

원 저

부식제 중독 환자에서 시간에 따른 내시경 합병증 비교

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Comparing the Possible Complications of Endoscopy Dependent on Time in Caustic Poisoned Patients

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Purpose: Endoscopy has been recommended as a primary procedure for determining the extent of damage and prognosis in patients with caustic ingestions. Endoscopy within the first 24 hours has been suggested, however, such immediate endoscopy is not always possible. Therefore, we wanted to determine complications and possible delayed sequelae after the endoscopy performed dependent on time, including less than 24 hours and more than 24 hours, after ingestion of relatively high toxic caustic agents.

Methods: From January 2005 to May 2013, 105 consecutive patients were diagnosed with caustic poisoning in the emergency department of the Wonju Severance Christian Hospital. Out of 95 patients who underwent endoscopy, while excluding 49 patients who ingested sodium hypochlorite and 15 patients due to insufficient data, 41 patients were ultimately included. We compared general characteristics, complications related to endoscopy, late sequelae, total admission length, and mortality between two groups.

Results: Twenty eight patients (68.3%) were diagnosed with acid ingestion. Median endoscopy time was 17.8 (IQR 9.7-36.9) hours and performed in 16 patients (39%) after 24 hours. There were no complications, such as perforation and bleeding in either endoscopy within 24 hours group or endoscopy after 24 hours group. In addition, no difference in ingested materials, endoscopy grade, or late sequelae was observed between endoscopy within 24 hours group and endoscopy after 24 hours group.

Conclusion: No difference in complications and late sequelae was observed between endoscopy within 24 hours group and endoscopy after 24 hours group when endoscopy was performed based on a clinician's assessment.

Key Words: Caustics, Endoscopy, Complication

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Introduction

Careless or intentional ingestion of acidic and alkaline agents is relatively common and often leads to severe morbidity and sometimes death, and the frequency of these injuries continues to increase in

developing countries^{1,2}.

In patients with caustic ingestion, endoscopy has been recommended as the primary procedure for determining the extent of damage and the prognosis^{3,4}. Endoscopy within the first 24 hours has been suggested to evaluate damage of caustic esophageal injury, even though there were cases that up to 96 hours after the injury were safe and reliable in Zargar et al. study⁵. There are two benefits if endoscopy is performed early. Firstly, if no injury in gastrointestinal tract, patients can be discharged more rapidly from the hospital. In fact, more than 50% of patients with a history of caustic ingestion have no evidence of injury to the gastrointestinal tract⁶. Secondly, patients with evidence of severe injury can be quickly and appropriately managed⁷.

We have compared the complications and possible delayed sequelae after the endoscopy performed dependent on time, including less than 24 hours and more than 24 hours, after ingestion of relatively high toxic caustic agents. For mild caustics such as sodium hypochlorite, the endoscopy time is not relatively important due to their mild toxicity.

Materials and methods

1. Patients

From January 2005 to May 2013, 105 consecutive patients were diagnosed with caustic poisoning in the emergency department (ED) of the Wonju Severance Christian Hospital, Wonju College of Medicine, Yonsei University. Of these, 95 patients underwent endoscopy. However, forty-nine patients who ingested sodium hypochlorite were excluded because sodium hypochlorite such as detergents and household bleach were not generally high toxic caustics. Fifteen patients were also excluded from the analysis because of insufficient data. Even though fifteen patients were excluded, all these patients did not have endoscopy related complications. Therefore, 41 consecutive patients were ultimately included in the study. From 2005 to 2013, the number of patients seen in our hospital ED averaged between 26,089 and 40,465.

2. Measurements

Data were retrospectively collected from medical records. Caustic ingestion was confirmed by either

Table 1. Endoscopic classification of caustic injuries

Grade	Features
Grade 0	Normal examination
Grade 1	Edema and hyperemia of the mucosa
Grade 2a	Friability, hemorrhages, erosions, blisters, whitish membranes, exudates and superficial ulcerations
Grade 2b	Grade 2a plus deep discrete or circumferential ulceration
Grade 3	Multiple ulcerations and areas of necrosis

Reproduced from Zargar et al.⁵

Table 2. Esophageal computed tomography (CT) grading of caustic injuries in esophagus

Grade	CT finding
Grade I	No definite swelling of esophagus wall (<3 mm, within normal limit)
Grade II	Edematous wall thickening without periesophageal soft tissue infiltration (3~5 mm wall thickening)
Grade III	Edematous wall thickening with periesophageal soft tissue infiltration plus well demarcated tissue interface (5~20 mm wall thickening)
Grade IV	Edematous wall thickening with periesophageal soft tissue infiltration plus blurring of tissue interface or localized fluid collection around esophagus or descending aorta (>20 mm wall thickening)

Reproduced from Ryu et al.⁸

patients or guardian statements, and verification of the ingested agent was performed by an emergency physician who transcribed the bottle label into patient records.

