Chapter

Acute Management in Corrosive Ingestion

Prasit Mahawongkajit

Abstract

Corrosive ingestion is an important health problem and medical emergency worldwide. It occurs by accident or by intention. Acids cause coagulation necrosis, and alkalis cause liquefaction necrosis. In the acute period, stabilization of the patient is most important. Airway assessment and prompt management are a priority for severe cases. Caustic substance reflux into the esophagus resulting in further damage should be prevented. The initial evaluation should be performed by endoscopy and graded according to the Zargar classification. Computed tomography (CT) should be used to assess injury to the esophagus because CT is non-invasive. For Zargar 3b injuries, views from both endoscopy and CT scans should be considered. Post-corrosive esophageal stricture is a complication that responds poorly to treatment. Research and development for stricture prevention are ongoing, especially for Zargar 2b and 3a cases.

Keywords: corrosive esophageal injury, caustic injury, esophageal perforation, post-corrosive esophageal stricture

1. Introduction

Corrosive ingestion is a medical emergency that is especially prevalent in developing countries such as Thailand [1–9]. Since 2020, the COVID-19 has had an enormous impact on many sectors worldwide, and it had affected the trend of rising incidence and severity of diseases [10]. However, the actual incidence should not be precise as the tip of the iceberg phenomenon is probably under-report [4, 8]. Currently, various studies on this topic are still being developed for medical knowledge to the achievement goal of the best practice. Perforation and stricture are complications of corrosive ingestion which are currently being researched and which are discussed in this chapter.

2. Cause of injury

Caustic injuries are caused by the ingestion of substances with acid or base properties. Acids cause coagulation necrosis, and alkalis cause liquefaction necrosis. Corrosive ingestion in children is usually accidental. In adults, it might be related to suicide. Therefore, it is a public health concern with mental and socioeconomic aspects [1, 2, 6, 11].

3. Impact of corrosive injury

Morbidity with mortality rates of corrosive injuries are high [12, 13]. Airway assessment and prompt management are priorities in emergency settings, especially in severe cases [2, 13, 14]. Extensive burns can cause the fragile esophageal wall to become perforated. Physicians must evaluate this condition as soon as possible. Stricture is another complication that physicians need to evaluate. Post-corrosive esophageal strictures cause patients to suffer and are difficult to treat [2–4, 9, 12, 15–19].

4. Pathophysiology

Caustic substances with pH less than two or more than 12 are especially destructive. Form, concentration, amount of ingestion, and contact duration also affect the results. Acidic substances generate coagulation necrosis which creates eschar formation. Eschar can limit the penetration of injuries [16]. On the other hand, alkaline substances melt the tissue protein and initiate liquefactive necrosis with saponification that can penetrate deeper into the esophageal wall [17].

Perforation occurs in the acute stage of severe esophageal injuries. As a consequence of perforation, stricture follows during the recovery stage. Tissue injuries after corrosive ingestion go through three phases. Phase 1 is characterized by cell necrosis and thrombosis, 48–72 hours after the event. Next, in Phase 2, there is mucosal sloughing with ulceration of the esophageal wall plus fibroblast colonization and granulation. This phase continues for 14 days from the Phase 1, and the esophagus is friable during this phase. Finally, in Phase 3, the healing process starts in the third week and usually continues 3–6 months [3, 20, 21].

5. Management

When patients arrive at the emergency department, stabilization of the patient is the most important target for this stage [21]. Signs and symptoms that often occur in corrosive ingested patients include burning of the oral cavity, drooling, nausea, and vomiting. Upper gastrointestinal bleeding can be found in severe cases, indicating substance injuries to the alimentary tract. Respiratory trauma can result in hoarseness, difficulty to breathe, stridor, and airway compromise. Esophagus perforation can be expressed as mediastinitis, chest wall emphysema, and pneumothorax, depending on time and severity.

Physicians should first examine the airway, especially for signs of aspiration or laryngeal injury. Physical examination and history taking should be done for details of the corrosive substance, the volume, timing before admission, pre-hospital treatment, and cause of ingestion. The patient should be given nil per os (NPO) and adequate resuscitation. Nasogastric tube intubation, gastric lavage, administration of emetic drugs, and neutralizing agents are not recommended because reflux of these agents into the esophagus could result in further damage [1, 8, 21]. Intravenous broad-spectrum antibiotics may benefit a patient with high-grade esophageal injuries. The investigation by chest and abdominal radiography should be evaluated. In cases of attempted suicide, the patient should be evaluated by the psychiatric department [1, 3, 4, 9, 22, 23].

