



Technique for Isoperistaltic Gastric Tube for Esophageal Bypass

R. W. POSTLETHWAIT, M.D.

*From the Department of Surgery,
Veterans Administration Hospital and
Duke University Medical Center, Durham, North Carolina*

There has not been described a uniformly successful method for palliation of inoperable carcinoma of the esophagus, especially malignant tracheoesophageal fistula. A gastric tube formed from the greater curvature of the stomach is being evaluated for these patients. The blood supply is based on the right gastroepiploic vessels. Using a stapler, one can form a gastric tube sufficiently long to reach the hypopharynx. Placed substernally, anastomosis to the cervical esophagus is performed. In 30 patients postoperative mortality has been 13%. No tube necrosis has occurred, but anastomotic leakage has been a problem. In those patients who had esophageal bypass for palliation and were discharged from the hospital, swallowing function has been satisfactory and the average survival has been 5.2 months.

THE NUMBER OF METHODS described for palliation in carcinoma of the esophagus suggests that no single approach has been decisively successful. Our interest was first stimulated by those patients with malignant tracheoesophageal fistula, whose terminal course is particularly miserable. In a group treated by colon interposition, morbidity and mortality were unacceptably high, so that a safer operation was sought. An evaluation of a greater curvature gastric tube, placed substernally, therefore was undertaken.

Beck and Carrell¹ first described experiments with these tubes in dogs in 1905. The reversed gastric tube was suggested as a means of prethoracic esophageal reconstruction; the isoperistaltic tube for use as a

permanent gastrostomy. In 1942 Carter, Abbott and Hanlon² in a first stage operation constructed a greater curvature gastric tube in dogs, leaving both ends intact. About three weeks later, through a thoracotomy, either a reversed or isoperistaltic tube was brought up into the chest or subcutaneously. They concluded that clinical application seemed feasible. Kay³ in the following year expressed the same opinion, although in his experiments a one-stage operation was adopted because of the vascular adhesions which developed after the first stage.

The most extensive clinical experience with the reversed gastric tube has been reported by Gavrilu³ from Bucharest and by Heimlich⁴ in this country. Gavrilu describes removal of the spleen routinely, as he believes this increases blood flow through the left gastroepiploic artery. To provide more length of the tube, the tail of the pancreas is mobilized over to the aorta. In about 20% of his patients, the pylorus and first portion of the duodenum are made part of the tube. In these fragile patients each additional step in the operation increases the possibility of complications. For this reason the isoperistaltic tube appeared preferable to the reversed tube.

No implication is intended that 1) an aggressive operative approach is appropriate in all of these patients or 2) that the isoperistaltic tube is the best means of palliation.

Presented at the Annual Meeting of the Southern Surgical Association, December 4-6 1978, Hot Springs, Virginia.

Reprint requests: R. W. Postlethwait, M.D., Veterans Administration Hospital, Durham, North Carolina 27705.

Submitted for publication: December 7, 1978.

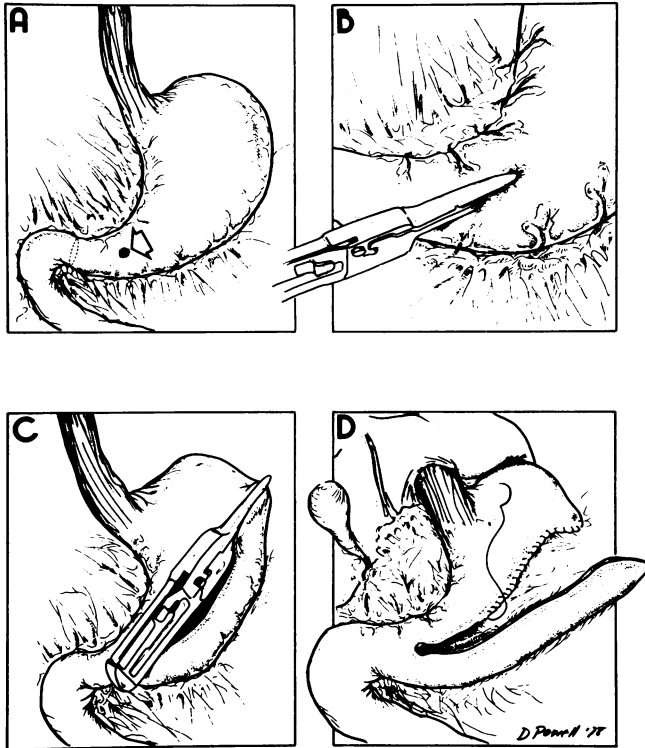


FIG. 1. A) After mobilization of greater curvature, a point is selected proximal to pylorus to begin tube. B) First application of stapler. C) Last application of stapler. D) Tube is formed, and staple row of stomach remnant is being closed with a continuous suture.

