Esophagogastrectomy: Left Thoracoabdominal Approach

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Indications

Carcinoma of the distal esophagus or proximal stomach
Distal esophageal stricture

Preoperative Preparation

See Chap. 14.

Pitfalls and Danger Points

Anastomotic failure

Ischemia of gastric pouch. Pay meticulous attention to preserving the entire arcade of the right gastroepiploic artery and vein along the greater curvature of the stomach.

Hemorrhage. Occasionally, the left gastric artery is embedded in tumor via invasion from metastatic lymph nodes. Unless this vessel can be identified, transecting the artery through the tumor may produce hemorrhage that is difficult to control.

Pancreas. Trauma to the tail of the pancreas may cause a pancreatic fistula or acute hemorrhagic pancreatitis.

Sepsis. Some malignancies in the proximal portion of the stomach are ulcerated and bulky with areas of necrosis that contain virulent bacteria. These bacteria may produce postoperative subhepatic or subphrenic abscesses via operative contamination even without anastomotic leakage. Both enteral and parenteral antibiotics that cover colon flora should be used.

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Inadequate cancer operation. Because gastric and esophageal malignancies can spread submucosally for some distance without being visible, frozen section studies of both proximal and distal margins of the excision are helpful.

Paralysis of the diaphragm. The diaphragm should be divided around the periphery to preserve phrenic innervation and prevent paralysis.

Operative Strategy

Objectives of Esophagogastrectomy

With operations done for cure, the objective is wide removal of the primary tumor, along with a 6- to 10-cm margin of normal esophagus in a proximal direction and a 6-cm margin of normal stomach below. Even if the stomach is not involved, when the tumor is situated low in the esophagus the proximal lesser curvature of the stomach should be included to remove the left gastric artery at its origin and the celiac lymph nodes. Splenectomy and removal of the lymph nodes at the splenic hilus may be required for large lesions of the proximal stomach and fundus. Any suspicious nodes along the superior border of the pancreas should also be removed.

Thoracoabdominal Incision with Preservation of Phrenic Nerve Function

When gastric cancer encroaches on the gastroesophageal junction, operations done by abdominal incision exclusively are contraindicated for several reasons. In the first place, this anastomosis frequently requires the surgeon's hand and the needle holder to be in an awkward position and may result in leakage. Furthermore, the abdominal incision makes it difficult to perform wide excision of possible areas of invasion of the

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distal esophagus. We have seen some upper gastric lesions that extended into the esophagus as far as 10 cm.

The left thoracoabdominal incision, we have found, is both safe and efficacious. It is easy to divide all the muscles of the thoracic cage rapidly by electrocautery. Even patients in their 80s have tolerated this incision well when given adequate postoperative support. Epidural anesthesia minimizes pain and allows early mobilization.

Positioning the patient in the full lateral position with an incision through the fifth or sixth intercostal space gives wide exposure to the mediastinum, left pleural space, and left upper quadrant of the abdomen.

The diaphragm should *not* be incised radially from the costal margin to the esophageal hiatus because it would transect the phrenic nerve and paralyze the left diaphragm. Many patients who require gastric surgery for cancer are aged and have limited pulmonary reserve; moreover, because atelectasis is a common postoperative complication, it is better to make a circumferential incision in the periphery of the diaphragm to preserve phrenic and intercostal nerve function and normal diaphragmatic motion.

Postoperative pain at the site of the divided costal margin is allegedly common following a thoracoabdominal incision. In our experience proper resuturing of the costal margin with monofilament steel wire results in solid healing of this area. Neither pain nor costochondritis has been a problem.

Anastomotic Leakage

Delicacy and precision of anastomotic technique and adequate exposure are important for preventing anastomotic leaks. If a gastric or lower esophageal lesion has spread up the lower esophagus for a distance of more than 6–8 cm, the esophagogastric anastomosis should not be constructed high up under the aortic arch as it is a hazardous technique. Instead, 1-cm posterior segments of two additional ribs are resected if necessary to give more proximal exposure, and the esophagus is liberated behind the arch of the aorta and passed out to an intrapleural, supraaortic position. This exposure permits the anastomosis to be done in a manner less traumatic to the tissues than an anastomosis constructed high up under the aortic arch. Otherwise, the surgeon's hand and wrist are situated in an awkward position, which makes smooth manipulation of instruments difficult. Jerky suturing motions produce small tears in the esophagus, especially in the posterior layer, where access is difficult.

