Treatment of Acute Esophageal Food Impaction with Glucagon, an Effervescent Agent, and Water

Mark I. Robbins[1]
Michael J. Shortsleeve

OBJECTIVE. In 1990, we described a combination therapy that uses glucagon, an effervescent agent, and water to relieve acute esophageal food impaction. The initial trial showed relief of the obstruction in 12 of 16 cases without complication, so we continued the series to determine the safety and effectiveness of this technique.

SUBJECTS AND METHODS. Between July 1987 and August 1993, a prospective trial consisting of 43 patients with 48 episodes of acute (less than 24-hr duration) food impaction in the distal two thirds of the esophagus were identified with either a barium or water-soluble contrast agent swallow. Subsequently, we attempted to relieve the obstruction by using 1 mg of IV glucagon, an effervescent agent, and water. A water-soluble esophagogram was obtained immediately in all cases to determine the response to the therapeutic intervention and to look for any complication such as perforation.

RESULTS. The combination therapy resulted in the clearance of food obstruction in 33 (69%) of 48 attempts. One complication, a minor mucosal laceration, occurred after two unsuccessful treatments. A lower esophageal ring was the single most common abnormality identified (n = 24). The average width of rings in the successful cases was 15.4 mm and the average in the unsuccessful cases was 13 mm. Other underlying causes of obstruction were esophagitis and stricture.

CONCLUSION. Our experience with the use of glucagon, an effervescent agent, and water to relieve acute esophageal food impaction indicates that the technique is highly successful and that serious complications are rare.

***AJR* 1994;162:325–328**

Acute esophageal food impaction is a common clinical problem. Many methods have been described as potential alternatives to endoscopy, which is invasive, expensive, and can result in esophageal perforation.

Proteolytic digestion of obstructing food has largely been abandoned in most emergency settings owing to reported deaths due to perforation and mediastinitis [1, 2]. Glucagon alone was used to eliminate impaction in 50% of cases in a limited study by Ferrucci and Long [3] and in seven of 19 cases treated by Trenker et al. [4]. Gas distention of the esophagus successfully cleared all eight cases of obstruction treated by Rice et al. [5]. In a retrospective study by Zimmers et al. [6], a 65% success rate was described in 26 patients treated with a gas-forming mixture to relieve esophageal food impactions, with one patient suffering a mucosal tear of the esophagus. Zalev [7] reported one case in which air insufflation via nasoesophageal tube combined with esophageal hypotonia relieved an obstructing food bolus.

Theoretically, the combination of glucagon, an effervescent agent, and water should improve the efficacy of using one agent alone. The combination therapy takes advantage of the ability of glucagon to relax the lower esophageal sphincter and possibly the smooth muscle of the distal esophagus, the distention of the esophagus produced by the effervescent agent, and the increased hydrostatic pressure caused by the column of water in conjunction with the use of gravity in the upright position.

Received August 23, 1993; accepted after revision October 11, 1993.

[1]Both authors: Department of Radiology, Mount Auburn Hospital, 330 Mount Auburn St., Cambridge, MA 02238. Address correspondence to M. J. Shortsleeve.

