

## Evaluation by Computed Tomography or Endoscopy After the Caustic Ingestion: Is Radiological Evaluation Alone Enough?

### *Kostik Madde Alımından Sonra Bilgisayarlı Tomografi veya Endoskopi ile Değerlendirme: Sadece Radyolojik Değerlendirme Yeterli mi?*

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#### ABSTRACT

**Aim:** We aimed to determine the correlation between endoscopic and computed tomography (CT) grading scores in patients presenting after caustic ingestion and to evaluate their effectiveness in predicting the severity of lesions.

**Material and Methods:** Patients aged 18 and older who presented to our emergency department due to caustic ingestion between 2019 and 2023 were included in the study. Clinical records of the patients were retrospectively analyzed.

**Results:** A total of 57 patients (27 males, 47.4%; 30 females, 52.6%) were included in the study. The mean age of the patients was 41.6 ( $\pm 17.0$ ) years. CT findings and emergency endoscopic evaluation results at the time of emergency department presentation were compared. When the CT scores were compared with the Zargar classification, statistically significant similarities were found for both the esophagus and the stomach.

**Conclusion:** This study suggests that CT evaluation in patients presenting with caustic ingestion may be as effective as emergency endoscopy. Additionally, for patients identified by CT as having a low likelihood of requiring an endoscopic intervention, treatment and follow-up may be feasible without performing emergency endoscopy.

**Keywords:** Caustic ingestion, computed tomography, Zargar's classification, mucosal injury, radiological classification

#### ÖZ

**Amaç:** Kostik madde alımı sonrası başvuran hastaların endoskopik ve bilgisayarlı tomografi derecelendirme skorları arasındaki korelasyonu belirlemeyi ve lezyon şiddetini öngörmedeki etkinliğini değerlendirmeyi amaçladık.

**Gereç ve Yöntemler:** Çalışmaya hastanemiz acil servisine 2019-2023 yılları arasında kostik madde alımı sonrası başvuran 18 yaş üzeri hastalar dahil edildi. Hastaların klinik kayıtları retrospektif olarak analiz edildi.

**Bulgular:** Çalışmaya 57 hasta (27 erkek, %47,4; 30 kadın, %52,6) dahil edildi. Hastaların yaş ortalaması 41,6 ( $\pm 17,0$ ) yıl idi. Acil servise başvuruda yapılan bilgisayarlı tomografi ve acil endoskopik değerlendirme sonuçları karşılaştırıldı. Bilgisayarlı tomografi skoru ile Zargar sınıflaması karşılaştırıldığında sonuçlarda hem özofagus hem de mide için istatistiksel olarak anlamlı benzerlik bulundu.

**Sonuç:** Bu çalışma kostik madde alımı ile başvuran hastalarda bilgisayarlı tomografi değerlendirmesinin acil endoskopi kadar etkili olabileceğini düşündürmektedir. Ayrıca, bilgisayarlı tomografi ile endoskopik girişim gerektirme ihtimalinin düşük olduğu tespit edilen hastalar için, acil endoskopi yapılmadan tedavi ve takip mümkün görünmektedir.

**Anahtar Kelimeler:** Kostik madde alımı, bilgisayarlı tomografi, Zargar sınıflaması, mukozal hasar, radyolojik sınıflama

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## Introduction

Ingestion of caustic substances is a rare gastrointestinal emergency that can lead to serious complications (1). As a result of the underreporting of caustic ingestion, epidemiological data on a global scale are limited, and the precise incidence of ingestion and prevalence of lesions such as strictures remain unknown (2, 3). While caustic ingestion in children is often unintentional (4), caustic ingestion in adults is often caused by suicidal thoughts and causes more severe injuries than in children (5, 6).

Caustic substances are basically classified as acidic, alkaline, and oxidizing agents according to their content. Strong acids cause coagulative necrosis or eschar, which inhibits deepening from a pathophysiological standpoint, whereas strong alkalis produce saponification or liquefaction effects that induce penetration. It is thought that alkalis cause liquefaction necrosis, which causes severe injuries right away at all levels of the digestive tract. However, transmural necrosis has been seen at all levels of the digestive tract after large amounts of both alkalis and acids (7).

