

# Gastrostomy and Its Complications\*

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GASTROSTOMY IS AMONG the oldest gastric operations, and although technically not difficult, there are many potential complications. The procedure was first proposed as an operation in 1837, by Egeberg, a Norwegian surgeon,<sup>4</sup> in a discussion of treatment of carcinoma of the esophagus. Staton,<sup>8</sup> a North Carolina surgeon, performed the first successful gastrostomy in this country in 1879, for lye stricture of the esophagus. For an excellent review of the inception and evolution of the gastrostomy, the reader is referred to the paper published by Cunha in *American Journal of Surgery*, 1946.<sup>4</sup>

The purpose of this paper is to review the gastrostomies performed at Duke Hospital during the past ten years, and to discuss the complications that occurred, several of which were quite unusual.

## MATERIAL

From 1944 to 1954 there were 125 gastrostomies done by various members of the senior and resident staff at Duke Hospital. The indications are listed in Table I. Carcinoma of the esophagus, stomach and oropharynx comprise 43 per cent, or 54 of the total 125 cases. Lye stricture and esophagitis comprise 39 per cent (49 cases), and tracheo-esophageal fistula 10 per cent (13 cases). The remaining 8 per cent were for various miscellaneous conditions. Lye stricture and carcinoma of the esophagus were by far the commonest indications in this series, being of equal incidence (39 per cent).

General anesthesia was used in 84 cases (67 per cent), and local anesthesia in the

remaining 41 cases (33 per cent). The latter was usually supplemented with light general anesthesia in infants.

Stamm gastrostomy was employed in all but five of the cases. A left rectus incision was almost routinely employed, and two or three purse-string sutures of catgut were placed in the anterior wall of the stomach to anchor a straight rubber catheter. The latter varied in size from an 18 Fr. to a 32 Fr. On rare occasions a Pezzar catheter was used, and a small mushroom catheter was used in infants. The stomach was anchored to the anterior parietal peritoneum. Feedings were started from one to four days post-operatively. The five cases who had a Witzel gastrostomy were all done by the same member of the senior staff who presumably at one time preferred this type of gastrostomy.

## COMPLICATIONS

There was a 14.4 per cent incidence of non-fatal complications, and 5.6 per cent incidence of fatal complications (Table II).

**A. Non-fatal Complications.** The commonest of the non-fatal complications (Table III) was leakage about the gastrostomy tube. This occurred in six cases, and leakage was severe enough to cause electrolyte imbalance in two of these cases. Separation of the skin occurred in three cases, and this invariably resulted in gastrostomy leakage and delayed wound healing. Excessive pain about the gastrostomy site occurred in two patients, both of whom were adults. Single instances of wound infection, excessive granulation tissue about the gas-

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TABLE I.

Diagnosis	No. of Cases	Age	Anesthesia			
			General	Local	Stamm	Witzel
Carcinoma of Esophagus.....	45 (36%)	35 yr.—81 yr.	30	15	42	3
Carcinoma of Cardia of Stomach.....	4 (3.2%)	54 yr.—62 yr.	2	2	4	0
Ca of Pharynx.....	2 (1.6%)	46 yr.—54 yr.	0	2	2	0
Ca in Branchial Cleft Cyst.....	1 (0.8%)	48 yr.	0	1	1	0
Ca of Tonsil.....	1 (0.8%)	49 yr.	0	1	1	0
Ca of Tongue.....	1 (0.8%)	52 yr.	0	1	1	0
Lye Stricture of Esophagus.....	45 (36%)	1 yr.—53 yr.	41	4	44	1
Tracheo-esophageal Stricture.....	13 (10.4%)	2 days—16 mos.	6	7	13	0
Esophagitis.....	4 (3.2%)	2 yr.—65 yr.	2	2	4	0
Lye Burns of Mouth and Esophagus.....	1 (0.8%)	15 yr.	0	1	1	0
Stricture of Esophagus due to Thermal Burn.	1 (0.8%)	8 yr.	1	0	1	0
Bulbar Palsy.....	1 (0.8%)	67 yr.	0	1	0	1
Esophagus Atresia and Anomaly of Pharynx.	1 (0.8%)	7 days	0	1	1	0
Anorexia Nervosa.....	1 (0.8%)	53 yr.	0	1	1	0
Head Injury.....	1 (0.8%)	30 yr.	0	1	1	0
Aneurysm of Descending Aorta.....	1 (0.8%)	65 yr.	0	1	1	0
Duodenal Ulcer.....	1* (0.8%)	64 yr.	1	0	1*	0
Gastric Ulcer.....	1* (0.8%)	58 yr.	1	0	1*	0
Total.....	125		84	41	120	5
Percent of Total.....		43.2% Malignant Lesions	67%	33%	96%	4%
		56.8% Benign Lesions				