0361–803X/94/1622–0325

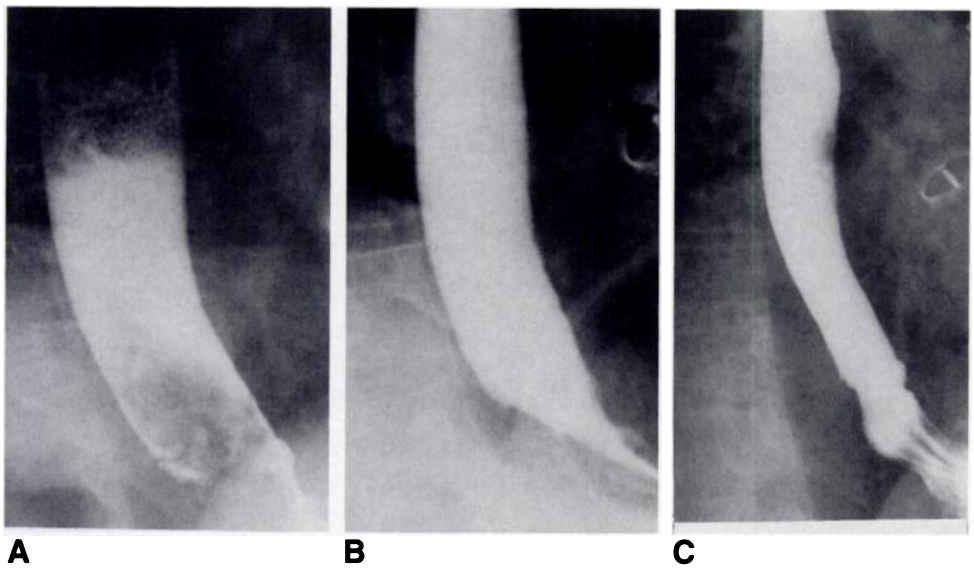

Fig. 1.—52-year-old man with food (orange) impaction of 3–4 hr duration.
***A,* Esophagogram obtained after administration of nonionic water-soluble contrast material shows obstructing food bolus in distal esophagus.**
***B,* Esophagogram obtained with water-soluble contrast material immediately after successful combination therapy shows that obstruction has been relieved.**
***C,* Follow-up barium esophagogram (10 days later) shows underlying cause of obstruction, a slight stricture and esophagitis.**

Because the radiologist is frequently consulted to establish the diagnosis of acute esophageal food impaction, it makes sense that he or she attempt to relieve the obstruction immediately and noninvasively with fluoroscopic monitoring. An initial trial at our institution that used a combination of glucagon, an effervescent agent, and water showed successful disimpaction of acute esophageal food impaction in 12 of 16 cases without complication at approximately one tenth the cost of surgical endoscopy [8]. Because these results were favorable, we continued the study in order to determine the efficacy and safety of this method in a larger group of patients.

Subjects and Methods

The study group included 43 patients with 48 episodes of acute (less than 24-hr duration) food impaction in the distal two thirds of the esophagus who were seen between July 1987 and August 1993. The diagnoses were based on findings on radiographs obtained after the patients swallowed either 5 ml of barium or 5–10 ml of water-soluble contrast material (iopamidol 41%, iopamidol 61%, or ioversol). Subsequently, we attempted to relieve the obstruction by using 1 mg of IV glucagon, an effervescent agent (E-Z Gas II, E-Z-EM, Inc., Westbury, NY), and water.

The five women and 38 men studied were 27–88 years old (mean age, 52 years). Red meat or pork was the cause of the obstruction in 24 of 48 cases. Other obstructing food boli included hot dogs, fish, shrimp, vegetables (carrot, raw potato, peas), fruit (Fig. 1), poultry (Fig. 2), bread, and crackers. The duration of esophageal obstruction was from 1 to 24 hr. The mean duration of obstruction was approximately 7 hr.

Although more than 90 cases of suspected esophageal food impaction were referred to our radiology department during this 6-year period, the combination therapy could be considered in only 48 cases. The most common reasons for exclusion were that the patient could not follow instructions or could not tolerate an upright position. Patients were also excluded from the study if the esophageal obstruction was (1) caused by a known sharp foreign body such as a bone or a plastic eating utensil, (2) caused by a known rigid obstruction such as esophageal carcinoma or fixed stricture, (3) longer than 24 hr in duration, or (4) located in the proximal third of the esophagus. In addition, the presence of an esophageal diverticulum or prominent cricopharyngeus muscle noted on a previous radiographic or endoscopic study, or on our initial fluoroscopic observation, was considered a contraindication to the use of combination therapy.

Contraindications to glucagon administration also precluded use of this protocol. Glucagon was contraindicated in patients with a known sensitivity to the drug and in patients with a suspected pheochromocytoma or insulinoma.

In the first 16 cases, we obtained the esophagograms after the patient swallowed 5 ml of barium, but we now universally use nonionic water-soluble contrast agents swallowed by the patient in the upright left posterior oblique position to determine the presence,

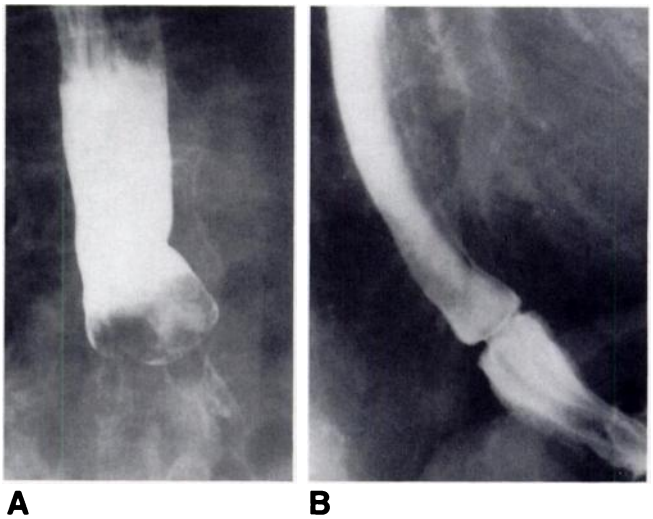

Fig. 2.—74-year-old man with symptoms of esophageal food (chicken) impaction.
***A,* Esophagogram obtained after administration of nonionic water-soluble contrast material shows obstructing food bolus in distal esophagus.**
***B,* Follow-up barium esophagogram obtained 10 days later shows cause of obstruction, a 14-mm lower esophageal ring.**

