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Clinical Spectrum and Management of Caustic Ingestion: A Case Series Presenting Three Opposing Outcomes

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Case series

Patient: **Female, 77 • Female, 46 • Female, 33**
Final Diagnosis: **Caustic injury**
Symptoms: —
Medication: —
Clinical Procedure: **Surgery**
Specialty: **Surgery**

Objective: **Unusual clinical course**

Background: Ingestion of caustic substances is a medical emergency in both the adult and pediatric population and is associated with high morbidity and mortality. The extent of injuries after ingestion of caustic substances depends on the nature, amount, and concentration of the agent and on the exposure time. Acutely, caustic substances may cause massive hemorrhage and gastrointestinal tract perforation; the most markedly affected cases require urgent surgical treatment. Patients surviving the initial event may present with aorto-enteric or gastrocolic fistulae, esophageal strictures, dysphagia, and increased risk of esophageal cancer as long term sequelae.

Case Report: The features of three cases of caustic ingestion are reported to demonstrate significantly different complaints presented at the emergency department. Two patients had free gastric perforation, one at presentation, and one delayed. The third patient presented with late severe strictures of the esophagus and pylorus. The outcomes of the three patients are discussed in detail along with the most current management strategies.

Conclusions: Among adults, ingestion of caustic substances is usually associated with more severe lesions due to the increased amount of ingested substance, as compared with pediatric patients. The most serious presentation is that of visceral perforation, most commonly of the stomach and rarely of the esophagus. Management involves urgent resuscitation with correction of fluid and electrolyte and acid-base abnormalities and immediate surgical exploration in those patients with signs of perforation. Once the perioperative period is managed successfully, the long-term results can be satisfactory. Managing of strictures or else reconstructive procedures must be well timed to allow for psychosocial and nutritional rehabilitation.

MeSH Keywords: **Abdomen, Acute • Caustics • Colorectal Surgery • Esophageal Stenosis • Gastrectomy • Pyloric Stenosis**

Full-text PDF: <http://www.amjcaserep.com/abstract/index/idArt/897778>

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Background

Ingestion of caustic substances is a life-threatening medical emergency, accompanied by high morbidity and mortality due to its detrimental sequelae. The ingestion of corrosive substances has devastating effects, as it generates tissue necrosis leading to severe upper gastrointestinal (UGI) injury and perforation of the stomach and/or esophagus. These injuries may be encountered both in adult and pediatric patients, with children representing 80% of ingestion injuries; however, the pattern of injury differs significantly [1]. In children, ingestion is usually accidental, and the lesions tend to be milder due to smaller volumes ingested. Adults usually ingest caustic substances in the setting of suicidal or homicidal acts or under the influence of alcohol or drugs, resulting in ingestion of larger volumes of the substance, and hence the degree of injury is often more severe [2].

The outcomes of caustic injury depend on the severity of the lesions, the patient's overall condition at presentation, and the promptness of medical management. Mortality in highly compromised patients is significant, in addition, functional consequences follow the most severe injuries. Immediate sequelae include visceral perforation with subsequent sepsis, multi-organ

dysfunction, and acid-base disturbances. However, complications such as tracheobronchial injury and necrosis, tracheo-esophageal fistula, hemorrhage, perforation, aorto-enteric fistula, or gastrocolic fistula may occur in patients surviving the initial event during the first two to three weeks after ingestion [3]. Long-term complications include esophageal strictures, dysphagia, and increased risk of esophageal cancer, affecting patients' quality of life, as well as their long-term survival [4,5].

Prompt diagnosis and management are of outmost importance in decreasing mortality and achieving optimal long-term outcomes in cases of caustic ingestion. However, diagnosis may be elusive, as the patient may present with varying clinical symptoms and give an inconclusive history. Often the signs and symptoms with which a patient initially presents can generally be unreliable in indicating the degree of the injury. We herein present three cases studies of patients who presented to our department secondary to ingestion of caustic substances, ranging from mild injury with stricture formation to total gastric necrosis with free intraperitoneal rupture, and discuss current guidelines for management. Two patients had successful outcomes after long-term therapeutic care and follow-up (Table 1).