Technique

With the patient supine, the neck, chest and abdomen are prepared and draped. A long upper midline abdominal incision is made, and the usual exploration is performed. The Upper Hand® retractor is placed. Although they have not yet been found to be deficient, the right gastroepiploic artery and vein should be checked for size and length. At a safe distance from these vessels, the gastrocolic omentum is divided, beginning 3–4 cm proximal to the pylorus. The vessels are carefully ligated, and if they are of appreciable size, transfixion ligatures are used. As the spleen is approached, the right and left gastroepiploic vessels will be found not to communicate, as usually shown in anatomy texts; at this point dissection is closer to the stomach wall. Depending on the length of tube needed, any number from one to all of the short gastric vessels are divided. The length required can be estimated by measuring from below the xiphoid to the neck and then along the greater curvature. A Kocher maneuver is then performed, generously mobilizing the duodenum.

A point at which to begin the tube is now determined in the antrum. This point is usually 4–6 cm proximal

to the pylorus but actually is selected where the antrum widens to permit an opening of 2.5–3.0 cm in diameter for both the tube and the remaining stomach (Fig. 1). With electrocautery an opening is made through anterior and posterior walls of the stomach to permit insertion of the GIA stapler. The tube is then formed by successive applications of the stapler, the diameter of the tube being 2.5–3.0 cm (Gavriliu believes a tube slightly less than 2 cm functions better and decreases reflux). As the stapler is placed and before it is closed, the assistant puts tension on the stomach wall to provide maximum length. At least five and as many as eight staple applications will be needed. The last application is placed obliquely across the edge of the greater curvature, forming a tapered tip to the tube.

A number of vessels, mainly in the submucosa on the stomach side, will require transfixion ligature, superficially placed in the staple line. Beginning proximally, the stapled edge of the stomach is inverted with a continuous suture of synthetic, non-absorbable material, either 2-0 or 3-0 in size. In the antrum where the tube was started, the mucosa and submucosa are closed with a continuous synthetic absorbable suture (Fig. 2). The seromuscular suture is

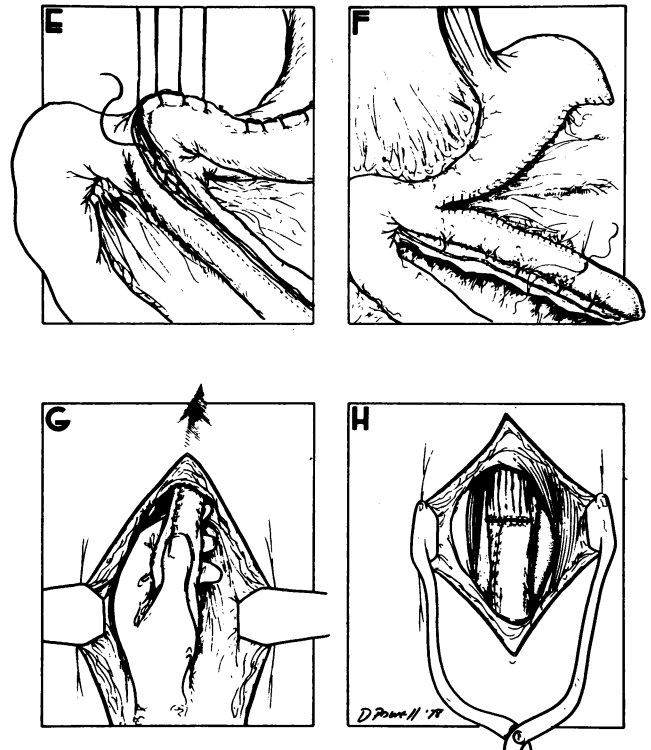


FIG. 2. E) Mucosa is closed with continuous suture and reinforced with interrupted seromuscular sutures. F) Interrupted sutures placed for entire length of tube. G) Tube is gently elevated into substernal position. H) End-to-end anastomosis of tube to esophagus in neck.

4-0 interrupted silk. This interrupted suture inversion is continued to the end of the tube, with care not to narrow the lumen. A pyloroplasty is not done routinely.

At the appropriate time, a second team starts the dissection in the neck. The incision may be on either side, unless recurrent nerve paralysis is present on a side, which would of course be the preferred side. The esophagus is mobilized and divided. The distal cut end may be closed with a stapler or with sutures. The sub-sternal tunnel is formed, and the gastric tube end is brought into the neck. No excessive redundancy of the tube should remain. For an end-to-end anastomosis, the excess portion of the tube is cut off, and anastomosis is performed according to the surgeon's preference. We have used two layers, both interrupted, with absorbable sutures inside and nonabsorbable sutures for the outer layer. Particular care is taken at the critical angle, *i.e.*, where the closure line of the tube meets the anastomosis. The inner sutures are through all layers of esophagus and tube, and an effort is made to secure good mucosal apposition.