End-to-End Versus End-to-Side Anastomosis

We showed that the end-to-end esophagogastric anastomosis carries with it a much higher rate of leakage and a higher mortality rate than the end-to-side variety (Chassin 1978). Explanations for the increased complication rate following end-to-end esophagogastrostomy are not difficult to find.

1. It is necessary to close a portion of the end of the stomach because of the disparity between the lumen of the stomach and that of the esophagus. This increases the technical difficulty of doing the end-to-end anastomosis (Fig. 15.1a, b).
2. The blood supply of the gastric pouch at its proximal margin is inferior to that at the site of the end-to-side anastomosis.
3. Inserting the posterior layer of esophagogastric sutures may be difficult. Traction must be applied to the esophagus to improve exposure, and the surgeon's hand and the needle holder may have to assume positions that are awkward for efficient, atraumatic suturing, which produces imperfections in the suture line.
4. As seen in Fig. 15.2a, protection from posterior leakage is achieved in the end-to-side cases by the buttress effect of a 6- to 7-cm segment of gastric wall behind the esophagus. In end-to-end operations, however, there is no second line of defense against technical error.

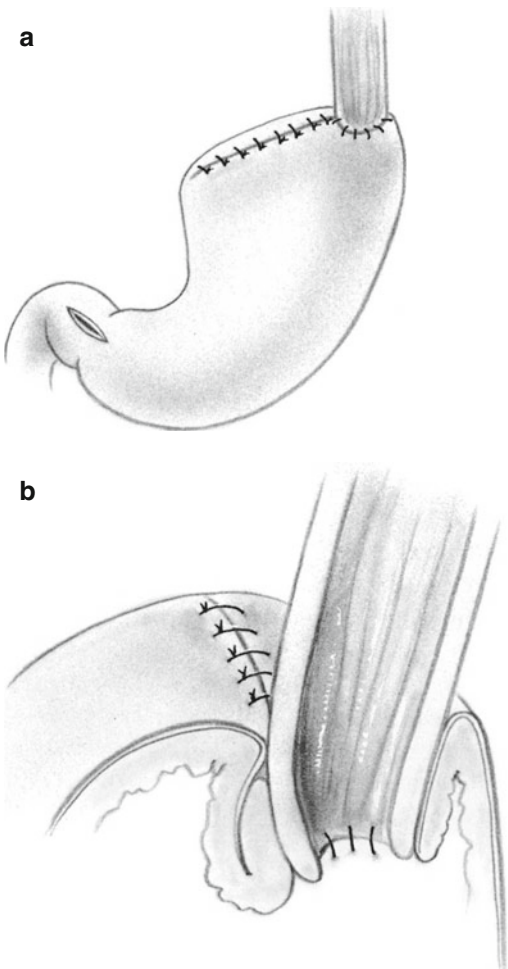


Fig. 15.1

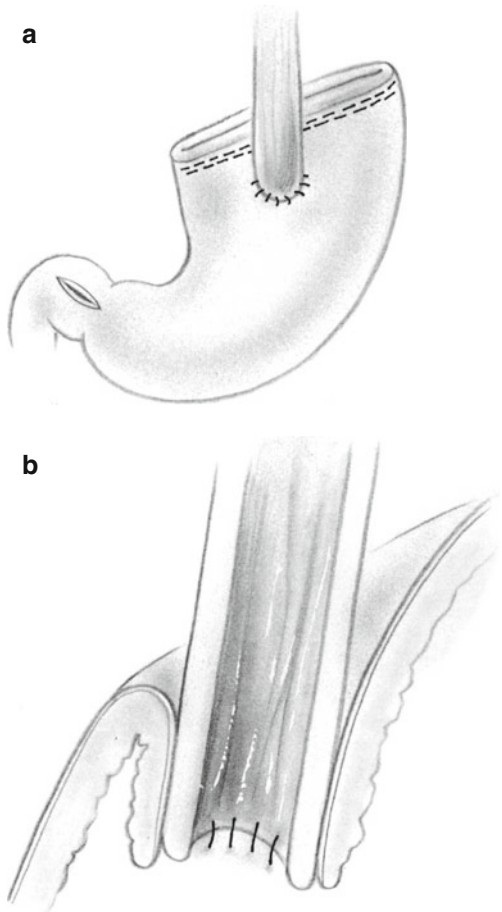


Fig. 15.2

5. Although the anterior layer of the end-to-end or the end-to-side esophagogastrostomy is much easier to construct without technical defects than the posterior layer, even here the end-to-side version offers advantages. Figure 15.2b illustrates how the anterior wall of the esophagus invaginates into the stomach for additional protection. If this were attempted with an end-to-end anastomosis, the large inverted cuff would produce stenosis at the stoma (Fig. 15.1b).

Additional protection against leakage from the anterior aspect of the end-to-side anastomosis can be achieved by performing a Nissen fundoplication around the anastomosis. This also helps prevent postoperative gastroesophageal reflux, but it requires the presence of a large gastric pouch and cannot be performed, unless modified, when the proximal stomach has been resected.

Avoiding Postoperative Reflux Esophagitis

Another serious drawback of an end-to-end esophagogastric anastomosis is the occurrence of reflux esophagitis in patients who achieve long-term survival. It can be avoided by implanting the end of the esophagus end-to-side into the stomach at least 6 cm beyond the proximal margin of the gastric pouch. This type of construction functions as a valve, probably because air in the gastric pouch behind the distal esophagus and above the esophagogastric anastomosis compresses the overlying esophagus. This is fortunate, as there is rarely enough remaining stomach to fashion an adequate "fundoplication" when the gastric fundus has been resected.