Table 1. Patient characteristics, clinical presentation and outcomes.

	Patients		
	Case #1	Case #2	Case #3
Age/gender	77 y/o female	46 y/o female	33 y/o female
Psychiatric history	Depression	Depression	None
Reason for exposure	Suspected suicide	Suicide attempt	Suicide attempt
Type of substance	Unknown	Household cleaning product (acidic)	Household cleaning product (acidic)
Presentation	– Dyspnea – Chest and abdominal pain – Progressive respiratory failure	– Respiratory distress – Nausea, vomiting	– No symptoms related to ingestion – Orthopedic injuries secondary to fall from height
Early management	– Airway protection – Chest/abdominal imaging	– Airway protection – Chest/abdominal imaging – UGI endoscopy	– UGI endoscopy – Focused on orthopedic injuries
Grade of injury	IIIB (full-thickness necrosis/perforation)	IIIA (focal necrotic lesions)	I (mucosal lesions)
Complications and management	Intraperitoneal perforation, Exploratory laparotomy	Intraperitoneal perforation, Exploratory laparotomy	Esophageal/pyloric stenosis, Dilatations
Late management	N/A	GI restoration, colonic interposition	N/A
Outcome	Death on 1 st POD	Patient healthy and functional	Patient healthy and functional



Figure 1. Intraoperative findings (Case #1). Complete necrosis of the stomach wall with free intraperitoneal rupture. Necrotic eschars were extending on the esophageal mucosa. 1) abdominal esophageal orifice; 2) pyloric orifice; and 3) thrombosed vessel of the gastric wall.

Case Report

Case #1

A 77-year-old obese woman presented to the emergency department because of acute onset of dyspnea and bilateral chest and abdominal pain after suspected ingestion of a caustic agent. Her past medical history included chronic obstructive pulmonary disease, coronary artery disease, and depression. The patient on initial assessment was nonverbal at baseline, hypotensive, and tachycardic; no acute abnormalities were seen on ECG. Arterial blood gases revealed severe metabolic acidosis and increased lactate. Abruptly, the patient presented with severe shortness of breath with associated stridor and progressive respiratory failure. The patient was intubated and a chest, abdominal, and pelvic CT scan followed, which revealed free intraperitoneal air. Accordingly, the patient was transferred to the operating room for an exploratory laparotomy. A full thickness necrosis of the stomach with free intraperitoneal rupture was found (Figure 1). Mucosal necrosis extended within the esophagus, which was confirmed by perioperative UGI endoscopy. The patient underwent a total gastrectomy stapling of the abdominal esophagus and duodenum, a cervical esophagostomy, and a percutaneous jejunostomy. The patient was transferred to the ICU, where she died in immediate postoperative care, within 24 hours from surgery on the first postoperative day.

Case #2

A 46-year-old woman with a longstanding history of depression was admitted to the emergency department after ingestion of a “large gulp” of household cleaning product and alprazolam tablets. The patient rapidly developed respiratory

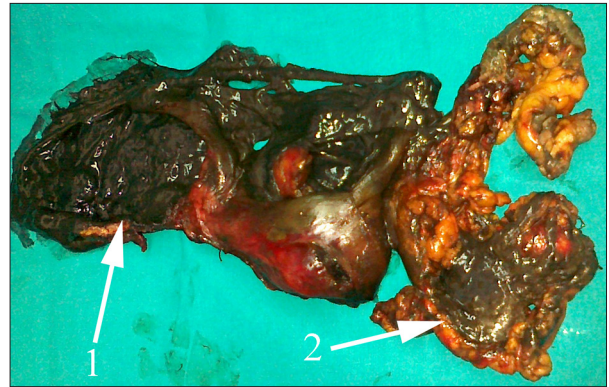


Figure 3. Specimen of total gastrectomy (Case #2). Complete necrosis of the gastric wall (1) and eschar formation with free intraperitoneal rupture, soiling the greater omentum (2), findings supportive of acid ingestion.