The initial evaluation of the severity of a caustic injury provides important information. Esophagogastroduodenoscopy (EGD) is recommended for grading esophageal injuries following the Zargar classification (**Table 1**). Zargar classification can assist prognosis and guide clinical management [16]. The EGD should be done as soon as possible within 24–48 hours. Performing endoscopy after 48 hours

Zargar classification	Description
Grade 0	Normal finding on endoscopic examination
Grade 1	Edema and hyperemia of the mucosa
Grade 2a	Friability, blisters, exudates, hemorrhages, whitish membrane, erosions, and superficial ulceration
Grade 2b	Grade 2a plus deep discrete or circumferential ulceration
Grade 3a	Small scattered areas of multiple ulceration and areas of necrosis with brown-black or grayish discoloration
Grade 3b	Extensive necrosis

Table 1.
Zargar classification of corrosive esophageal injury.

Score	Endoscopic score [16]	Computerized tomography score [24]
0	Grade 0; Normal	Normal
I	Grade 1; Edema and hyperemia of the mucosa	No definite swelling of esophagus wall (<3 mm, within normal limit)
II	Grade 2a; Friability, blisters, exudates, hemorrhages, whitish membrane, erosion, and superficial ulceration	Edematous wall thickening (>3 mm) without periesophageal soft tissue infiltration
	Grade 2b; Grade 2a plus deep discrete or circumferential ulceration	
III	Grade 3a; Small scattered areas of multiple ulceration and areas of necrosis with brown-black or grayish discoloration	Edematous wall thickening with periesophageal soft tissue infiltration pulse well-demarcated tissue interface
	Grade 3b; Extensive necrosis	
VI	Grade 4; Perforation	Edematous wall thickening with periesophageal soft tissue infiltration plus blurring of tissue interface or localized fluid collection around the esophagus or the descending aorta

Table 2.
Endoscopic score and computerized tomography score of corrosive esophageal injury.

is not recommended because the tissue injuries go through Phase 2 when they should not be subjected to an unwanted event [16, 21]. For patients with Zargar grade 1 and 2a, an oral diet may be given. Patients with Zargar grade 2b and 3a can start an oral diet once they can swallow saliva. Esophagectomy should be performed on patients with Zargar grade 3b injuries.

The method for assessing the degree of esophageal damage by computed tomography (CT) with scoring was recently established as a noninvasive modality [24]. Nowadays, the use of CT scans of the chest and abdomen is increasing. CT can assist prognosis after ingestion, but it is still inconclusive [25–27]. CT also provides extraesophageal information regarding anatomies such as the mediastinum, lung, and pleural cavity, which endoscopies do not (**Table 2**).

6. Perforation

Although an endoscopy is an important tool for initial evaluation, contraindications are suspected perforation, oral cavity necrosis, and airway injury with compromised respiration. CT scans can safely provide details about esophageal transmural necrosis consisting of esophageal wall blurring, peri-esophageal fat stranding, and no enhancement of esophageal wall after administration of intravenous contrast [24]. Recent studies reported that unnecessary esophagectomy following endoscopic evaluation of patients with Zargar grade 3b could have been avoided if CT had been used [28–30].

Both CT and endoscopy have distinctive advantages. CT is minimally invasive with high sensitivity and specificity [24, 25, 27–30]. Intra-luminal evaluation by endoscopy reveals subtle details of the esophageal mucosa and degrees of damage [31]. The combination of CT and endoscopy is especially useful for examining patients with Zargar 3b injuries [8, 30, 31].

7. Stricture

As the esophagus is healing following ingestion of a corrosive substance, the possibility of stricture should be assessed. Post-corrosive esophageal stricture is a complication that produces suffering for victims [9, 15, 17]. Esophageal dilation is a therapeutic intervention of choice to perform at the onset of stricture. If left until later, the procedure becomes more difficult, decreasing the success and increasing adverse events [21, 32–36]. Esophageal dilatation can be performed repeatedly according to schedule and using various dilators such as Maloney-Hurst, Savary-Gilliard, and Balloon dilator under the endoscopy, fluoroscopy, or both. Alternative