\*Done during the early days of vagotomy as an experimental means of decompression.

trostomy site, severe diarrhea from gastrostomy feedings, and pneumonia occurred.

There were three unusual complications which could have been fatal. These were: (1) pyloric obstruction by the gastrostomy tube; (2) erosion of the gastrostomy tube through the stomach and diaphragm; (3) complete prolapse of the stomach through the gastrostomy.

*B. Fatal Complications.* There were seven fatal complications (Table IV), four of which occurred in the infants with tracheo-esophageal fistula. Three of the latter deaths resulted from starvation secondary to a malfunctioning gastrostomy. The fourth death was the result of an incorrectly placed gastrostomy tube, which eroded through the stomach and diaphragm. The remaining three deaths occurred in carcinoma patients. One patient with carcinoma of the esophagus died one week postoperatively following an abdominal wound disruption. Another patient with carcinoma of the esophagus died as a result of the gastrostomy tube inadvertently being placed in the first portion of the duodenum. The third death was a patient who had a palliative gastrostomy

for carcinoma of the cardia of the stomach. The patient died suddenly on the eighth postoperative day, and the cause of death was not determined.

DISCUSSION

With the advent of successful esophageal resection the need for gastrostomy was diminished. It has also become apparent that gastrostomy offers little palliation in most instances of irresectable carcinoma of the esophagus.<sup>2, 3, 7, 9</sup> Nevertheless, esophageal lesions still comprise the largest indication for gastrostomy today. Currently the authors' most frequent use of gastrostomy is in the treatment of lye stricture of the esophagus. It is our feeling that the majority of children with lye stricture are candidates for retrograde dilatation, reserving resection of the esophagus and esophago-gastrostomy for patients who do not respond to dilatation within a reasonable period of time.<sup>1</sup> Gastrostomy is not routinely done following repair of tracheo-esophageal fistula as advocated by Gross.<sup>5</sup> Gastrostomy is occasionally used in treating a completely obstructing, irresectable carcinoma of the

TABLE II. *Complications.*

Diagnosis	No. of Cases	Non-Fatal Complications	Fatal Complications
Lye Stricture of Esophagus...	45	9	0
Carcinoma of Esophagus.....	45	4	2
Carcinoma of Cardia of Stomach.....	4	1	1
Tracheo-Esophageal Fistula...	13	2	4
Esophagitis.....	4	1	0
Carcinoma of Pharynx.....	2	1	0
Head Injury.....	1	0	0
Esophageal Atresia and Anomaly of Pharynx.....	1	0	0
Remaining Cases.....	10	0	0
Total.....	125	18	7
Percent of Total.....	100%	14.4%	5.6%

TABLE III. *Non-fatal Complications.*

Complication	No.
Leakage about Gastrostomy Tube.....	4
Leakage about Gastrostomy Tube with Electrolyte Imbalance.....	2
Wound Separation (Skin).....	3
Wound Infection.....	1
Excessive Granulations about Gastrostomy.....	1
Pain about Gastrostomy Site.....	2
Severe Diarrhea from Gastrostomy Feedings.....	1
Pneumonia.....	1
Pyloric Obstruction by Gastrostomy Tube.....	1
Erosion of Gastrostomy Tube through Stomach and Diaphragm.....	1
Complete Prolapse of Somach through Gastrostomy.....	1
TOTAL.....	18

esophagus. The patient is then able to continue roentgen ray therapy as an outpatient with considerably less financial burden. In a few cases survival has been as long as 14 months.<sup>10</sup> The injudicious use of gastrostomy in irresectable carcinoma of the esophagus, however, does not always result in palliation for the patient.<sup>2, 3, 7, 9</sup>

