

Treatment of Caustic Injuries of the Esophagus:

A Ten Year Experience

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The methods of managing 32 patients sustaining caustic injuries to the esophagus are assessed. Treatment of these patients must be individualized according to the type of caustic ingested, the degree of burn and other clinical signs. While an aggressive approach is favored for second and third-degree burns in the form of early esophagogastrectomy with subsequent colon interposition, operation is not necessary in all patients, particularly those with first-degree burns. The use of antibiotics is recommended as soon as the diagnosis of esophageal injury is established. The efficacy of steroids in preventing stricture formation, especially with third-degree burns, is questioned.

IN THE PAST TEN YEARS lye in a crystalline or liquid state has been marketed commercially as a drain cleaner and become widely available. It is frequently ingested either accidentally or with the intent of doing self-injury. Since such ingestion of lye may result in immediate and permanent injury to the lips, mouth, larynx, esophagus and stomach, it is imperative that the physician promptly determine the extent and severity of the injury and institute the appropriate therapy. Early in our experience these patients were treated in the conventional manner (steroids, antibiotics, early dilatation) with disastrous results. Consequently, an aggressive approach in the form of early esophagogastrectomy was recommended for all patients who ingested these corrosives.^{1,7,8}

Since that time the Federal Hazardous Substance Act has modified the concentration of these corrosives so that the earlier recommended therapy has been altered. Over the past ten years we have treated 32 patients who have ingested highly alkaline caustics. This report assesses our methods of handling patients who have sustained caustic injuries to the esophagus and stomach and discusses our present plan of management.

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Management

All patients with physical findings of caustic ingestion must be admitted to the hospital; in fact, anyone in whom there is the least suspicion of caustic ingestion should be admitted and undergo evaluation. An attempt should be made to find the container that held the ingested caustic or some of the material itself for proper identification.

In those patients who are hypotensive on admission, arterial and central venous catheters are inserted for constant pressure monitoring. Hypovolemia is treated with either whole blood or colloid-containing fluids. The patient is carefully observed for airway obstruction. Laryngeal edema is frequently seen in the first 24 hours in association with severe caustic burns of the esophagus, and endotracheal intubation or tracheostomy may be needed. In view of the instantaneous nature of the injury produced by liquid caustics, water or other liquids to "dilute the caustic" are of little value. In fact, they may produce additional vomiting or retching that may aggravate the situation. For the same reason, emetics and gastric lavage are contraindicated.

The patient is kept NPO and maintained on intravenous fluid. Clear fluids are begun by mouth only when the patient is able to swallow his saliva; he may then progress to a regular diet as tolerated. If the patient is unable to swallow, a gastrostomy should be performed.

Antibiotics are administered as soon as the diagnosis of esophageal injury is established. Our preference is for ampicillin (40 mg/kg/body weight/day in divided doses) because it is effective against oropharyngeal flora. It should be administered intravenously at first

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and then intramuscularly until oral feedings are begun. The antibiotics are discontinued at seven days if the patient is afebrile. If after a two week course of antibiotic therapy fever continues, one should suspect an associated complication such as mediastinitis, peritonitis, or a localized abscess in either the mediastinum or peritoneum.

Contrast visualization of the esophagus and stomach is carried out shortly after admission. Esophagoscopy is done upon admission or not later than 24 hours after the ingestion. The esophagoscope is inserted only as far as the first identifiable mucosal lesion and not beyond. This safeguards against esophageal perforation. Those patients in whom there are no oropharyngeal or esophageal burns and in whom the barium swallow is normal are discharged after 24 hours of observation. A repeat barium swallow is performed at regular intervals for a year so that an unrecognized esophageal stricture will not be overlooked.

Liquid Caustics

The liquid caustics, because of their high specific gravity, pass rapidly through the esophagus and reach the stomach soon after ingestion, destroying its full thickness and even adjacent tissues and causing gastric perforation. Severe esophageal injury occurs frequently.

A nasogastric tube is inserted cautiously and the stomach is aspirated. If the aspirate is basic and the alkalinity does not cease with gentle and limited irrigation, it is presumed that the stomach and esophagus are burned. Contrast visualization of the esophagus and stomach is also obtained. Esophagoscopy is not performed in this circumstance, as it does not give accurate information about the extent of necrosis. Instead a celiotomy is performed, and if the gastric wall is ecchymotic or black, indicating a necrotic stomach, a gastrectomy is performed. At times a burn extends through the stomach wall to involve the adjacent viscera such as colon, pancreas, spleen, or small bowel. If damaged, these structures are also removed.