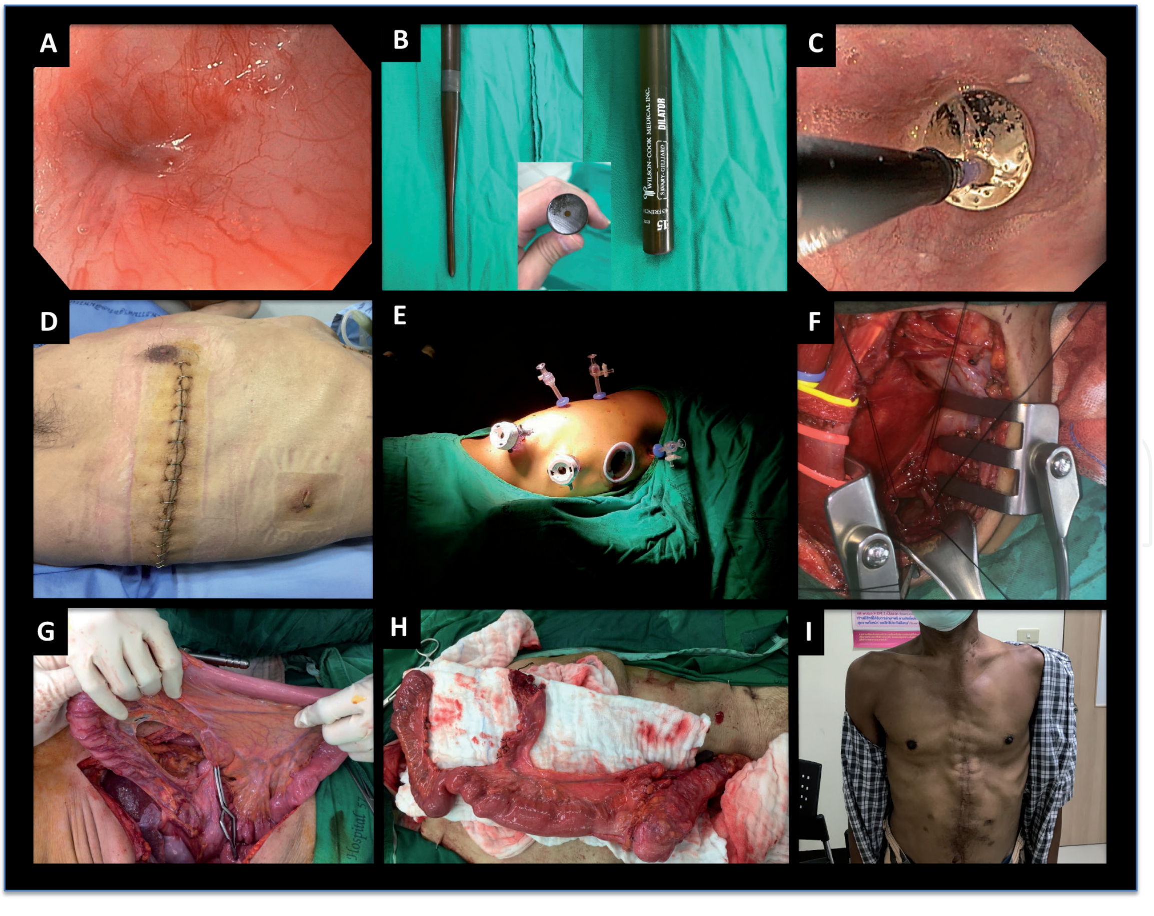

Figure 1.
The treatment options for post-corrosive esophageal stricture. (A) Severe post-corrosive esophageal stricture; (B) Savary-Gilliard dilator; (C) endoscopic balloon dilation; (D) esophagectomy with open right thoracotomy; (E) esophagectomy with video-assisted thoracoscopic surgery (VATS); (F) reconstruction with cervical anastomosis after esophagectomy; (G, H) right side colonic conduit for esophageal replacement; and (I) subcutaneous colon interposition.

