ORIGINAL ARTICLE

Predictive Factors of Gastrointestinal Caustic Injury According to Clinical and Endoscopic Findings

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Abstract

Background: Ingestion of caustic substances is the main reason for referral to Philippines National Poison Management and Control Center among other causes of acute poisoning. Rapid assessment of severity of injury is important for treatment and prognosis of these cases. This study was aimed to investigate the correlation of clinical factors with severity of gastrointestinal (GI) mucosal injury.
Methods: In this retrospective study, a total of 105 patients were included. Patients were categorized into two groups including 35 patients with low grade and 70 patients with high grade GI injury to compare the predictive value of clinical findings.
Results: Mean (SD) age of patients was 27 (10) and 47% of patients were male. Oral burns (P<0.001), dysphagia (P=0.001), hematemesis (P<0.001), number of presenting symptoms (P=0.001), and type of substance consumed (P<0.001) were significantly different between patients with high grade and low grade GI injuries. Multivariate analysis showed that only leukocytosis was a significant predictor of higher grades of GI injury (OR=17.3, P=0.004). Nevertheless, dysphagia (OR=8.1), and higher number of manifestations (OR=2.8) on initial evaluation could be considered as weak factors as they did not reach significance (P=0.09).
Conclusion: Following caustic substance injury, prompt assessment of severity of GI injury according to endoscopic and physical examinations can facilitate better treatment plan and prognosis. Patients with leukocytosis should be more carefully monitored as they might be injured with higher grades of GI mucosal lesions.

Keywords: Caustic substance ingestion; Endoscopy; Predictive factor; Poisoning; Gastrointestinal injury

INTRODUCTION

Caustic substance ingestion is the most common reason of referral to Philippines National Poison Management and Control Center among other causes of acute poisoning. According to available information, each year, 23% of 500 poisoned patients referred to this center are due to caustic ingestion (1).

Early assessment of severity of Gastrointestinal (GI) injury is important for better management of caustic injuries and helps to determine prognosis (2). The gold-standard method to safely assess the depth and extent of injury and to devise appropriate therapeutic regimen is still esophagogastroduodenoscopy (3). In our clinic, endoscopic examination is performed for patients with history of corrosive ingestion within 24 hours post-admission, under local anesthesia with supportive medical treatment using either proton pump inhibitors or H_2 blockers.

Evaluation of predictive values of clinical manifestations following a caustic injury can be an important step to elaborate treatment protocols, determine the grade of GI injury and improve assessment of prognosis. This study is designed to investigate the predictive factors of caustic injury and to analyze the correlation of clinical manifestations and severity of GI injury based on endoscopic findings.

METHODS

Study Design

This retrospective study was conducted in a tertiary hospital in Manila, Philippines. 105 patients with over 18 years of age and with history of caustic substance ingestion including hydrochloric acid, silver jewellery cleaner (alkaline), sodium hypochlorite (alkaline) and sodium hydroxide (alkaline) who underwent endoscopic examinations were included in this study. Patients were categorized into two groups including 35 patients with high-grade injury (at least one severe lesion which means grade 2b and higher based on Zargar's scale) and 70 patients with low-grade injury (grade 2a and lower) either on esophagus, stomach or duodenum. A sample size of 105 comprising of 35 cases and 70controls was estimated to achieve 80% power with 95% confidence level.

Evaluation of Outcome

Main outcome was based on the endoscopic findings which are routinely recorded by gastroenterology fellows. Grading of the GI lesions was based on Zargar's scale (4,5) as follows: grade 0: normal findings, grade 1: mucosal edema or hyperemia, grade 2a: friability, hemorrhage, erosion, blisters, whitish membrane, exudates and superficial ulcer, grade 2b: grade 2a plus deep discrete or circumferential ulceration, and grade 3: multiple ulcerations

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and areas of necrosis. Grades 0, 1, and 2a were defined as low-grade injuries, whereas grades 2b and 3 were defined as high-grade injuries. In this study, leukocytosis was defined as white blood cell (WBC) count over 11000.

Ethics and Data Collection

The study was conducted according to the Declaration of Helsinki. All data was abstracted by the principal investigator and research assistant. Data collection was commenced after full approval of institution review board.

