Acute gastric dilatation associated with multiple trauma

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This article provides both a review of the literature and a case presentation whereby the anesthesia and surgical procedures were complicated by acute gastric dilatation. The patient was undergoing emergency exploratory laparotomy for blunt abdominal trauma as the result of multiple injuries sustained in an automobile accident.

More than 30 years ago Dr. Henry K. Beecher advocated gastric emptying on all war casualties prior to the administration of anesthesia. The primary reason was to avoid aspiration of gastric contents, but a secondary one was the interference with circulation that seemed to occur with gastric distention.1

Since World War II there have been reports in the literature of acute gastric dilatation following application of plaster jackets or hip spicas (body cast syndrome) and after minor surgery such as dilatation and curettage and appendectomy.2 There have also been reports of acute gastric dilatation following blunt abdominal trauma and trauma to the extremities.3 These reports have been concerned with patients not requiring surgery.

In 1979 a report in the Norwegian literature described a case of acute gastric dilatation following trauma, which resulted in exploratory laparotomy.4 If this dilatation had been correctly diagnosed, laparotomy could have been avoided. The case presented in this article is one of multiple trauma with acute gastric dilatation complicating anesthesia and the surgical procedure.

A case report

A 29-year-old, well-developed and well-nourished Caucasian male was brought to surgery for an exploratory laparotomy. The only history available at the time of his arrival in the operating room was that he had been involved in a single car accident as the sole occupant when the car hit a tree. He was transported to the hospital by the emergency medical service unit. His blood pressure at the scene of the accident was 70/20; he had never been responsive.

He was intubated in the emergency room and an 18-gauge nasogastric tube was placed in the stomach. A chest x-ray showed a fracture of the seventh rib with a 20% pneumothorax on the right and a first rib and clavicular fracture on the left. A chest tube was inserted on the right side. A flat plate of the abdomen and intravenous pyelogram were unremarkable, except for the position of the nasogastric tube which was noted in the postoperative period to be very close to the crest of the ilium (Figure 1).

Laboratory values on admission revealed hematocrit of 38.7, white count of 13.9 and normal urinalysis. A diagnostic peritoneal lavage was performed which was positive for blood. Neurologically, a cerebral contusion was diagnosed.
On arrival in the operating room, the patient was comatose but moving all extremities and appeared responsive to painful stimuli. He was breathing spontaneously with a blood pressure of 120/80 and pulse 110. Anesthesia was maintained with fentanyl, thiopental, and 50% nitrous oxide and oxygen. Pancuronium bromide was given to facilitate relaxation. Monitoring included electrocardiograph, temperature, direct arterial pressure, central venous pressure and urinary output. Ventilation was maintained with an Engstrom® ventilator with a tidal volume of 1200 ml and a rate of 12/min.

When the abdomen was opened, approximately 1000 ml of blood was obtained. Exploration revealed a stellate laceration on the dome of the right lobe of the liver and a large laceration on the inferior surface of the spleen. As the liver laceration was not actively bleeding, the decision was made to proceed with a splenectomy. Arterial blood gases at this time revealed a PaO₂ of 75 torr, PaCO₂ of 42 torr, pH 7.38 and base excess (BE) of zero. The F10₂ was then increased 100%.

During the removal of the spleen considerable difficulty was encountered secondary to a grossly distended stomach. Adequate decompression by suctioning with the Salem® tube was impossible due to a large quantity of partially digested food. During the interval, when gastric decompression was being attempted, the tie placed on the splenic vessels broke loose and a moderate amount of bleeding ensued. The vessels were reclamped and resutured but operating conditions were most unfavorable.

At this time, an Ewald tube was passed into the stomach and irrigation and aspiration of gastric contents were carried out vigorously. Within a period of 15 minutes, the total amount of aspirate from the stomach was approximately 6000 ml (Figure 2). Subtracting 3000 ml of irrigant resulted in a net amount of 3000 ml for gastric contents alone, and there appeared to be a marked relaxation of the abdomen because of the termination of gastric distention. Arterial blood gases following decompression of the stomach revealed PaO₂ of 283 torr, CO₂ of 32 torr, pH 7.43 and BE of -2. The remainder of the surgical procedure was com-

Figure 1
Flat plate of the abdomen depicting the tip of nasogastric tube in close proximity to the crest of the ilium, suggesting gastric distention in the preoperative period.