The following parameters were assessed: age, gender, cause of poisoning (acid or alkali), amount of ingested agent, presence of intentionality, elapsed time from ingestion to endoscopy, endoscopy grade (Table 1)⁵⁾, endoscopy complications (perforation, severe bleeding, and interactions with sedative medications), computed tomography (CT) grade (Table 2)⁸⁾, initial symptoms, and late sequelae (esophageal stricture, gastric outlet obstruction, esophageal dysmotility, and severe gastroesophageal reflux disease [GERD]). Ingested amounts were interpreted as follows: "a little" or "a spoonful" was taken to be 5 mL, "a mouthful" was presumed to be 25 mL, "a small cup" was presumed to be 100 mL, and "a bottle" was presumed to be 300 mL⁹⁾. Arterial blood gas analysis and lactate were evaluated. Patients were classified into two groups, including endoscopy within 24 hours group and endoscopy after 24 hours group.

We compared the general characteristics, complications related to endoscopy, late sequelae, total admission length, and mortality between two groups. The study was approved by the institutional review board committee of Wonju College of Medicine, Yonsei University (approval number: YWMR-13-5-033).

3. Statistical analysis

Statistical analyses were performed using SPSS software for Windows (version 20.0 K, SPSS Inc., Chicago, IL, USA). Nominal data are presented as frequencies and percentages, and continuous variables are presented as mean and standard deviation (SD) and median and interquartile range (IQR) after investigating for normality using the Shapiro-Wilk test. The chi-square test and Fisher's exact test were used for comparison of nominal variables while the two-sample t-test and Mann-Whitney U test were used for comparison of continuous variables. P-values less than 0.05 were considered statistically significant.

Results

1. The characteristics of patients with caustic poisoning

A total of 41 patients were selected for this study. There were 20 male patients (48.8%), and age range of all patients was 1 to 83 years with a mean of 47.3 ± 22.1 years. Twenty eight patients (68.3%) ingested an acidic substance, and glacial acetic acid was the most commonly ingested substance (23 patients, 56.1%). Nineteen patients (46.3%) had been intentionally exposed to caustic agents. Median endoscopy time and median ingested amounts were 17.8 (IQR 9.7-36.9) hours and 25 (15~100) mL, respectively. Patients with endoscopy after 24 hours were 16 patients (39%). The causes of a delayed endoscopy study was mostly due to the patient's unstable vital status: hemodynamic instability (7 patients, 43.8%), bleeding (2 patients, 12.5%), and severe drooling (2 patients, 12.5%). Other than the patient's vital instability, the delayed endoscopy was due to the decision of internal medicine physician on duty that emergent endoscopy was not necessary, especially at night-time (3 patients, 18.8%). There was no medical documentation for the cause of delayed procedure for the other 2 patients (Table 3).

The most common endoscopy grades⁵⁾ were 2a (19 patients, 46.3%), grade 1 (10 patients, 24.4%), grade 0 (7 patients, 17.1%), grade 2b (4 patients, 9.8%), and grade 3 (1 patient, 2.4%). With regards to CT grade⁸⁾, grade II was the most common (6 patients, 54.5%). There were no complications related to endoscopy, and the most common injury site was the esophagus (34 patients, 82.9%) (Table 3).

Late sequelae after caustic poisoning were seen in nine patients (22.0%). These included esophageal stricture (6 patients, 14.6%), severe gastroesophageal reflux (3 patients, 7.3%), gastric outlet obstruction (1 patients, 2.4%), and esophageal dysmotility (1 patients, 2.4%), respectively. Median total admission length was 10.0 (IQR 5.5-18.5) days and mortality was one patient (2.4%) (Table 3).