The majority of patients present with transient, uncomplicated upper gastrointestinal tract injuries. A minority of patients necessitate surgical intervention, either as an emergency life-saving measure or in conjunction with other therapeutic modalities to address delayed sequelae of the injury (8). Emergency management of caustic ingestion is dependent on concurrent intervention and multidisciplinary collaboration. Patients exposed to caustic substances usually present to the emergency department after ingestion. After the emergency evaluation, computed tomography (CT) and/or esophagogastroduodenoscopy (EGD) are used to evaluate the injury status of patients (9). In recent years, for the evaluation of the extent of digestive damage in adults with caustic injuries, some studies suggest performing CT rather than endoscopy. For predicting the depths of esophageal wall involvement, CT showed superior performance to endoscopy. CT is believed to be a safe substitute for endoscopy in this setting (10-12).

In light of all these studies, although new algorithms have been proposed to approach the ingestion of caustic

substances, a consensus has still not been reached. Our aim in this study is to determine whether the endoscopic and CT rating scores of patients admitted after caustic substance ingestion are correlated and to review their effectiveness in predicting lesion severity.

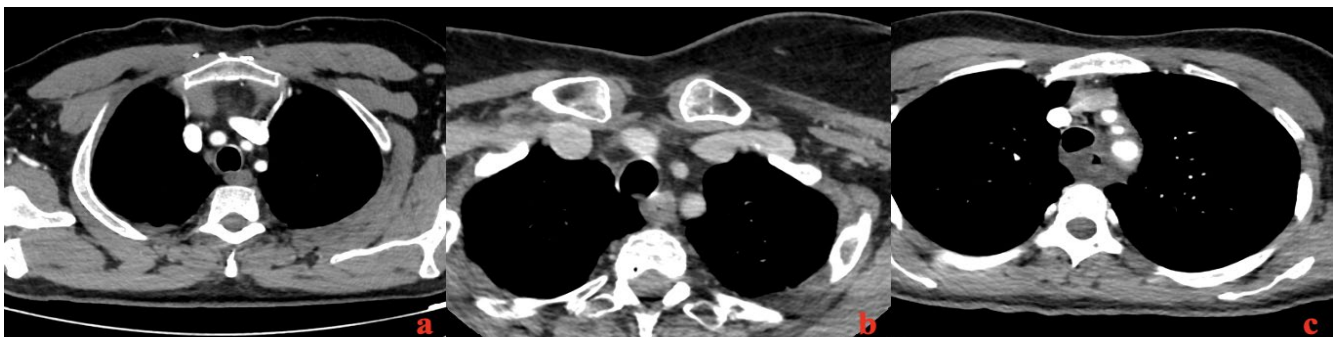
## Material and Methods

This study was a retrospective medical chart review of adult ( $\geq 18$  years) patients admitted to our hospital's emergency department between 2019 and 2023 for caustic ingestion. Patient medical records were reviewed to collect demographic data, the type and amount of the ingested substance, and the interval between ingestion and performing EGD. Patients who did not undergo endoscopic evaluation and/or CT were excluded from the study. Additionally, patients whose amount and type of caustic substance were unknown were excluded from the study.

Caustic substances ingested by the subjects were categorized into two main headings according to their content: acidic and alkaline. The volume of ingested substance was documented in milliliters (mL), with a normal sip ingestion defined as 30 mL and a large gulp ingestion defined as 60 mL.

EGD was performed by experienced endoscopists within 24 hours of ingestion, using three different video endoscopes (GIFQ 140, 145, and 160; Olympus Optical Co., Tokyo, Japan). Anesthesia was achieved through the administration of lidocaine spray to the oral cavity. Gentle insufflation and retrovision techniques were meticulously applied in cases of severe gastric injuries. Zargar et al. (13) established a modified endoscopic classification system to grade mucosal damage (Table 1). The radiologic assessment involved separate scoring of the esophagus and stomach using a previously defined scoring system (1) (Table 2). A single radiologist (Sarıaltın F.) performed this radiological evaluation. Examples of radiological classification are shown in Figure 1.