Figure 2
Gastric contents obtained by irrigation through an Ewald tube. Irrigant utilized during aspiration was 3000 ml which produced 3000 ml of gastric contents alone, primarily partially digested food.
completed uneventfully; there were no problems encountered in the anesthetic management.

**Etiology of acute gastric dilatation**

The etiology of acute gastric dilatation is still a controversial issue today probably because of its occurrence in a wide variety of cases. It has been reported following minor surgery such as dilatation and curettage, appendectomy and following the application of a plaster jacket or hip spica (body cast syndrome). It has also been associated with war injuries, severe and wasting diseases, childbirth, falls and injuries, catheterization of the ureters, blows to the abdomen, errors in diet associated with sudden overloading of the stomach and has been reported in persons with spinal deformities of various kinds.

Such case reports (more frequent in the literature 50 years ago), were evidenced by restlessness, vomiting, dyspnea, tachycardia, abdominal pain, distention and rigidity. Aspiration of gastric contents was a frequent, dreaded complication and if the syndrome was not diagnosed early and treated, it often resulted in circulatory collapse and cardiac arrest.

Best and Taylor* describe acute gastric dilatation occurring as a grave condition characterized by a greatly, sometimes enormously, distended stomach, apparently of reflex origin. The cavity contains large quantities of fluid and gas which may stretch the walls to paper thinness. The accumulated fluid represents a loss of water and chloride from the circulation. Reduction in blood chloride, alkalosis and dehydration result.

When the dilatation occurs during surgery and there is more gas than fluid, the problem usually arises from nitrous oxide in the anesthetic mixture. Marx* and Fouldes* have reported cases of severe gastrointestinal dilatation during nitrous oxide and oxygen anesthesia. This has been ascribed to the fact that during the anesthetic administration, the partial pressure of nitrous oxide in the blood rises rapidly; at the same time nitrogen is exhaled and the partial pressure of nitrogen in the blood falls. As equilibrium between blood and body cavity takes place, nitrogen molecules pass from the cavity to the blood and nitrous oxide molecules enter the cavity.

Since the solubility coefficient of nitrous oxide (0.468) is 36 times greater than nitrogen (1.013), more nitrous oxide molecules diffuse into the cavity than there are nitrogen molecules diffusing out. As a result there is an increase in the gas volume in the gastrointestinal tract. This situation can be reversed by the elimination of nitrous oxide from the anesthetic gas mixture. Although in the case that we described the dilatation was due more so to partially digested food, nitrous oxide was still eliminated to improve ventilation.

The most comprehensive work on the etiology of acute gastric dilatation was done by Dragstedt and associates in 1931. They concluded that the primary cause of acute gastric dilatation is due to the reflex inhibition of the vagus and stimulation of sympathetic nerves (celiac plexus) to the stomach.

**Conclusion**

This case study was presented to alert the anesthetist to the fact that the "one grim spectre" as it has been known, can still occur today. The incidence, however, has been markedly decreased since the introduction of the Levin® tube and now the Salem® sump tube.

The problems associated with acute gastric dilatation are important to note, in that circulatory collapse and/or aspiration of gastric contents may result. Traumatic shock may be further complicated by the inherent distention and becomes more difficult to treat. The diaphragm is elevated which results in subsequent displacement of the mediastinum, a reduction in vital capacity, and a predisposition to atelectasis. In the case described here, artificial ventilation was not adequate, even with the abdomen open, as evidenced by arterial blood gases.

In summary, when the problem of acute gastric dilatation is recognized, it is strongly recommended that a wide-bore tube, such as the Ewald tube, be utilized to adequately decompress the stomach.

**REFERENCES**

AUTHORS

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