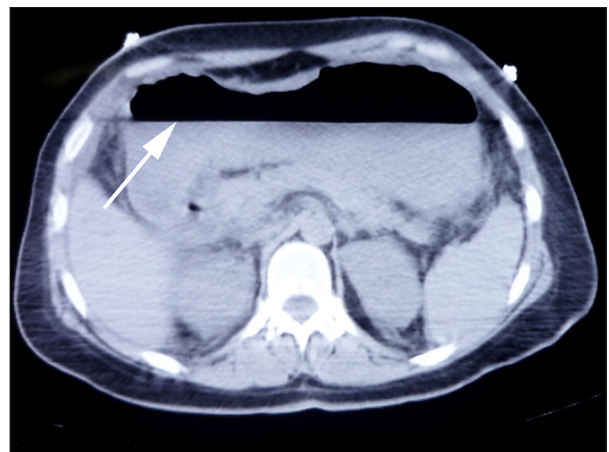
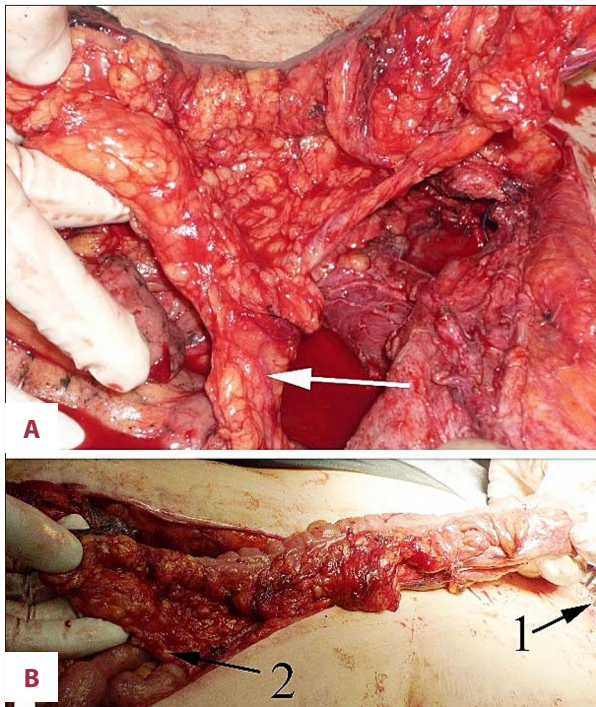


Figure 2. Delayed CT scan three days after admission (Case #2). Cross-section imaging depicting free intraperitoneal air with the associated air-fluid level (white arrow).

distress, nausea, and vomiting, and was therefore intubated for airway protection. The initial work-up did not reveal perforation of the GI tract; hence, conservative treatment was initiated with intravenous fluids and antibiotics. UGI endoscopy revealed grade IIIA focal necrotic lesions of the esophagus and the stomach. The patient responded poorly in the following days and gradually developed multi-organ dysfunction with acute renal failure, needing hemofiltration. A repeat CT scan three days later revealed free intraperitoneal air, confirming visceral perforation (Figure 2). On exploratory laparotomy, complete necrosis of the stomach and generalized peritonitis were found with no external signs of esophageal necrosis. Consequently, the patient underwent a total gastrectomy with stapling of the duodenal stump and abdominal esophagus, distal feeding jejunostomy, and wash-out of the peritoneal cavity (Figure 3). A cervical esophagostomy completed the operation, as the intrathoracic esophagus was left *in situ*. The postoperative course was cumbersome but uneventful. After



the initial improvement, she was transferred to a hospital ward in order to recover completely as well as to remain under constant psychiatric monitoring and evaluation.