The commonest complications of a gastrostomy, particularly a Stamm, are leakage about the gastrostomy tube, skin separation, wound infection, and diarrhea from tube feeding. In most instances it is difficult to attribute leakage about the gastrostomy tube to any single factor. It is advisable to use a relatively small catheter at the time of the gastrostomy unless retrograde dilatation of the esophagus is anticipated. If leakage develops it may be controlled by using a larger mushroom or Foley catheter. The latter may be taped to the skin so that it is held snugly against the anterior wall of the stomach. When adhesive tape will not hold because of continuing leakage, the authors have occasionally surmounted the difficulty by using a homemade rubber washer over the catheter and against the anterior abdominal wall. Leakage has been a serious problem only in children in whom gastrostomy was being used for retrograde dilatation, and in infants with tracheo-esophageal fistula. In the former group the dilatations

probably also dilated the gastrostomy opening, and may have been directly responsible for the leakage. Minor degrees of leakage not infrequently occur with most gastrostomies. In two of the cases with persistent leakage, superimposed gastro-enteritis in one and dehydration in the other nearly resulted in fatalities.

**Case 1.** Duke Hospital #D5537. This 2-year-old white male child was originally seen at Duke Hospital because of esophageal obstruction. Diagnostic esophagoscopy resulted in perforation and empyema. A gastrostomy was carried out and the empyema drained. The child recovered, and his esophageal obstruction was attributed to esophagitis and stricture. He received retrograde dilatations with improvement. It was noted in the record, however, that he had persistent leakage about the gastrostomy tube. Following a bout of vomiting and diarrhea of 2 to 3 days' duration, the child was brought to the hospital. On examination he was found to be quite lethargic and dehydrated. There was marked irritation of the skin on the abdominal wall, and leakage about the gastrostomy tube. Upon questioning the parents stated that there had been considerable leakage of stomach contents in the previous few days. The child became comatose several hours after admission, and was found to be in marked hypokalemia and hypochloremia. He ultimately recovered following fluid and electrolyte replacement. Leakage about the gastrostomy tube was controlled by using a larger mushroom catheter which was anchored by a homemade rubber washer. The latter was slipped over the tube and placed against the skin, so that the mushroom tip of the catheter was held snugly against the anterior stomach wall.

TABLE IV. *Fatal Complications.*

Diagnosis	Complication	No.
Tracheo-esophageal Fistula	Malfunctioning Gastrostomy —Leakage—.....	3
Tracheo-esophageal Fistula	Erosion of Gastrostomy Tube Through Stomach and Diaphragm with Empyema	1
Carcinoma of Esophagus	Wound Disruption.....	1
Carcinoma of Esophagus	Gastrostomy Tube Errone- ously Placed in Wall of Duodenum.....	1
Carcinoma of the Cardia of the Stomach.....	Sudden Death Eight Days Postoperatively. Etiology?	1
Total.....		7

Skin separation about the gastrostomy site is either the result of infection, or poor approximation. When this complication develops, care of the gastrostomy becomes a greater problem. Antibiotics and careful approximation may circumvent this difficulty. Wound disruption may be prevented by using a small incision and wire stay sutures in patients who are in a poor nutritional status.

Diarrhea may develop from high fat concentration in the feeding mixture. If this occurs, the patient is given Kaopectate, or a similar medication, and the tube feeding is made more dilute. This difficulty is most often encountered in patients with carcinoma of the esophagus in whom gastrostomy tube feeding must be maintained for many months. If excessive granulations develop about the gastrostomy site, these may be controlled by excision, or cauterization with silver nitrate. Pain about the gastrostomy site occurred in two patients, and it was relieved in one of the patients by re-positioning the gastrostomy tube. In the other patient, pain was intermittent in character and persisted for several months until death. Minor degrees of discomfort may result from skin irritation due to gastrostomy leakage. Bronchopneumonia has not been a common complication since the advent of antibiotics, although it was a problem, particularly in the aged, in the pre-antibiotic days.