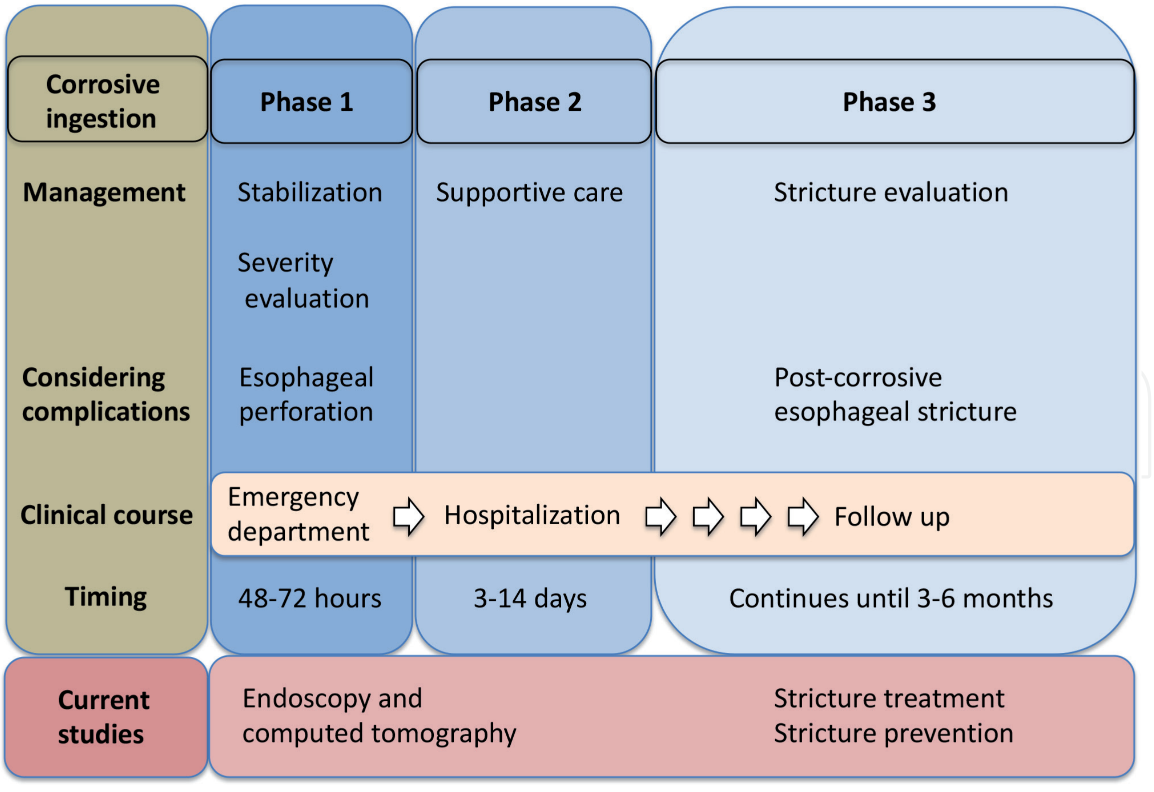

Figure 2.
Schematic diagram of corrosive ingestion in esophageal injury.

methods for post-corrosive esophageal stricture such as esophageal stenting [21, 37, 38], intralesional steroids [21, 39–43], and, Mitomycin-C [21, 44–48] have been published with various outcomes. These options might supplement dilation with better results. In cases of severe stricture, failure to dilate, or refractory strictures, surgery might be necessary (**Figure 1**) [4, 18, 19, 49–54].

Post-corrosive esophageal stricture should highly consider inpatient with Zargar grade 2b and 3a [4, 5, 8, 9, 16, 55]. Although various treatment strategies have been developed, none of them can provide outstanding results. Stricture prevention would be the ideal method. Corticosteroids reduce inflammation, but the benefit is inconclusive. Steroids cause severe adverse side effects such as esophageal candidiasis, gastric ulcer, ethmoiditis, osteomyelitis, and osteoporosis [56–58]. Recent studies have demonstrated that omeprazole with proton pump inhibitor activity could enhance healing, reduce stricture, and reduce the short-term risk of developing esophageal stricture in patients with 2b and 3a corrosive injuries [9, 59–61]. However, further studies of omeprazole are needed to corroborate these findings (**Figure 2**).

8. Conclusion

Corrosive ingestion is a serious medical emergency that is a global problem, especially in several developing countries. When patients arrive at the emergency department, stabilization of the patient is initially the most important target. Airway assessment and prompt management are the priorities for emergency settings, especially in severe cases. Any intervention that might cause substance reflux into the esophagus resulting in further damage is not recommended. Current methods for assessing the degree of esophageal damage are early endoscopy for Zargar classification and CT scan, which focuses on ruling out perforation. Post-corrosive esophageal stricture can be a consequent complication with poor treatment outcomes, and stricture prevention is an interesting idea.

Conflict of interest

The author declares no conflict of interest.

Notes/thanks/other declarations

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