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Original Contributions

INITIAL SIGNS AND SYMPTOMS AS PROGNOSTIC INDICATORS OF SEVERE GASTROINTESTINAL TRACT INJURY DUE TO CORROSIVE INGESTION

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□ **Abstract—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, not only for treatment, but also for hospitalization. We did a prospective study to determine the prognostic value of initial signs and symptoms as indicators of the degree of gastrointestinal injury. We found that drooling saliva, buccal mucosa burn, and white blood cell count were significant independent predictors. The simple chart, "Med-TU chart," has been developed. We consider it to be a useful tool for emergency physicians who evaluate patients with corrosive ingestions.** © 2007 Elsevier Inc.

□ **Keywords—Corrosive ingestion; caustic ingestion; upper gastrointestinal injury; endoscope; predicting factors**

INTRODUCTION

Cases of corrosive substance ingestion have become a significant concern in Thailand since the time of economic crisis. A number of people, especially industrial workers, deal with their stress and conflict by ingesting caustic products (1). There are two basic types of corrosive ingestion: accidental ingestions in which the amount of caustic substance is less, and intentional ingestions of varying amounts in which almost all patients are adolescents or adults (1). In 2000, The Division of Epidemiology, Ministry of Public Health, Thailand discovered 10.2 suicides by liquid substance and drug per 100,000 population. Corrosive products, which were commercially available as household cleaners, are ranked third after sleeping pills and insecticides (2). Household cleaning products containing alkali, acid, and detergents have varying biological injury patterns. Acid causes coagulation necrosis, whereas alkaline substances cause saponification or liquefaction necrosis. Clinical presentation depends on several factors such as type of substance, concentration, physical form, amount, and intent (3). Because rapid assessment of severity of injury is important for treatment, many studies are designed to show the correlation between the signs and symptoms at the moment of presentation and the severity of esophageal injury (3–8). If the absence of complications can be predicted, unnecessary hospitalization and treatment may be avoided (9).

There are no strict guidelines for endoscopy in corrosive ingestion patients. Several studies recommend that early endoscopy should be performed with care in symptomatic patients. High grade (2b and 3) injury can produce severe complications such as perforation or stricture (3–6). On the other hand, the routine use of endoscopic examination after corrosive ingestions is a matter of some debate (9–12). Christesen reported that no patient with grade 0, 1, or 2a esophageal injury developed treatment-demanding complication (9). However, whether initial signs and symptoms were useful in assessing the degree of upper gastrointestinal tract injury was still contentious (5,9,10).

In this prospective study, we aimed to identify the correlation between the clinical presentation and the severity of upper gastrointestinal tract injury from endo-

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Table 1. Detail of General Characteristics of Patients and Ingested Material

Demographic Data	Percent
Age (years)	
Median	22
Minimum-Maximum	2–61
Gender	
Male	23
Female	77
Substance	
Toilet disinfectant: strong acid	62
Toilet disinfectant: strong alkali	3
Household cleaner (ethoxy alcohol, sod. alkyl benzalkonium sulfone, isopropylene)	15
Detergent, dishwasher (liquid soap)	12
Bleach	7
Un-accessible container	1
Reasons for ingestion	
Intention	92
Accident	8

scopic findings. Furthermore, we sought to obtain criteria for patients who need endoscopic investigation to evaluate the degree of injury for further treatment.

PATIENTS AND METHODS

The Training Data Set

Cases of corrosive ingestion managed in Thammasat Hospital, a university hospital located in an industrial area in the north of Bangkok, formed the study group. All were evaluated by one surgeon. The patients' ages, symptoms, ingestion histories, and types of corrosive agents were recorded. Common manifestations included nausea, vomiting, oropharyngeal burn, drooling saliva, stridor, and hoarseness. Heart, lung, chest, and abdomen examinations, as well as complete blood counts were evaluated. Flexible endoscopic examination was performed under local anesthesia in all patients within 24 h after admission. Endoscopic finding indicate further investigations. After endoscopic evaluation, the amount of the corrosive material ingested was measured by asking patients who had under a grade 2b injury to drink water in an equivalent amount. However, this was not done in three patients who needed an emergency operation. The severity of upper gastrointestinal injury was classified as follows (4):

Grade 0: Negative finding

Grade 1: Edema and hyperemia of the mucosa

Grade 2a: Friability, hemorrhage, erosion, blisters, whitish membrane, exudates and superficial ulcer

Grade 2b: Degree 2a plus deep discrete or circumferential ulceration

Grade 3: Multiple ulcerations 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 ones. Endoscopic reports were reviewed without the knowledge of the initial signs and symptoms and routine investigation. The study was performed after obtaining proper informed consent.

Sample Size

The sample size was calculated using Schlesselman and Stolley's method to estimate the sample size for odds ratio 3, setting alpha = 0.05, and power of test 80% (13).

Data Analysis

Data are presented as description of frequency and percentages. Correlation between signs and symptoms, clinical finding, laboratory finding, and the presence of low- or high-grade injury were analyzed using Chi-square or Fisher exact test or unpaired *t*-test if appropriate. A *p*-value of < 0.05 was considered statistically significant. Stepwise logistic regression was performed to assess the set of independent predictors of upper gastrointestinal tract severity (14).

The Testing Data Set

The testing data set for corrosive ingestions presenting July 2004 to December 2005 in the same hospital were used for analysis. Initial symptoms and endoscopic examination were performed within 24 h after admission. Endoscopic examination was performed blinded to the clinical presentation. Calculations were made to derive the sensitivity, specificity, positive predictive value, neg-

Table 2. Presenting Clinical Signs and Symptoms (n = 148)

Clinical Signs and Symptoms	Percent
Nausea or vomiting	84
General appearance	
Depressed	5
Drowsy	5
Hoarseness	14
Drooling saliva	24
Stridor	2
Visible lesions	
Lip: Hyperesia or superficial ulcer	33
Buccal mucosa: Hyperesia or superficial ulcer	43
Tongue: Hyperesia or superficial ulcer	44
Palate: Hyperesia or superficial ulcer	49
Abdomen	
Slight guarding	2
Tender	34