Alternatively, the end of the esophagus may be anastomosed into the side of the tube opposite the staple line. The tip of the tube is then sutured to the skin as a controlled fistula, or it may remain closed and sutured to the prevertebral fascia, well above the anastomosis. The abdomen is closed without drainage, the neck with drainage. A chest film is obtained before moving the patient from the table, as the pleura may have been torn and a chest tube is then necessary.

Results

Isoperistaltic gastric tubes have been constructed in 30 patients. One was for a long stricture, secondary to prolonged nasogastric intubation after a stroke. The stricture could not be dilated, and because of severe pulmonary disease, esophageal bypass was elected. The patient has done well for over 2 years. Four patients had carcinoma of the cervical portion of the esophagus treated by cervical esophagectomy and laryngectomy. All are living after intervals of 5-39 months. One has hypothyroidism, another both hypothyroidism and hypoparathyroidism. Swallowing is satisfactory in all.

Twenty-five patients with carcinoma had bypass for the following reasons: Five had tracheo- or broncho-esophageal fistula, nine had tracheal or bronchial involvement with impending fistula formation, seven had excessively large tumors, one had lung metastases and three had intra-abdominal metastases.

Four deaths occurred within 30 days: two because

of pneumonia and respiratory failure, one due to renal failure and sepsis and one from mediastinitis and empyema. Three other patients were never discharged from the hospital; all three died of progression of their malignancy with terminal pneumonia and respiratory failure at 41, 55 and 65 days after operation.

Cervical anastomotic leak developed in 13 patients (43%); in ten the leak closed in 1-4 weeks. One patient who had laryngoesophagectomy had a fistula into the trachea, which closed after 2 weeks of total parenteral nutrition. One patient developed a subhepatic abscess but responded promptly to drainage. One stricture occurred.

Survival of those discharged (excluding the benign stricture and the cervical carcinomas) ranged from 1-11 months, with an average of 5.2 months. Oral intake of soft food was restored in most patients and of solid food in a few.

Discussion

The report of Gavrieliu lists 21, 3.62%, deaths in 580 gastric tube operations. The number of patients with benign or malignant disease is not stated, which is important in the expected mortality. In his table of complications after 536 replacements, the following are listed: mediastinitis, 10; tube necrosis, 3; subphrenic abscess, 2; empyema, 4; pneumothorax, 12 and anastomotic fistula, 41. Regarding the last, he states "one need not include in a section on fistula the mere leaks that close spontaneously during the fortnight following their occurrence." It is not clear if the 41 listed fistulas are all that occurred or only the ones which persisted.

Considering that 25 of the 30 patients reported here had far advanced carcinoma, the postoperative mortality rate of 13% would appear to be acceptable. The frequency of fistula at the cervical anastomosis, however, was excessive, even though all but three closed.

The advantages of this operation include a mucosa-lined, serosa-covered tube with a good blood supply, adequate length and lumen and satisfactory emptying, although seldom by peristaltic action. Tube necrosis has not been seen, although in one patient who died postoperatively, autopsy showed a narrow rim of necrotic gastric mucosa. A length of 28-32 cm is usually sufficient and is easily obtained; one tube was 38 cm long. Early in our experience, the required length was misjudged in one patient, resulting in moderate tension on the anastomosis.

The disadvantage of anastomotic leak must be considered. These do not appear to be due to impaired blood supply or anastomotic tension and probably not faulty suture technique. The critical angle may be the

weak point, or possibly with each swallow (which cannot be prevented), the proximal esophageal segment momentarily shortens, placing a tug on the anastomosis. Another disadvantage is reflux, which is seldom a problem through the tube, as the head of the bed is elevated. With an incompetent lower esophageal sphincter, however, reflux from the stomach remnant into the esophagus will occur and, in the presence of a fistula, could cause continued aspiration pneumonitis.

In summary, the palliation obtained with an isoperistaltic gastric tube for bypass of inoperable carcinoma of the esophagus has been sufficient to encourage continued evaluation of this method.

DISCUSSION

DR. EDWARD F. PARKER (Charleston, South Carolina): Dr. Sparkman, Dr. Warren, members and guests: I certainly enjoyed this presentation very much. I want to commend Dr. Postlethwait for his continued interest and patience in seeking a reasonable method of palliation for patients with carcinoma of the esophagus with esophagotracheal or esophagobronchial fistula, which leads to a quick miserable death in those so afflicted.