It has now been amply demonstrated that when the stomach is necrotic following caustic ingestion, the esophagus will also be necrotic or so severely burned that a nondilatable stricture will develop within several months.³ Therefore, a right thoracotomy is performed, and if the esophagus is necrotic, total esophagostomy and left cervical esophagostomy should be carried out. Colon interposition is performed three or four weeks later. If the distal intra-abdominal segment of esophagus is necrotic or if

contrast examination shows dilation of the esophagus with retention of either swallowed air or contrast material (which implies diffuse muscular necrosis and impending perforation), esophagectomy and left cervical esophagostomy are performed. If neither of these abnormalities is present, the extent and severity of the esophageal injuries are assessed by careful esophagoscopy and managed conservatively with antibiotics and later dilations.

If the gastric aspirate is acidic and peritoneal signs are present, a celiotomy is performed and gastrectomy, esophagostomy, or both carried out if indicated. When the gastric aspirate is acidic (as is apt to occur when ingestion occurs on a full stomach) and there are no peritoneal signs, there is little likelihood that the stomach is seriously burned, and a celiotomy is not performed. An esophagectomy is now recommended only if there are clinical signs of perforation or if a contrast examination shows evidence of impending perforation. When neither is present, an esophagoscopy is performed to assess the severity and extent of the injury.

Solid-state Caustics

As a rule, the ingestion of caustic crystals almost immediately produces severe pain that causes the patient to stop further ingestion. The crystals tend to adhere to the mucous membranes of the tissues with which they first come into contact, namely, the mouth, pharynx, and esophagus. The majority of patients who have ingested crystals do not suffer severe esophageal burns. Those patients who sustain a second or third-degree burn often develop an esophageal stricture. Dilatation is not started until healing is complete and epithelialization of the mucosa is seen as far as the esophagoscope can be advanced. This usually takes four to five weeks. Dilatation is carried out with the mercury-filled, tapered Hurst-Maloney bougies. If a gastrostomy has been performed, a retrograde esophageal dilator with the Tucker bougie is an alternate method of dilatation. Even if dilatation is delayed until healing has occurred, there is still an increased risk of perforation, hemorrhage, or both when it is instituted. Therefore dilatation should be carried out as carefully as possible. If bleeding occurs, dilatation should be temporarily discontinued until it has stopped; dilatation is then reinstated cautiously.

Clinical Findings

Over the past ten years 32 children and adults were treated for caustic injuries to the esophagus and stomach. The age and sex of the patients are listed in Table 1. The caustic ingested and its state at time of

TABLE 1. Age and Sex of Patients

Age (year)	Male	Female
<-1	3	3
1-5	10	3
5-20	1	2
20-40	2	4
>-40	4	0

ingestion are listed in Table 2. Since the pathophysiology and treatment of burns caused by solid or liquid agents are different they will be discussed separately.

Results (Tables 4 and 5)

Liquid Caustic

In only five of the 18 patients ingesting a liquid caustic no oropharyngeal abnormalities were noted on the initial or subsequent examination. In other patients oropharyngeal lesions ranged from scattered areas of superficial mucosal erosions of the lips and tongue in six patients to deep and extensive destruction of the lingual, buccal and pharyngeal mucosa in seven patients. Table 3 summarizes the findings at esophagoscopy. A first-degree burn was characterized by superficial mucosal hyperemia, mucosal edema and superficial sloughing. A second-degree burn involved all layers of the esophagus and was characterized by exudate, ulceration and loss of mucosa. A third-degree burn was one which, in addition to involving the esophageal wall, had eroded through the esophagus into the periesophageal tissues. There was only one perforation associated with the initial esophagoscopy.

Three patients with third-degree burns of the esophagus underwent an emergency esophagogastrectomy as their initial mode of therapy within 12 hours following the ingestion. There were no deaths among these patients. Following this a colon interposition was performed from three weeks to six months later. There were no deaths and only one anastomotic leak.

In contrast to this there were 11 patients with second or third-degree burns of esophagus who did not undergo esophagogastrectomy initially. Four of

TABLE 2. Caustic Ingested and Its State at Time of Ingestion

<i>Liquid state</i>	18
Liquid Plumer	9
Draino	5
Lye	3
Plunge	1
<i>Solid State</i>	14
Draino	12
Rooto	2

TABLE 3. Summary of Esophoscope Examination

	Liquid	Solid
First-degree	4	7
Second-degree	3	4
Third-degree	11	3

these patients were treated with steroids, antibiotics and early dilatations. Despite the fact that the perforations were recognized early, three of these patients died, two from overwhelming sepsis and one from an aorto-esophageal fistula. An additional patient was perforated during dilatation and was treated by drainage alone. He has subsequently been lost to follow-up. The remaining seven patients were treated with antibiotics and late dilatation. All of these patients developed severe esophageal strictures which necessitated colon interposition in six patients.