Table 3. General characteristics and laboratory findings of caustic poisoning patients

Characteristics	All	Endoscopy within 24 hours (n=25)	Endoscopy after 24 hours (n=16)	p-value
Age (yrs)	47.3±22.1*	49.2±21.6*	44.3±23.1*	0.500
Male gender	20 (48.8%)	10 (40.0%)	10 (62.5%)	0.160
Children and adolescent	4 (9.8%)	1 (4.0%)	3 (18.8%)	0.281
Intentional poisoning	19 (46.3%)	11 (44.0%)	11 (68.8%)	0.121
Acid	28 (68.3%)	17 (68.0%)	11 (68.8%)	0.960
Liquid	39 (95.1%)	25 (100 %)	14 (87.5%)	0.146
Ingested materials				0.865
Glacial acetic acid	23 (56.1%)	13 (52.0%)	10 (62.5%)	
Lye	8 (19.5%)	5 (20.0%)	3 (18.8%)	
Hydrochloric acid	7 (17.1%)	5 (20.0%)	2 (12.5%)	
Sodium hydroxide	1 (2.4%)	0 (0.0%)	1 (6.3%)	
Sodium polyphosphate	1 (2.4%)	1 (4.0%)	0 (0.0%)	
Potassium hydroxide	1 (2.4%)	1 (4.0%)	0 (0.0%)	
Ingested amounts	25 (15-100) [†]	25.0 (15.0-100.0) [†]	25.0 (12.6-100.0) [†]	0.757
Endoscopy times (hrs)	17.8 (9.7-36.9) [†]	11.7±5.9*	46.6±18.4*	0.352
Endoscopy within 24 hours	25 (61%)			
Endoscopy after 24 hours	16 (39%)			
Endoscopic grade				0.855
Grade 0	7 (17.1%)	4 (16.0%)	3 (18.8%)	
Grade 1	10 (24.4%)	7 (28.0%)	3 (18.8%)	
Grade 2a	19 (46.3%)	10 (40.0%)	9 (56.3%)	
Grade 2b	4 (9.8%)	3 (12.0%)	1 (6.3%)	
Grade 3	1 (2.4%)	1 (4.0%)	0 (0.0%)	
CT grade				1.000
Grade I	5 (45.5%)	3 (50.0%)	2 (40.0%)	
Grade II	6 (54.5%)	3 (50.0%)	3 (60.0%)	
Grade III	0 (0%)	0 (0.0%)	0 (0.0%)	
Grade IV	0 (0%)	0 (0.0%)	0 (0.0%)	
Injury site in endoscopy				
Mouth and pharynx	21 (51.2%)	14 (56.0%)	7 (43.8%)	0.444
Esophagus	34 (82.9%)	22 (88.0%)	12 (75.0%)	0.401
Stomach	19 (46.3%)	13 (56.5%)	6 (40.0%)	0.319
Duodenum	2 (4.9%)	1 (4.3%)	1 (6.7%)	1.000
Endoscopy complication	0 (0%)	0 (0.0%)	0 (0.0%)	
Initial symptom				
Sore throat	27 (65.9%)	18 (72.0%)	9 (56.3%)	0.300
Nausea and vomiting	24 (58.5%)	16 (64.0%)	8 (50.0%)	0.375
Hoarseness or stridor	2 (4.9%)	2 (8.0%)	0 (0.0%)	0.512
Dysphagia	9 (22.0%)	5 (20.0%)	4 (25.0%)	0.717
Chest pain	4 (9.8%)	3 (12.0%)	1 (6.3%)	1.000
Epigastric pain	19 (46.3%)	14 (56.0%)	5 (31.3%)	0.121
Bleeding	8 (19.5%)	5 (20.0%)	3 (18.8%)	1.000
Dyspnea	10 (24.4%)	8 (32.0%)	2 (12.5%)	0.265
Mental change	7 (17.1%)	3 (12.0%)	4 (25.0%)	0.401
pH	7.41±0.06*	7.40±0.06*	7.43±0.05*	0.160
Base excess (mmol/L)	-3.3 (-5.5- -2.1) [†]	-3.4 (-6.3- -2.0) [†]	-3.2 (-3.8- -2.5) [†]	0.626
Lactate (mmol/L)	1.87 (1.53-2.81) [†]	1.74 (1.37-2.67) [†]	2.40 (1.95-4.17) [†]	0.147
Late sequelae	9 (22.0%)	7 (35.0%)	2 (13.3%)	0.244
Esophageal stricture	6 (14.6%)	4 (19.0%)	2 (13.3%)	1.000

continue

Table 3. General characteristics and laboratory findings of caustic poisoning patients

Characteristics	All	Endoscopy within 24 hours (n=25)	Endoscopy after 24 hours (n=16)	p-value
Severe gastroesophageal reflux	3 (7.3%)	2 (9.5%)	1 (6.7%)	1.000
Gastric outlet obstruction	1 (2.4%)	1 (4.8%)	0 (0%)	1.000
Esophageal dysmotility	1 (2.4%)	1 (4.8%)	0 (0%)	1.000
Outcome				
Total admission length (days)	10.0 (5.5-18.5) [†]	10.0 (5.5-18.5) [†]	10.0 (4.8-18.0) [†]	0.925
Mortality	1(2.4%)	1 (4.0%)	0 (0.0%)	1.000