Statistical Analysis

Categorical data was summarized as frequencies and percentages, and continuous data were reported as mean and standard deviation. Chi square test was used to determine significant clinical manifestations associated with outcome. To determine predictive factors, logistic regression analysis was used. To analyze the correlation of a combination of signs and symptoms with endoscopic findings, Cramer V or Phi tests were used. Data analysis was performed using the statistical package of social sciences (SPSS) for Windows (SPSS Inc., Chicago, IL, USA).

RESULTS

Demographics

A total of 105 patients who presented in emergency department within 24 hours of corrosive ingestion were studied. Initial endoscopy was done within 24-48 hours post-ingestion. Among patients, mean (SD) age was 27 (10) years and 47% were male. All cases were intentional in nature.

Regarding site of injury and type of agent (acid or alkali), there was no significant difference between low-grade and high-grade cases (P= 0.54) (Figure 1). There was, however, a predominance of more severe injury in the gastric area among acids (Figure 1). Moreover, almost all patients with ingestion of silver jewellery cleaning products had low grade GI injury, while most patients with ingestion of hydrochloric acid and sodium hypochlorite experienced high grade injuries (Table 1). Analysis of silver jewellery cleaners showed a pH range of 10-12 with cyanide salts as active ingredient. Among low-grade cases, 40% were due to acid ingestion, 60% were due to alkali and among high-grade cases 51% were due to acid and 49% were due to alkali ingestion.

As shown in table 1, oral burns (P<0.001), dysphagia (P=0.001), hematemesis (P<0.001), number of presenting symptoms (P=0.001), and type of substance consumed (P<0.001) were significantly different between high-grade and low-grade cases. Moreover, four combinations of clinical manifestations were studied according to low-grade and high-grade cases. Combination A (P=0.014), C (P=0.03) and D (P=0.002) were found to be significantly associated with higher grades of GI mucosal injury (Table 2). It should be noted that not all combinations of possible clinical presentations were studied.

Predictors of Severe Caustic Injury

To evaluate independent contribution to the risk for high-grade GI mucosal injury, all factors with P<0.05 were modeled with logistic regression. Through multivariable

Table 1. Comparison of clinical manifestations following caustic ingestion between patients with low grade and high grade GI injury

Clinical Factors	High-grade GI injury (n; 35) No. (%)	Low-grade GI injury (n; 70) No. (%)	P value
Oral burns	21 (60.0)	14 (20.0)	<0.001*
Dysphagia	21 (60.0)	18 (25.7)	0.001*
Leukocytosis	7 (20.0)	12 (17.1)	0.64
Abdominal pain	28 (80.0)	33 (47.1)	0.003*
Hematemesis	22 (62.8)	33 (47.1)	<0.001*
Substance type			<0.001*
Hydrochloric acid	19	8	<0.001*
Sodium Hypochlorite	25	11	0.001*
Sodium Hydroxide	6	6	0.193*
Silver Jewelry Cleaner	1	31	<0.001*

* Level of significance, 95%; α=0.05

Table 2. Correlation of combinations of clinical manifestations with severity of GI injury

Clinical Presentation	High-grade GI injury	Low-grade GI injury	Chi Square P value	Phi
A: Abdominal pain + Dysphagia + Oral Ulcers	12	9	0.014*	0.24
B: Abdominal pain + Dysphagia + Leukocytosis	5	5	0.271	0.107
C: Abdominal pain + Oral ulcers + Leukocytosis	4	7	0.03*	0.212
D: Abdominal pain + Dysphagia + Oral ulcers + Leukocytosis	5	0	0.002*	0.3