We have long been interested in the possibility of using an isoperistaltic tube to bypass it, because our experience with the reversed gastric tube, with the blood supply based at the fundus, has been not a happy one at all over the years, and we commend him for his reasonable success, although the mortality rates and the high percentage of anastomotic leaks are still discouraging.

Also, it would seem to me that the use of the isoperistaltic tube would have a better chance of success if the terminal esophagus were also occluded, as he brought out, because without this, serious reflux and aspiration through the fistula can still continue.

Also, I would doubt that use of the tube has any real advantage over the use of the whole stomach. That long suture line can be avoided, and the chance of leakage abolished.

(slide) Our recent experience in a group of 110 cases of carcinoma of the esophagus seen in the last three and one-half years has been reviewed, along with the methods of management, including those with inability to swallow, with or without fistula. Our operability rate is still low (21%) though the palliation and the chance for long-term survival are gratifying among the survivors.

In two cases, the Celestin tube has been a complete disappointment. They survive the insertion, but have succumbed to aspiration, possibly because of the loss of the lower esophageal sphincter.

The reversed gastric tube has been successful in two recent cases without fistula, but this was not our earlier experience. In the presence of fistula (three cases), one reversed gastric tube and two colic interpositions have failed.

In the past three and one-half years we have become interested in the Proctor-Livingstone tube as the preferable endoesophageal prosthesis (six cases). However, there are no long-term survivors, and they too appear to be subject to sudden aspiration death, even though the lower esophageal sphincter is still intact.

(slide) This slide shows the equipment we use for dilatations and insertion: long and short rigid esophagoscopes with 10 mm internal diameter to allow dilatations with woven, tapered bougies, if

References

1. Beck, C. and Carrell, A.: Demonstration of Specimens Illustrating a Method of Formation of a Prethoracic Esophagus. *Ill. Med. J.*, 7:463, 1905.
2. Carter, B. N., Abbott, O. A. and Hanlon, C. R.: An Experimental Study of Tubes Made From the Greater Curvature of the Stomach. *J. Thorac. Surg.*, 11:494, 1942.
3. Gavriliu, D.: Aspects of Esophageal Surgery. *Curr. Probl. Surg.*, 12:1, 1975.
4. Heimlich, H. J.: Reversed Gastric Tube (RGT) Esophagoplasty for Failure of Colon, Jejunum and Prosthetic Interpositions. *Ann Surg.*, 182:154, 1975.
5. Kay, E. B.: Experimental Observations on Reconstructive Intrathoracic Esophagogastric Anastomosis Following Resection of the Esophagus for Carcinoma. *Surg. Gynecol. Obstet.*, 76:300, 1943.

necessary. Thereafter, Hurst and Maloney dilators are passed, up through No. 50 French. Thereafter, a No. 30 French Hurst is passed through the esophagus into the stomach as a guide. A prosthesis of appropriate length, with an internal diameter of one-half inch, is passed over it. Next, a piece of Tygon tubing with an internal diameter of one-half inch is also threaded over the bougie and used as a pusher, against the prosthesis until it is seated at the proper level. Next, the pusher and the guide are removed. This is best done under general anesthesia, and no incisions are required.

(slide) The next slide shows such a tube in place.

(slide) The last slide shows still another tube, with esophagograms at different times. It looks good, but even so the patients may still be unable to swallow consistently.

I have great admiration for Dr. Postlethwait's work and results. Notwithstanding, it is our general feeling that in the type of patient under discussion, in whom we are not really trying to prevent death, but, rather, to alter the manner of death, we see body defense mechanisms, resistance, reparative power, all very seriously impaired in these very malnourished patients.

Even the operation of feeding gastrostomy can be associated with a mortality of 17% and greater in some reports.

So we feel that until we have a method of restoring these deficiencies almost instantly, it is best to avoid major operation, and therefore we plan to continue to try endoesophageal prostheses in spite of the vexations and vicissitudes associated with their use.

DR. R. W. POSTLETHWAIT (Closing discussion): Occlusion of the esophagogastric junction to prevent the reflux was mentioned. We have had some rather unfortunate consequences when we used the stapler for this or when we simply tied a tape or heavy suture around it. Therefore, if it is to be divided, then one must suture both the esophagus and the stomach. As I tried to make clear at the outset I hoped for something extremely simple for palliation. Division of the cardia adds another step. We will accept some reflux, and hope we can control it at least partially by positioning.

The whole stomach used for bypass is also a more extensive procedure, and we are trying to find the most simple procedure.

I am aware of the very excellent papers of Hagerty and his associates from South Africa. It would be beautiful if their very simple placement of an endoesophageal tube would give satisfactory palliation.