The three unusual complications will be described:

**Case 2. Pyloric Obstruction by Gastrostomy Tube.** Duke Hospital #D26626. This 3½-year-old colored boy was admitted to Duke Hospital at the age of 1½ years, with a lye stricture of the esophagus. Gastrostomy was done, and the child was treated with retrograde dilatations of the esophagus for the next 2 years. Two weeks following a dilatation, the child was brought to the hospital because of persistent vomiting. Barium studies of the esophagus and stomach revealed the tip of the gastrostomy tube, which was a mushroom catheter, to be occluding the pylorus. The tube was removed and replaced by a straight catheter. The vomiting ceased, and the child has had no further difficulty.

We subsequently discovered that the gastrostomy tube had been replaced by one of the operating room orderlies following the last retrograde dilatation. The prevention of this complication is obvious.

**Case 3. Erosion of Gastrostomy Tube Through the Stomach and Diaphragm.** Duke Hospital, #C54199. This 4-year-old colored boy was admitted to Duke Hospital at the age of 1 year, with lye stricture of the esophagus. Gastrostomy was done, and the child was followed in the retrograde clinic as an outpatient for the next 3 years. Two months following a retrograde dilatation the child was brought to the Pediatric Outpatient Clinic because of fever. An empyema was found and drained. The child improved but had a bronchopleural fistula, and subsequently gastric contents were found draining through the thoracotomy tube. After the child's general condition had improved a thoracotomy was done. A fistula was found in the stomach and diaphragm which had resulted from erosion by the gastrostomy tube. The fistula was closed and the lung decorticated. Recovery was uneventful.

Questioning at a later date revealed that the mother had actually replaced the gastrostomy tube several weeks previously when it had been removed to be cleaned. This complication can be prevented by constantly explaining and cautioning the parents of the dangers of replacing the tube incorrectly.

**Case 4. Complete Prolapse of the Stomach Through the Gastrostomy.** Duke Hospital, #D26079. This 2½-year-old colored girl was ad-

mitted to Duke Hospital at the age of 1½ years, with a lye stricture of the esophagus. A gastrostomy was done, and retrograde esophageal dilations were carried out for the ensuing year. One night the child was brought into the Emergency Clinic, having developed a complete prolapse of the stomach through the gastrostomy site several hours previously. The prolapse could not be reduced under general anesthesia, and it was necessary to do a laparotomy. The gastrostomy was closed, and recovery was uneventful.

Upon reviewing the record it was noted that a No. 28 Fr. straight rubber catheter was used for a gastrostomy tube at the time of the original operation, since retrograde dilations were to be undertaken. The size of the gastrostomy may have been a contributing factor. This is mere speculation, however, since it is the only case of prolapse that we have encountered.

It has been our experience that complications from gastrostomies are most frequently encountered in newborn infants. This is exemplified if one looks at Table II. Of the 13 patients with tracheo-esophageal fistula in whom it was necessary to do a gastrostomy, there were four fatal complications. The two non-fatal complications were single instances of wound separation and gastrostomy leakage with electrolyte imbalance. The latter occurred four years after successful closure of a tracheo-esophageal fistula, and actually should not be included with complications of a gastrostomy in a newborn. This leaves a total complication rate in newborn of 38.5 per cent, and a fatal complication rate of 30.7 per cent. The major difficulty encountered is a malfunctioning gastrostomy, which results in considerable leakage about the gastrostomy site. In spite of electrolyte replacement and continuing feeding, the infant eventually becomes cachectic and dies. This has occurred in three cases. The fourth case died as a result of a gastrostomy tube being placed too deeply at the time of operation. The infant died five days later, and autopsy revealed that the gastrostomy tube had eroded through the wall of the stomach

and diaphragm, with an overwhelming empyema. Extreme caution should be taken when the gastrostomy tube is anchored, and it should be remembered that the margin of error is less in the infant. This error can be avoided by using a small mushroom catheter.

