophageal injury did not exhibit any adverse consequences during the follow-up period. Therefore, after an endoscopy shows a low-grade esophageal mucosal lesion, patients can be treated as outpatients. The follow-up is not necessary after one year if the patients did not experience any adverse event.

Disclosure statement

The authors declare that they have no conflict of interest.

References

- Hall AH, Jacquemin D, Henny D, Mathieu L, Josset P, Meyer B. Corrosive substances ingestion: a review. *Crit Rev Toxicol*. 2019;49(8):637-69.
- Lakshmi CP, Vijayahari R, Kate V, Ananthakrishnan N. A hospital-based epidemiological study of corrosive

alimentary injuries with particular reference to the Indian experience. *Natl Med J India*. 2013;26(1):31-6.

- Botwe BO, Anim-Sampong S, Sarkodie BD, Antwi WK, Obeng-Nkansah J, Ashong GG. Caustic soda ingestion in children under-5 years presenting for fluoroscopic examinations in an Academic Hospital in Ghana. *BMC Res Notes*. 2015;8:684.
- Sabzevari A, Maamouri G, Kiani MA, Saeidi M, Kianifar H, Jafari SA, et al. Clinical and endoscopic findings of children hospitalized in Qa'em Hospital of Mashhad due to caustic ingestion (2011-2013). *Electron Physician*. 2017;9(4):4248-50.
- Ducoudray R, Mariani A, Corte H, Kraemer A, Munoz-Bongrand N, Sarfati E, et al. The Damage Pattern to the Gastrointestinal Tract Depends on the Nature of the Ingested Caustic Agent. *World J Surg*. 2016;40(7):1638-44.
- Chibishev A, Simonovska N, Shikole A. Post-corrosive injuries of upper gastrointestinal tract. *Prilozi*. 2010;31(1):297-316.
- Millar AJ, Cox SG. Caustic injury of the oesophagus. *Pediatr Surg Int*. 2015;31(2):111-21.
- Le Naoures P, Hamy A, Lerolle N, Metivier E, Lermite E, Venara A. Risk factors for symptomatic esophageal stricture after caustic ingestion-a retrospective cohort study. *Dis Esophagus*. 2017;30(6):1-6.
- Cheng HT, Cheng CL, Lin CH, Tang JH, Chu YY, Liu NJ, et al. Caustic ingestion in adults: the role of endoscopic classification in predicting outcome. *BMC Gastroenterol*. 2008;8:31.
- Chibishev A, Pereska Z, Simonovska N, Chibisheva V, Glasnovic M, Chitkushev LT. Conservative therapeutic approach to corrosive poisonings in adults. *J Gastrointest Surg*. 2013;17(6):1044-9.
- Zargar SA, Kochhar R, Mehta S, Mehta SK. The role of fiberoptic endoscopy in the management of corrosive ingestion and modified endoscopic classification of burns. *Gastrointest Endosc*. 1991;37(2):165-9.
- Kochhar R, Ashat M, Reddy YR, Dhaka N, Manrai M, Sinha SK, et al. Relook endoscopy predicts the development of esophageal and antropyloric stenosis

- better than immediate endoscopy in patients with caustic ingestion. *Endoscopy*. 2017;49(7):643-50.
13. Havanond C, Havanond P. Initial signs and symptoms as prognostic indicators of severe gastrointestinal tract injury due to corrosive ingestion. *J Emerg Med*. 2007;33(4):349-53.
 14. Havanond C. Clinical features of corrosive ingestion. *J Med Assoc Thai*. 2003;86(10):918-24.
 15. Cabral C, Chirica M, de Chaisemartin C, Gornet JM, Munoz-Bongrand N, Halimi B, et al. Caustic injuries of the upper digestive tract: a population observational study. *Surg Endosc*. 2012;26(1):214-21.
 16. Zerbib P, Voisin B, Truant S, Saulnier F, Vinet A, Chambon JP, et al. The conservative management of severe caustic gastric injuries. *Ann Surg*. 2011;253(4):684-8.
 17. Chibishev A, Pareska Z, Chibisheva V, Simonovska N. Clinical and epidemiological features of acute corrosive poisonings. *Med Arch*. 2012;66(3 Suppl 1):11-5.
 18. Bharath Kumar C, Chowdhury SD, Ghatak SK, Sreekar D, Kurien RT, David D, et al. Immediate and long-term outcome of corrosive ingestion. *Indian J Gastroenterol*. 2019;38(4):356-61.