After a full recovery, six months later, she was scheduled for gastrointestinal tract restoration with colonic interposition. CT angiography was performed for evaluation of the colonic vessels and the left colon was preferred for interposition through the retrosternal route (Figure 4A). A cervical esophageal-colonic anastomosis and a Roux-en-Y small bowel limb-colonic anastomosis were performed for the GI tract restoration (Figure 4B). The postoperative course was uneventful and the patient was discharged on the fifteenth postoperative day. Two months later during follow-up, an anastomotic stricture at the site of the esophageal-colon anastomosis was diagnosed, which was managed with repeated endoscopic bougie

Figure 4. Intraoperative view (Case #2). (A) Pedicle of the colonic graft based on the middle colic vessels (B) Prepared colonic graft, originating from the left colon: (1) site of future cervical anastomosis; (2) preserved “feeding” middle colic vessels for the colonic graft.

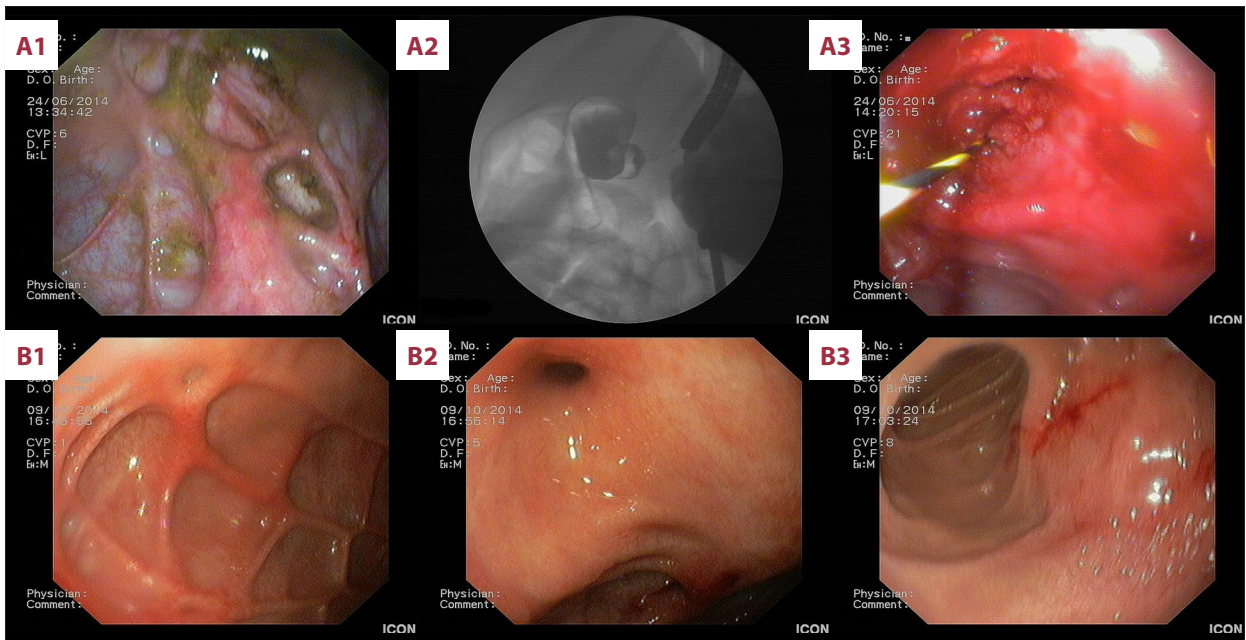


Figure 5. Endoscopic view following ingestion of a caustic substance (Case #3). The upper row of images depicts the patient’s injuries two months after the caustic ingestion (A). (A1) Multiple “diverticula-like” lesions of the gastric wall, forming a “honeycomb” pattern. (A2) UGI series revealed severe pyloric stenosis with post-stenotic dilatation. (A3) Endoscopic guidewire crossing the pyloric stenosis. The lower row of images are from the endoscopy follow-up four months following the initial endoscopy and six months since the ingestion of the caustic substance (B). (B1) Although the “honeycomb” pattern remained, there was significant healing of the gastric “diverticula.” (B2) The pyloric orifice had maintained its patency. (B3) No other evidence of mucosal injury of the duodenum was macroscopically evident.

dilatations (Savary-Gillard dilator) for a six-month period. The patient made a full recovery and remains fully functional after two years of follow-up.