There were four patients who sustained only first-degree esophageal burns. There were no deaths in this group of patients and none required an emergency esophagogastrectomy. Two of these patients developed an esophageal stricture which was easily treated by esophageal dilatation.

Solid-state Caustic (14 patients)

In 12 of the patients with solid-state caustic there were oropharyngeal abnormalities noted on the initial examination. In six patients there was extensive destruction of the lingual, buccal and pharyngeal mucosa in addition to burns of the face. In six patients there were only superficial mucosal erosion of the lips and mouth and in two patients there were no oropharyngeal abnormalities noted on the initial examination. Table 3 summarizes the findings at esophagoscopy. There were eight patients who sustained only first-degree burns. None of these patients developed an esophageal stricture. Four of the six patients with second or third-degree burns were treated with

TABLE 4. Results with Liquid Ingestion

<i>Second and third-degree burns</i>	14
Immediate Esophagogastrectomy	3
Early dilatation, steroids	4
death	3*
perforation	1
Antibiotics alone + dilatation	7
nondilatable stricture	7
colon interposition	6†
<i>First-degree Burn</i>	4
Dilatable stricture	2
No stricture	2
Death	0

* One death secondary to esophageal perforation.

† Patient requires colon interposition but refused operation.

TABLE 5. Results with Solid-State Caustic

<i>Second and Third-degree Burns</i>	6
Early dilatation	4
death	1
perforation	3
Nondilatable stricture (colon interposition)	1
Dilatable stricture	1
<i>First-degree Burns</i>	8
Deaths	0
Stricture	0

early dilatation. One of these patients died as a result of a trachea-innominate fistula. In the remaining three patients perforation of the esophagus occurred which necessitated an emergency esophagogastrectomy in two patients. One of the two remaining patients with second and third-degree esophageal burns developed a nondilatable stricture which necessitated a colon interposition.

Discussion

Our discussion concerns only the principles of management. The pathology, pathophysiology, clinical and radiographic features have been described elsewhere.³

Early in our experience patients with caustic injuries of the esophagus were treated with steroids, antibiotics and early dilatations. The basis for steroid therapy in the treatment of caustic injuries of the esophagus is the observation by Spain and associates that early administration of cortisone in mice inhibited fibroplasia and formation of granulation tissue.¹⁰ They also observed that, to be effective, glucocorticoids must be given within 48 hours of injury. Similar findings showing that steroids inhibit the formation of strictures after caustic ingestion in animals have been reported by Wieskuff,¹¹ Haller and colleagues,² and others.⁹ These experimental studies have been supported by Haller's² report on 60 patients with esophageal burns after caustic ingestion. Stricture developed in 25% of the patients treated without steroids compared with only nine per cent of those treated with steroids plus antibiotics. Contrasting results have been reported by Middlekamp, Ashcraft, and Leape.⁴⁻⁶ In these series 18 of 19 patients with a severe (third-degree) circumferential esophageal burn developed a stricture despite the early administration of steroids and antibiotics. In addition, an increased occurrence of perforation has been found when steroids were used following ingestion of concentrated solutions of alkali. Similar results were found in our patients who were treated with steroids. Steroids have also been found to mask symptoms of infection in other mediastinal structures and have delayed healing.

As a result of these studies and our own experience, the efficacy of steroids in preventing stricture formation after caustic ingestion is "highly questionable," especially with third-degree burns. Because of the potentially serious complications that might result from their administration and the fact that their administration does not prevent stricture formation after third-degree burns, it is our conviction that steroids should not be used in the treatment of esophageal injuries caused by liquid caustics.

In addition, early dilatation was associated with an increased incidence of perforation. Five of the 12 patients treated with early dilatation developed a perforation of the esophagus. Consequently, an aggressive approach in the form of early esophagogastrectomy was recommended for all patients who ingested these corrosives. As our experience increased in the management of these patients it soon became apparent that not all patients who had ingested these caustic agents required an esophagogastrectomy. Perforation of the esophagus following solid-state caustic ingestion was an infrequent occurrence, whereas perforation of the esophagus following liquid caustic ingestion was common. The indications for esophagogastrectomy have been discussed in detail in the section on management.

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