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**Figure 1.** Examples of radiological classification a) Grade 1, normal findings; b) Grade 2, diffuse edema, and increased wall contrast enhancement in the esophageal wall; c) Grade 3, findings consistent with necrosis of the esophageal wall showing diffuse edema and loss of contrast enhancement.

Grade	Findings
<b>Grade 0</b>	Normal examination
<b>Grade 1</b>	Edema and hyperemia of the mucosa
<b>Grade 2a</b>	Superficial ulceration, erosions, friability, blisters, exudates, hemorrhages, whitish membranes
<b>Grade 2b</b>	Grade 2a plus deep discrete or circumferential ulcerations
<b>Grade 3a</b>	Small, scattered areas of multiple ulceration and areas of necrosis with brown-black or greyish discoloration
<b>Grade 3b</b>	Extensive necrosis

**Table 1.** Zargar's grading classification of mucosal injury caused by ingestion of caustic substances.

Grade	Findings
<b>Grade 1</b>	Normal appearance
<b>Grade 2</b>	Wall and soft tissue edema, increased wall enhancement
<b>Grade 3</b>	Transmural necrosis with absent wall enhancement

**Table 2.** CT grading of corrosive injuries of the oesophagus and the stomach.

### Statistical Analysis

We employed IBM SPSS Statistics version 25.0, developed by IBM Corp. in Armonk, New York, USA, in our statistical investigations. We conducted the assessment of normality in the distribution of numerical values using the Kolmogorov-Smirnov test. Descriptive statistics, specifically mean  $\pm$  standard deviation, were reported for numerical variables demonstrating a normal distribution, while median with interquartile range was utilized for those lacking a normal distribution, as determined through distribution analysis outcomes. To compare categorical factors, the Chi-Square test was used. The p-value, cut-off value, precision, and sensitivity were also given. A two-tailed p-value  $<0.05$ , which means the statistical analysis found a significant finding.

### Results

The data of a total of 110 patients who presented to the emergency department after caustic substance ingestion was examined. We excluded 53 patients with missing data, no CT scan, or no urgent EGD from our analysis. A total of 57 patients, consisting of 27 (47.4%) males and 30 females (52.6%) with a mean age of 41.6 ( $\pm 17.0$ ), were included in our analysis.

When we classified ingested caustic substances, it was found that 33 (57.9%) patients ingested alkaline agents and 24 (42.1%) patients ingested acidic agents. The amount of ingested substance ranged from 5 mL to 600 mL. The mean time between ingestion and performing EGD was 9,04 ( $\pm 6,34$ ) hours.

The results of EGD in this study showed that grade 0 injuries were the most common caustic injury ( $n = 20$ , 35.1%), followed by grade 1 injuries ( $n = 13$ , 22.8%). Grade 2a injuries were on ten patients ( $n = 10$ , 17.5%), grade 2b injuries were on eight patients ( $n = 8$ , 14.0%), grade 3a injuries were on three patients ( $n = 3$ , 5.3%), and grade 3b injuries were on three patients ( $n = 3$ , 5.3%).

Table 3 displays the grading of the patients based on their emergency room CT scans and compares them with the EGD results. A statistically significant similarity was found in the CT scores for both the esophagus and stomach when compared with the Zargar's classification.

### Discussion

Our study results highlight a significant correlation between CT and endoscopic grading of caustic injuries, affirming the reliability of CT in assessing injury severity. Specifically, we observed that most injuries were classified as grade 0 or grade 1 by EGD, with corresponding mild findings on CT. This suggests that in low-grade cases, where endoscopic intervention may not alter the treatment plan, CT could serve as a non-invasive, reliable alternative for initial assessment. Additionally, the presence of higher-grade injuries on EGD correlated well with more severe findings on CT, underscoring the utility of CT in identifying patients who might require more intensive monitoring or intervention. For several decades, emergency management algorithms worldwide have relied on the endoscopic approach as the conventional method to detect esophageal injury. The primary objective of conducting an esophageal endoscopic examination subsequent to caustic ingestion is to confirm the existence, extent, and site of injury, all of which play an important part in guiding treatment choices and forecasting the prognosis (3, 6).