Case #3

A 33-year-old woman was admitted to the emergency department after voluntary ingestion of a rather small quantity of a household cleaning product and a fall from a height in an attempt to commit suicide. The patient presented with multiple injuries of the spine and extremities but unremarkable symptoms secondary to corrosive ingestion. UGI endoscopy revealed grade I mucosal damage of the esophagus and the stomach, and thus priority was given to the severe orthopedic injuries, which were treated with osteosynthesis and spinal fusion. Gradually, after a two-month period, the patient developed dysphagia with solids and symptoms of gastric outlet obstruction. Endoscopy revealed upper esophageal stenosis as well as gastric and pyloric scarring associated with pyloric stenosis. The patient underwent three consecutive esophageal and pyloric dilatations in a two-month period. The esophageal stricture was dilated with Savary-Gillard bougies and the pyloric stenosis was dilated with balloons following the insertion of a guide wire through a tight pyloric opening (Figure 5A, 5B). After one year of follow-up, the patient was free of symptoms and under constant psychiatric evaluation.

Discussion

Caustic ingestion is a frequent mode of suicide attempt among adults, and represents a surgical emergency, carries significant morbidity, and mortality rates are reported as high as 20%; the true prevalence of this problem remains underrated [1]. Therefore, prompt diagnosis and sound medical management are required to avoid dismal immediate results and achieve favorable long-term outcomes. A detailed and careful history usually reveals psychiatric background (e.g., depression), which should not be underestimated, but should trigger vigilance on behalf of the physician for a possible suicide attempt. In our first two case reports, depression was the common factor. Although in the second case the patient's report of a suicide attempt made the diagnosis straightforward, in the first case the patient was in a more acute state and therefore could not elucidate her history (Table 1).

Presenting symptoms may vary widely among patients, and therefore a high threshold of suspicion should be maintained to allow a prompt diagnosis of any possible UGI necrosis or perforation. Depending on the ingested substance's pH and volume, and the duration of exposure, a patient may present with oropharyngeal lesions and minimal symptoms, or be in shock with an acute abdomen after visceral perforation. Although

historically alkalis have been considered to be more corrosive than acids due to inherent chemical differences, when significant amounts of a corrosive substance has been ingested, the end results are similar [1].

Management of UGI caustic injuries begins with assessment of patient's hemodynamic stability and airway adequacy. Arterial blood gases at presentation are of paramount importance, as they will reveal life-threatening acid-base disorders and/or an increased lactic acid level. A chest x-ray may depict signs of mediastinitis or free intraperitoneal air secondary to esophageal or gastric perforation; however, occasionally a chest x-ray may fail to identify free intraperitoneal air (e.g., Case #1). When clinical suspicion of peritonitis is raised, either initially or later during the clinical course of a patient admitted for corrosive UGI injury, a CT scan of the chest-abdomen and pelvis should be performed [1,4,6]. Endoscopy is the gold standard for the diagnosis of UGI caustic injuries, and should be performed when there is either a documented or suspected ingestion of a corrosive substance, to reveal the extent and degree of lesions and direct further management [7]. Ideally, UGI endoscopy should be performed within 12 to 24 hours from the ingestion of the caustic substance, and can be used for grading the lesions, which could be predictive of morbidity and complications [8,9]. However, performing immediate UGI endoscopy may not be feasible when the patient is critically ill with signs of peritonitis and there is no evidence or suspicion of caustic substance ingestion, as with our first patient case. In this situation, when laparotomy precedes endoscopy and the intraoperative findings are suggestive of caustic injury, a physician should not hesitate to perform an "on-table" endoscopy to document the diagnosis and delineate the extent of GI injuries. The 2015 World Society of Emergency Surgery consensus conference reported that although endoscopy is the cornerstone of management of caustic injuries, the use of CT helps palliate shortcomings of endoscopy-based algorithms [3]. In a recent study, CT did better than endoscopy in selecting patients for surgery or nonoperative treatment, suggesting that CT can replace endoscopy in the management of caustic injuries [3]. Particularly, in Case #2, there was a discrepancy between the endoscopy and perioperative findings regarding the extent of the grade III focal necrotic lesions of the esophagus. If UGI endoscopy is performed, further management depends on the degree of the injury, as partial-thickness lesions (grades I, II) could be treated conservatively with nil per os, intravenous fluids, and antibiotics (Case #3). However, constant monitoring, preferably within an ICU environment for the first 48 hours, and frequent reevaluation are necessary, since perforation may occur a few days post-ingestion [4]. Full-thickness necrosis (grade III) may require immediate surgical intervention, especially in unstable patients or patients with intraperitoneal perforation.