* Mean \pm Standard deviation, [†] Median (interquartile range), CT: computed tomography

2. Comparison of endoscopy within 24 hours group and endoscopy after 24 hours group

There were no differences between endoscopy within 24 hours group and endoscopy after 24 hours group in terms of age (49.2 ± 21.6 vs. 44.3 ± 23.1 , $p=0.500$) and intentionality (11 patient [44.0%] vs. 11 patients [68.8%], $p=0.121$), respectively. Acid was ingested in 17 (68.0%) and 11 patients (68.8%) in the endoscopy within 24 hours group vs. endoscopy after 24 hours group ($p=0.960$), respectively. Also, there was no difference in ingested materials, endoscopy grade, CT grade, and late sequelae between the two groups. There were no complications related to endoscopy, such as perforation, bleeding, or interaction with sedative medications, in either group (Table 3).

Median total admission length was 10.0 (IQR 5.5-18.5) and 10.0 (IQR 4.8-18.0) days in the early and late endoscopy groups ($p=0.925$), respectively. One patient (4.0%) died in the endoscopy within 24 hours group while there were no deaths in the endoscopy after 24 hours group ($p=1.000$) (Table 3).

Discussion

When ingestion of caustic material occurs, prompt and adequate assessment of the location, extent, and severity of the injury lead to the optimal treatment needed and can be predictive of long-term outcome¹⁰. Endoscopy is the most efficient technique known for evaluating esophageal damage after caustic ingestion^{11,12}. However, recently, there has been controversy surrounding both the need for

endoscopy and the optimal timing of the procedure. Gorman et al¹³, and Gupta et al¹¹, suggested that endoscopy seemed unnecessary in asymptomatic patients with suspected caustic ingestion. Other studies have recommended that endoscopy be performed as promptly as possible^{12,14}. However, until recently, most experts agreed that endoscopy should ideally be performed within 24 hours postingestion because wound softening after caustic poisoning increases at 24 to 48 hours postinjury and is maximal between 5 and 14 days¹⁵, therefore increasing the risk of iatrogenic perforation. However, if these guidelines are strictly applied to all caustic poisoning cases, then patients who present more than 24 hours postingestion cannot undergo endoscopy and may therefore experience unnecessary fasting, treatment, and admission. Until recently, there were few studies which assessed the utility of late endoscopy following caustic poisoning⁵.

In this study, sixteen patients (39.0%) underwent endoscopy more than 24 hours post-ingestion based on a clinician's assessment. Causes of late endoscopy were due to patient's unstable status including bleeding, severe drooling, and, etc. The results demonstrated no endoscopy related complications in this endoscopy after 24 hours group and among sixteen patients, seven patients underwent endoscopy even more than 48 hours postingestion. One may assume that if a patient ingests highly toxic caustics, endoscopy will be performed more quickly, but this study demonstrated no differences in ingested caustics or amounts between the endoscopy within 24 hours group and endoscopy after 24 hours group (Table 3). We thought although the wound softening is true,

there were no significant differences because of the developed endoscopy skill and renovated fiberscope.

In Celiket al. study¹⁶⁾, sodium hypochlorite was the most commonly ingested material. However, in this study, we excluded sodium hypochlorite because endoscopy time is not relatively important in sodium hypochlorite poisoning due to their mild toxicity. However, in this study, unlike in western countries, glacial acetic acid was common ingested substance. Glacial acetic acid is used to make food, most commonly as a diluted solution in Korea⁸⁾, which would explain its prevalence.

This study revealed a higher prevalence of esophageal injuries than mouth and pharynx injuries (Table 3), implying that esophageal injury can occur without accompanying mouth and pharynx injury. Therefore, mouth and pharynx injury is not a reliable index of esophageal damage, which is similar to a previous report by Gorman RL et al¹³⁾.

This study had some limitations. It was a retrospective study and only involved single tertiary hospital. Therefore, a total number of caustics poisoning patients included in the study were not a large number, which might be the cause of having relatively mild toxicity patients were presented in the study.

Also, not all relevant assessment parameters could be included and ingested amount, ingested material, and ED arrival time after ingestion may not be accurate. Therefore, additional prospective studies with a large number of patients will be needed to further assess timing of endoscopy in patients with caustic poisoning.

Conclusion

There was no difference in the complications and late sequelae between endoscopy within 24 hours group and endoscopy after 24 hours group when endoscopy was performed based on a clinician's assessment.

Declaration of interest

The authors have no financial conflicts of interest.

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