However, both patient-related conditions and inadequate clinic conditions can sometimes make endoscopic evaluation under emergency conditions difficult (14). Gorman et al. (15) were the first to critically evaluate the established practice of endoscopy in asymptomatic patients following unintentional caustic ingestion, paving the way for a paradigm shift in patient management. In addition, Lamireau et al. (16) and Cox and Eisenbeis further supported the limitation of endoscopy in asymptomatic pediatric patients from developed countries following accidental caustic substance ingestion (17).

Although there is no clear consensus on this issue in adult patients, it has been shown that evaluation with CT alone may be sufficient, especially in asymptomatic, low-level exposures (18, 19). Emergency management of caustic ingestion may be safely executed with the aid of computed tomographic evaluation, according to 2019 World Society of Emergency Surgery guidelines (20). In detecting transmural injuries of the gastrointestinal tract after caustic ingestion and in forecasting the formation of an esophageal stricture, emergency CT examination demonstrated superior performance compared to endoscopy, according to recent studies (11, 21, 22).

Endoscopic Classification	Grade 0 (n=20)	Grade 1 (n=13)	Grade 2a (n=10)	Grade 2b (n=8)	Grade 3a (n=3)	Grade 3b (n=3)	
Grading of Esophagus - CT	Grade 1, n=18	Grade 1, n=8	Grade 1, n=4	Grade 1, n=3	Grade 1, n=0	Grade 1, n=0	p<0.05*
	Grade 2, n=2	Grade 2, n=5	Grade 2, n=6	Grade 2, n=5	Grade 2, n=3	Grade 2, n=2	
	Grade 3, n=0	Grade 3, n=0	Grade 3, n=0	Grade 3, n=0	Grade 3, n=0	Grade 3, n=1	
Grading of stomach - CT	Grade 0, n=20	Grade 0, n=13	Grade 0, n=8	Grade 0, n=6	Grade 0, n=2	Grade 0, n=0	p<0.05*
	Grade 1, n=0	Grade 1, n=0	Grade 1, n=2	Grade 1, n=2	Grade 1, n=1	Grade 1, n=2	
	Grade 2, n=0	Grade 2, n=0	Grade 2, n=0	Grade 2, n=0	Grade 2, n=0	Grade 2, n=1	

**Table 3.** Radiological and endoscopic classification of the patients.

\*: To compare categorical factors, the Chi-Square test was used.

In our study, as a result of endoscopic evaluation, we found a statistically significant similarity with the CT grade result in all grades of Zargar's classification. However, the number of patients in the high-grade groups was insufficient. Although endoscopic evaluation is still the most valuable approach for the treatment plan and follow-up of patients, urgent endoscopic evaluation does not seem to be necessary in asymptomatic and low-grade patients who do not require endoscopic treatment. This implies the potential for selective use of urgent endoscopy, potentially reserving it for symptomatic individuals. Considering the costs and benefits of endoscopy, more studies are needed on this subject. Moreover, the integration of CT into emergency protocols could lead to a more streamlined and less invasive approach, reducing the burden on healthcare resources and minimizing patient discomfort. Future research should focus on establishing clearer guidelines and protocols that leverage the strengths of both CT and endoscopy, potentially creating a hybrid approach that optimizes patient outcomes while being mindful of resource allocation.

#### Limitations

The most important limitations of our study are that it is single-center, the number of patients is insufficient, and the patient population is heterogeneous. Additionally, the lack of long-term treatment and follow-up by the patients limits the ability of this study to draw conclusions about long-term outcomes. The evaluation of CT scans by a single radiologist in the study may also have caused bias in the results.

#### Conclusion

In patients presenting to the emergency department with caustic substance ingestion, evaluation with CT seems to be at least as successful as urgent endoscopic evaluation, and treatment and follow-up seem to be possible without emergency endoscopy, at least for patient groups that will not require endoscopic treatment as a result of CT.

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