* Level of significance, 95%; α=0.05

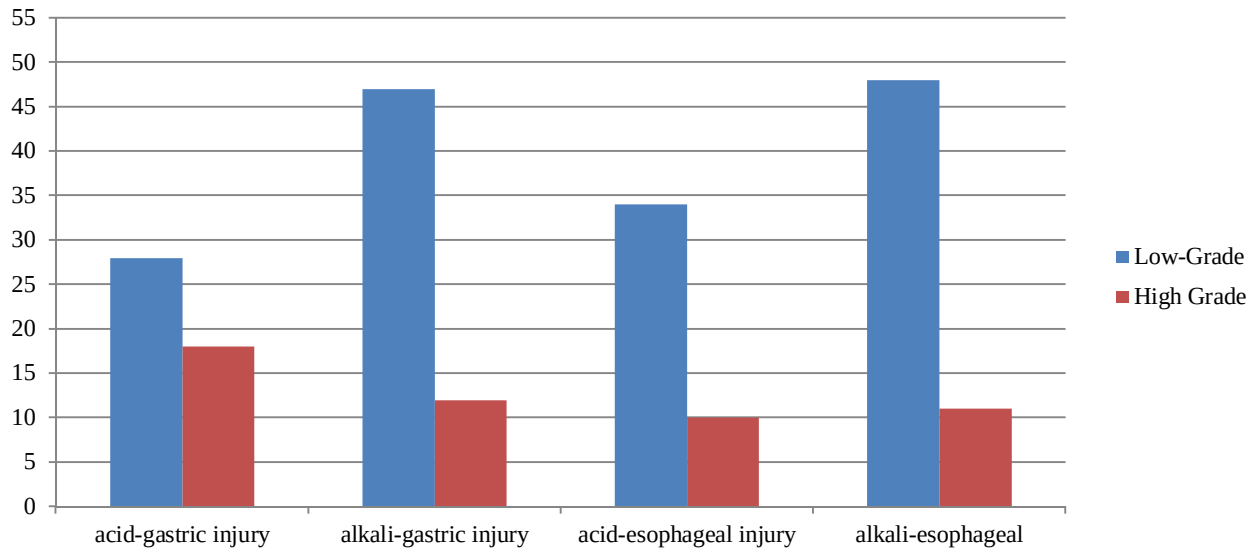

Figure 1. Comparison of Low-grade GI injury and High-grade GI injury on Number and Site of GI lesions

analysis, after excluding confounding factors, only the presence of leukocytosis was found to be significantly associated with higher grades of GI injury (OR=17.3, P= 0.004). However, two other factors including dysphagia (OR=8.1, P=0.09) and higher number of manifestations (OR=2.8, P=0.09) can be considered as having predictive values, though they did not reach statistical significance.

DISCUSSION

In this study, we investigated the predictive value of clinical and laboratory findings on determining the extent of GI mucosal damage following caustic substance ingestion. We found that oral burn, abdominal pain, hematemesis and dysphagia were significantly associated with high grade GI injury. Similarly, in one study which 378 pediatric cases following caustic ingestion were enrolled, it was found that vomiting, dysphagia, excessive salivation and abdominal pain were significantly correlated to grade 2 or 3 esophageal lesions (6). In spite of this, the authors concluded that signs and symptoms do not adequately predict the severity of esophageal lesions (6). Nevertheless, a prospective study on 79 patients younger than 20 years old by Crain et al. showed that presence of two out of three serious manifestations including vomiting, drooling, and stridor are reliable predictors of esophageal injury (7). In our local setting, an prospective study on 320 patients who ingested caustic agents showed a six-fold risk of having severe mucosal injury in the presence of any of the manifestations including oral lesions, drooling, vomiting, abdominal pain and dysphagia (M.C. Dizon and G. Gregorio, unpubl. data). In addition, in a recent study by Brusin et al. it was demonstrated that severe manifestations following acetic acid ingestion including laryngeal edema, pneumonia and GI bleeding were significantly associated with higher Zargar's grades (8). Havanod et al. developed a simple chart utilizing the signs, symptoms and laboratory parameters to predict the extent of caustic injury (9). They found that drooling, buccal mucosa injury and white blood cell count are independent predictors for high-grade injury (Zagar's grade 2b and 3) (9).

In the present study, it was found that leukocytosis was the only significant risk factor of severer GI injury. However, dysphagia and higher numbers of clinical manifestations were found to be weak factors. Correspondingly, Havanod et al. showed that only high WBC count on initial presentation was the main predictive indicator of high-grade caustic injury. This can be explained by the pathophysiological basis of caustic injuries as in the first hours eosinophilic necrosis with edema and intense hemorrhagic congestion occur (10). Hence, the increasing values of WBC can predict the extent of reactive caustic inflammation and necrosis.

In this study, it was found that more clinical manifestations on presentation were positively associated with high-grade caustic injury which was similar to previous studies (6-16). Ferguson et al. showed that among patients with esophageal burns following alkali ingestion, higher number of symptoms was correlated to more severe GI injury (11). Moreover, Crain et al. and Gorman et al. demonstrated that the presence of at least 3 positive clinical findings can reliably predict the worseness of GI damage (7,12).