The principles of the initial laparotomy are those of damage control, i.e., cessation of bleeding and contamination. Usually this incorporates a total gastrectomy with feeding jejunostomy. Esophagectomy during the initial exploratory laparotomy is of little benefit, as it significantly increases the operating time, and control of contamination could be achieved with a cervical esophagostomy and intra-abdominal drainage of the mediastinum. In addition, esophagectomy is an independent negative predictor of survival after emergency surgery. Decisively, every effort possible should be made to mature a feeding jejunostomy at the initial operation, to provide enteral feeding and avoid parenteral nutrition, which are known to prolong hospital stay, and increase the risk of infections [10,11]. Although some authors have advocated immediate restoration of the GI tract with esophagojejunostomy, this option should only be used for stable patients with minimal intraperitoneal soiling [12]. On the contrary, restoration of the GI tract should be performed as soon as the patient has recovered from the systemic insult of the caustic injury. Multi-organ dysfunction and systemic inflammatory response syndrome (SIRS) must have resolved, and the patient must have good nutritional status, before one should embark on a restorative procedure. In Case #2, restoration was performed six months after the index operation. Restoration of the GI tract is usually performed with a pedicle colonic graft, which is associated with satisfactory functional results and adequate durability [13,14]. Transposition through the posterior mediastinum is the shortest route and provides the best functional outcome. Nevertheless, in cases where the esophagus is left *in situ*, (like in Case #2 patient), or when fibrotic lesions are developed due to delayed restoration, retrosternal approach or subcutaneous approach can be used [13,15]. Another major issue to consider during the restorative procedure is whether to resect the esophagus; a strictured esophagus carries an 8% risk of developing malignancy over a 25- to 50-year period [14]. Within this context, esophagectomy should definitely be performed in children and young adults with a long life expectancy. However, in middle-aged adults or elderly patients, this issue should be a matter of sound assessment, and esophagectomy could be avoided,

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unless a scheduled thoracotomy is imperative in case of a tracheobronchial injury or necrosis. Although rare, this clinical condition is almost uniformly fatal without surgical intervention (93% mortality) and emergency surgical management is warranted [16]. It occurs more commonly from transesophageal penetration affecting distal trachea and left mainstem bronchus adjacent to the thoracic esophagus [17].

The most important long-term complication of caustic ingestion is esophageal stricture formation, reported at rates as high as 100% for transmural lesions [1]. Occasionally, depending on the quantity and chemical nature of the ingested substance, injury may appear in the lower parts of the UGI, leading to pyloric stricture. Stricture, in turn, could cause dysphagia and gastric outlet obstruction, requiring repeated dilations. Furthermore, there is increased risk for esophageal cancer, extending to a period of up to 40 or 50 years after the exposure [4,13]. Thus, careful follow-up and routine screening for esophageal cancer is mandatory in order to protect the patient's quality of life and prevent long-term complications after caustic esophago-gastric injuries.

Conclusions

The management of caustic ingestions involves urgent resuscitation with correction of fluid and electrolyte and acid-base abnormalities and immediate surgical exploration in those patients with signs of perforation, because this is the only way to improve survival. The perioperative period is the most challenging, as the rate and severity of complications is grave. Successful management of this period results in highly satisfactory results. Managing of strictures or reconstructive surgical procedures should be well timed to allow for psychological as well as nutritional rehabilitation.

Competing interests

The authors declare that they have no competing interests.

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