configuration, and location of the foreign body. The fluoroscopy table is then turned to horizontal so that the patient is supine, and 1 mg of glucagon is given IV over 30 sec. This injection rate can produce less vomiting than a more rapid bolus injection would. Immediately thereafter, the table is again turned upright. Two minutes after the administration of glucagon, the patient is given one packet of E-Z Gas II in 30 ml of water followed by one cup (240 ml) of water. The E-Z Gas II consists of sodium bicarbonate, citric acid, and simethicone and will produce not less than 400 ml of CO_2 when added to 30 ml of water. Immediate symptomatic relief is experienced by all patients in whom the treatment is successful. A second limited esophagogram is obtained, after the patient has swallowed approximately 50 ml of water-soluble contrast material, to confirm that the foreign body has passed and that no perforation has occurred.

The underlying abnormality was diagnosed on the basis of esophagographic findings in 14 cases, endoscopic findings in 16 cases, and findings from both techniques in six cases. No follow-up was done in 12 cases; however, the underlying abnormality was identified in four cases from previous radiographic or endoscopic records.

Follow-up double-contrast esophagography is the procedure of choice for diagnosing the underlying cause of esophageal obstruction and the response to endoscopic dilatation of esophageal rings and strictures. In most cases, this was performed 7–14 days after disimpaction to allow time for edema or mucosal irritation to subside. Esophageal abnormalities were shown on spot films. Measurements of rings and strictures were taken directly from the spot films, uncorrected for magnification.

All patients in whom the combination treatment was unsuccessful underwent endoscopy, except one patient in whom the obstructing food bolus passed spontaneously 30 min after combination therapy. In our series, endoscopy was performed for therapeutic, not diagnostic purposes, except in two cases in which the diagnosis of Barrett's esophagitis was considered.

Results

The combination therapy resulted in the clearance of food obstruction in 33 (69%) of 48 attempts. A lower esophageal ring was the single most common abnormality identified (n = 24). Five of these rings were associated with esophagitis or slight strictures. Although lower esophageal rings were the most common underlying cause of food impaction, a stricture or esophagitis was identified as the source of obstruction in 15 of 48 cases.

The 33 cases treated successfully included 16 lower esophageal rings, five cases of esophagitis, three cases of stricture, and one normal case. Eight patients in this group did not return for follow-up. The 15 unsuccessful cases included eight rings, four strictures, and three cases of esophagitis. All these patients had endoscopic follow-up, except for one who underwent esophagography after his food bolus passed spontaneously.

The average width of lower esophageal rings was 15.4 mm in the successful group and 13.0 mm in the unsuccessful group. Nevertheless, treatment was successful in the two patients with the narrowest rings in the series, one of which was 9 mm wide and the other of which was 10 mm wide.

The one complication, a minor mucosal laceration, occurred after two unsuccessful attempts, one immediately after the other. Immediately afterward, hematemesis developed. The laceration was observed while the impaction was being treated endoscopically. A follow-up esophagogram 2 weeks later showed that the injury had healed. No other complications occurred in the patients who had combination therapy.

In the unsuccessful cases treated with rigid endoscopy, one major complication occurred, an esophageal perforation after bougienage of a stricture. Another case in which the combination therapy failed was treated with endoscopy; however, the obstruction persisted after endoscopy. At the request of the surgeons, the radiologic disimpaction protocol was later repeated successfully without complication.

Discussion

The combination therapy was highly successful and safe in these 48 cases. We were careful in the selection of patients, attempting to avoid situations that might (1) predispose to esophageal perforation (e.g., presence of esophageal diverticulum, sharp foreign body, or possible mucosal ulceration due to obstruction of more than 24-hr duration); (2) fail to respond to glucagon (e.g., obstruction in the proximal third of the esophagus, presence of carcinoma, or fixed stricture); or (3) impede the release of excess gas (e.g., a prominent cricopharyngeus muscle).

This protocol is also precluded by contraindications to glucagon administration, for example, in patients who have a known sensitivity to the drug and patients with suspected pheochromocytoma or insulinoma. IV glucagon can stimulate an insulinoma to release insulin with a precipitous drop in serum level of glucose, and it can stimulate the release of catecholamines in patients with pheochromocytomas.