The prevention of a malfunctioning gastrostomy is a more difficult problem. There may be several factors which bring about this difficulty. They are: (1) reverse peristalsis in the stomach; (2) food intolerance; (3) pylorospasm; (4) unusually small stomach. Reverse peristalsis occurs in the stomach of a normal infant, being more marked in some than in others. The cardiac sphincter is usually competent, and the gastrostomy thus becomes the most convenient site for decompression, particularly since it is not water tight.

It is not uncommon for a newborn to tolerate its formula poorly. Once vomiting develops in an infant with a gastrostomy, leakage occurs about the gastrostomy and is quite a problem to control.

Pylorospasm may be induced by the presence of a gastrostomy tube.<sup>6</sup> In one of the infants with tracheo-esophageal fistula, the gastrostomy was revised because of persistent leakage and weight loss. Barium injected into the gastrostomy tube preoperatively showed pyloric obstruction. Palpation at the time of revision failed to reveal a hypertrophied pylorus. The revised gastrostomy broke down four days later, and leakage occurred. The infant ultimately died.

Another malfunctioning gastrostomy occurred in an infant with extensive esophageal atresia without a fistula. An exploratory thoracotomy was carried out, followed by a pharyngostomy and gastrostomy. A malfunctioning gastrostomy developed, and an attempt was made at revision ten days later. At operation the entire anterior wall of the stomach was purse-stringed around the gastrostomy tube. A revision was attempted, but the infant died a week later. In infants

with esophageal atresia but without fistula, the stomach is unusually small, and the operator is cautioned again to use a small mushroom catheter and incorporate as little of the stomach wall in the purse-string suture as possible. In the third fatal malfunctioning gastrostomy, congenital heart disease was a contributing factor to the death. The gastrostomy never functioned satisfactorily, however, and there was persistent leakage and malnutrition prior to death.

It is possible that the previously described difficulties may be circumvented by threading a small plastic catheter into the duodenum at the time of operation, and bringing it out through the gastrostomy tube for feeding purposes.<sup>6</sup> We have had no experience with this technic. Because of the above experiences, however, we do not routinely do gastrostomies following tracheo-esophageal fistula repair. Gastrostomies are done: (1) in the immediate postoperative period if there is evidence of breakdown at the esophageal suture line; (2) if stricture occurs at the site of repair; (3) in infants with atresia of the esophagus without fistula. Some of the latter infants may be candidates for esophago-gastrostomy. It is our general policy, however, to defer this phase of the operation for several years.

Although we encountered most of the common complications and a few unusual ones, our total complication rate is considerably lower than in previously reported series.<sup>2, 3, 7</sup> This may be explained by the fact that the majority of our cases were done in "the antibiotic era." For this reason it is suggested that all gastrostomy patients be given antibiotics postoperatively.

#### SUMMARY

Gastrostomy is one of the oldest gastric operations. Although the development of technics for successful esophageal resection diminished the need for gastrostomy, there are still indications for its use today. From 1944 to 1954, there were 125 gastrostomies

done at Duke Hospital. There was a non-fatal complication incidence of 14.4 per cent, and a fatal complication incidence of 5.6 per cent. The various complications are reviewed, and means of prevention are discussed. Three unusual complications encountered were: (1) pyloric obstruction by the gastrostomy tube; (2) erosion of the gastrostomy tube through the stomach and diaphragm; (3) complete prolapse of the stomach through the gastrostomy. The highest incidence of fatal complication occurred in infants with tracheo-esophageal fistula. Reasons for not doing gastrostomy routinely in infants with tracheo-esophageal fistula are discussed.

It is suggested that all gastrostomy patients be given antibiotics postoperatively, that extreme caution be exercised in positioning the gastrostomy tube, that a small mushroom catheter (16 Fr.) be used in infants, and that wound edges be approximated carefully. If there is considerable leakage about the gastrostomy tube, electrolyte balance may become a serious problem.

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