Along with number of manifestations, other risk factors such as type of ingested substance and amount of the substance ingested should also be taken into account. In this regard, Brusin et al. ascertained that ingestion of higher volumes of acid is related to higher grades of GI injury (8). Likewise, we found that most patients who ingested hydrochloric acid had high-grade injuries.

LIMITATIONS

Problems and biases inherent to this type of study design

are reverse association and sampling bias. These were addressed using statistical control group and also multivariate analysis. The results of the study were only limited to ingestion of some specific caustic substances such as silver jewellery cleaner, hydrochloric acid, sodium hydroxide and sodium hypochlorite. In this study, 4 combinations of clinical manifestations were compared against two groups of patients. However, we could not analyze all possible combinations of clinical presentations.

CONCLUSION

More accurate prognosis of a patient with caustic substance ingestion depends on rapid assessment of severity and early appropriate supportive care in the emergency department. According to this study, patients with more clinical manifestations should be more carefully monitored as they might be injured with higher grades of GI mucosal lesions. Some objective manifestations including increased WBC count and dysphagia could also be used as a guide in assessment of the severity of injury.

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REFERENCES

1. Philippine General Hospital. National Poison Management and Control Center. Philippine General Hospital Annual Census (2008-2009). Manila: University of the Philippines; 2009.
2. Ramasamy K, Gumaste VV. Corrosive ingestion in adults. J Clin Gastroenterol 2003 Aug;37(2):119-24.
3. Pace F, Antinori S, Repici A. What is new in esophageal injury (infection, drug-induced, caustic, stricture, perforation)? Curr Opin Gastroenterol 2009 Jul;25(4):372-9.
4. Zargar SA, Kochhar R, Nagi B, Mehta S, Mehta SK. Ingestion of corrosive acids. Spectrum of injury to upper gastrointestinal tract and natural history. Gastroenterology 1989 Sep;97(3):702-7.
5. 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 Mar-Apr;37(2):165-9.
6. Gaudreault P, Parent M, McGuigan MA, Chicoine L, Lovejoy FH Jr. Predictability of esophageal injury from signs and symptoms: a study of caustic ingestion in 378 children. Pediatrics 1983 May;71(5):767-70.
7. Crain EF, Gershel JC, Mezey AP. Caustic ingestions. Symptoms as predictors of esophageal injury. Am J Dis Child 1984 Sep;138(9):863-5.
8. Brusin KM, Krayeva YV. Highly Concentrated Acetic Acid Poisoning: 400 Cases Reviewed. Asia Pac J Med Toxicol 2012 Dec;1(1):3-9.
9. Havanond C, Havanond P. Initial signs and symptoms as prognostic indicators of severe gastrointestinal tract injury due to corrosive ingestion. J Emerg Med 2007 Nov;33(4):349-53.
10. Haller JA Jr, Andrews HG, White JJ, Tamer MA, Cleveland WW. Pathophysiology and management of acute corrosive burns of the esophagus: results of treatment in 285 children. J Pediatr Surg 1971 Oct;6(5):578-84.
11. Ferguson MK, Migliore M, Staszak VM, Little AG. Early evaluation and therapy for caustic esophageal injury. Am J Surg 1989 Jan;157(1):116-20.
12. Gorman RL, Khin-Maung-Gyi MT, Klein-Schwartz W, Oderda GM, Benson B, Litovitz T, et al. Initial symptoms as predictors of esophageal injury in alkaline corrosive ingestions. Am J Emerg Med 1992 May;10(3):189-94.
13. Betalli P, Falchetti D, Giuliani S, Pane A, Dall'Oglio L, de Angelis GL, et al. Caustic ingestion in children: is endoscopy always indicated? The results of an Italian multicenter observational study. Gastrointest Endosc 2008 Sep;68(3):434-9.
14. Wason S. The emergency management of caustic ingestions. J Emerg Med 1985;2(3):175-82.
15. 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 Jul 25;8:31. doi: 10.1186/1471-230X-8-31.
16. Arévalo-Silva C, Eliashar R, Wohlgelernter J, Elidan J, Gross M. Ingestion of caustic substances: a 15-year experience. Laryngoscope 2006 Aug;116(8):1422-6.