Although 5 ml of barium was used to diagnose the obstruction in the first 16 cases, we now routinely use nonionic, low osmolality, water-soluble contrast agents such as iopamidol 41% (413 mOsm/kg water) because we believe that if perforation or aspiration does occur, this type of agent will produce fewer complications than barium or ionic, higher osmolarity water-soluble agents. Moreover, our endoscopists believe that it is easier to view foreign bodies through the water-soluble agent than through barium.

In two cases, the patients vomited a meat bolus rather than passing it directly into the stomach. Although vomiting can occur as a side effect of glucagon, we have found that it occurs more often after the administration of the effervescent agent and water, possibly because of forceful reflux. This raises the theoretical possibility that a patient might aspirate the esophageal foreign body. Although this complication was not observed, the authors recommend that the technique be performed in the presence of persons trained in airway management with ready access to proper equipment required to handle such an emergency. Obviously, patients with impaired gag reflexes should not receive combination therapy.

Although lower esophageal rings were the most common underlying cause of food impaction in the distal esophagus, strictures and esophagitis were identified as the source of obstruction in 15 of the 48 cases. Combination therapy was successful in eight (53%) of these 15 cases.

Although a known fixed stricture is a contraindication to combination therapy, the protocol was attempted in seven patients in whom this entity was present, but unsuspected.

Combination therapy was successful in three (43%) of these seven cases. The only complication in our series, the mucosal laceration, occurred in a patient who had a stricture. Because this occurred after two successive attempts, we do not advocate more than a single trial of the procedure.

Interestingly, in one case in which rigid endoscopy failed to clear an impaction in the distal esophagus, a second trial of combination therapy was successful. Despite the success of the second attempt, we no longer advocate the use of this procedure immediately after endoscopy. We think that such patients may be at increased risk of perforation because of potential esophageal trauma from instrumentation.

The average width of the lower esophageal ring in patients in whom treatment failed was narrower than the average width in patients who were successfully treated (13.0 mm vs 15.4 mm). However, we do not think that patients with known rings narrower than 15 mm should be necessarily excluded from a trial of combination therapy, because five such patients were treated successfully, including two with the narrowest (9 mm and 10 mm) rings in the series. We believe that success of the procedure is determined by the width of the esophageal ring with respect to the size and texture of the impacted food bolus, rather than the absolute width of the ring itself. For example, one successful case involved a 70-year-old man with chest pain who had been admitted to the coronary care unit to exclude a myocardial infarction. During his hospitalization, some applesauce and peas became impacted in his distal esophagus. Combination therapy relieved the obstruction. The underlying cause was a narrow (9 mm) lower esophageal ring. As the data did not suggest a cardiac source of chest pain and the acute food impaction reproduced his chest discomfort, the clinicians thought that this ring was the probable source of his symptoms. In this case, the combination therapy helped to minimize the cost and duration of the patient's hospitalization.

In conclusion, our experience confirms that combination therapy is a safe, cost-effective, and efficient method of relieving esophageal food impaction, often eliminating the need for invasive and expensive procedures such as endoscopy.

ACKNOWLEDGEMENT

We express sincere appreciation to Ruth McNeill for preparation of this manuscript.

REFERENCES

1. Andersen HA, Bernatz PE, Grindlay JH. Perforation of the esophagus after use of a digestive agent: report of a case and experimental study. *Ann Otol Rhinol Laryngol* **1959**;68:890–896
2. Holsinger JW Jr, Fuson RL, Sealy WC. Esophageal perforation following meat impaction and papain ingestion. *JAMA* **1968**;203:734–735
3. Ferrucci JT, Long JA. Radiologic treatment of acute esophageal food impaction using intravenous glucagon. *Radiology* **1977**;125:25–28
4. Trenker SW, Maglinte DDT, Lehman GA, Chernish SM, Miller RE, Johnson, CW. Esophageal food impaction: treatment with glucagon. *Radiology* **1983**;149:401–403
5. Rice BT, Spiegel PK, Dombrowski PJ. Acute esophageal food impaction treated by gas-forming agents. *Radiology* **1983**;146:299–301
6. Zimmers TE, Chan SB, Kouchoukos PL, Mirande H, Noy Y, VanLeuven B. Use of gas-forming agents in esophageal food impactions. *Ann Emerg Med* **1988**;17:693–695
7. Zalev AH. Radiologic treatment of a patient with the "steakhouse syndrome": case report. *J Can Assoc Radiol* **1988**;39:59–61
8. Kaszer-Seibert DJ, Korn WT, Bindman DJ, Shortsleeve MJ. Treatment of acute esophageal food impaction with a combination of glucagon, effervescent agent, and water. *AJR* **1990**;154:533–534