When the anastomosis is performed by the stapling method, the anastomosis should still be a comfortable distance from the proximal end of the gastric interposition for the same reason as elaborated for the sutured anastomosis.

Efficacy of Stapling Techniques for the Esophagogastric Anastomosis

We have developed a stapling technique for end-to-side esophagogastrostomy that can be done swiftly with an extremely low leak rate (Chassin 1978). After a long, sometimes complicated dissection, an accurate anastomosis that takes only 2–3 min of operating time constitutes a welcome epilogue, especially when treating poor-risk patients. Whereas 28-mm and 31-mm circular stapling cartridges produce a good anastomosis, use of the 25-mm cartridge results in a high incidence of anastomotic postoperative strictures requiring dilatation.

Postoperative Sepsis

To prevent postoperative sepsis, meticulously avoid spillage of the gastric content, which can contaminate the subhepatic or subcutaneous space. Any instruments that come into contact with the lumen of the stomach or esophagus should be treated as dirty and the area walled off wherever possible. During the operation intravenous antibiotics that cover a spectrum from lower mouth to skin to enteric organisms should be given at appropriate intervals to ensure that body fluid and tissue levels are maintained.

Documentation Basics

Coding for esophageal procedures is complex. Consult the most recent edition of the AMA's Current Procedural Terminology book for details (see references at the end). In general, it is important to document:

- Findings
- Extent of resection
- Stapled or sutured anastomosis?
- Pyloromyotomy or not?

Fig. 15.3

Operative Technique

Incision and Position

Endobronchial (double-lumen) one-lung anesthesia permits atraumatic collapse of the left lung during the esophageal dissection. It is far preferable to advancing an endotracheal tube down the right mainstream bronchus.

With the aid of sandbags and wide adhesive tape across the patient's hips and left shoulder, elevate the patient's left side to a 60–90° angle. Place the right arm straight on an arm board. Pad the patient's left arm and suspend it in a forward position (Fig. 15.3).

Begin the incision at the umbilicus and continue it up the midline about halfway to the xiphoid, or use an oblique incision parallel to the right costal margin midway between the xiphoid and umbilicus. Explore the abdomen. The presence of metastasis of moderate degree to the celiac lymph nodes or to the liver does not constitute a contraindication to resection.

Redirect the incision to cross the costal margin into the sixth intercostal space and continue to it the region of the erector spinae muscle near the tip of the scapula. After the skin incision has been completed, use the coagulating current to divide the latissimus dorsi muscle in as caudal a location as possible (Fig. 15.4). The index fingers of both the

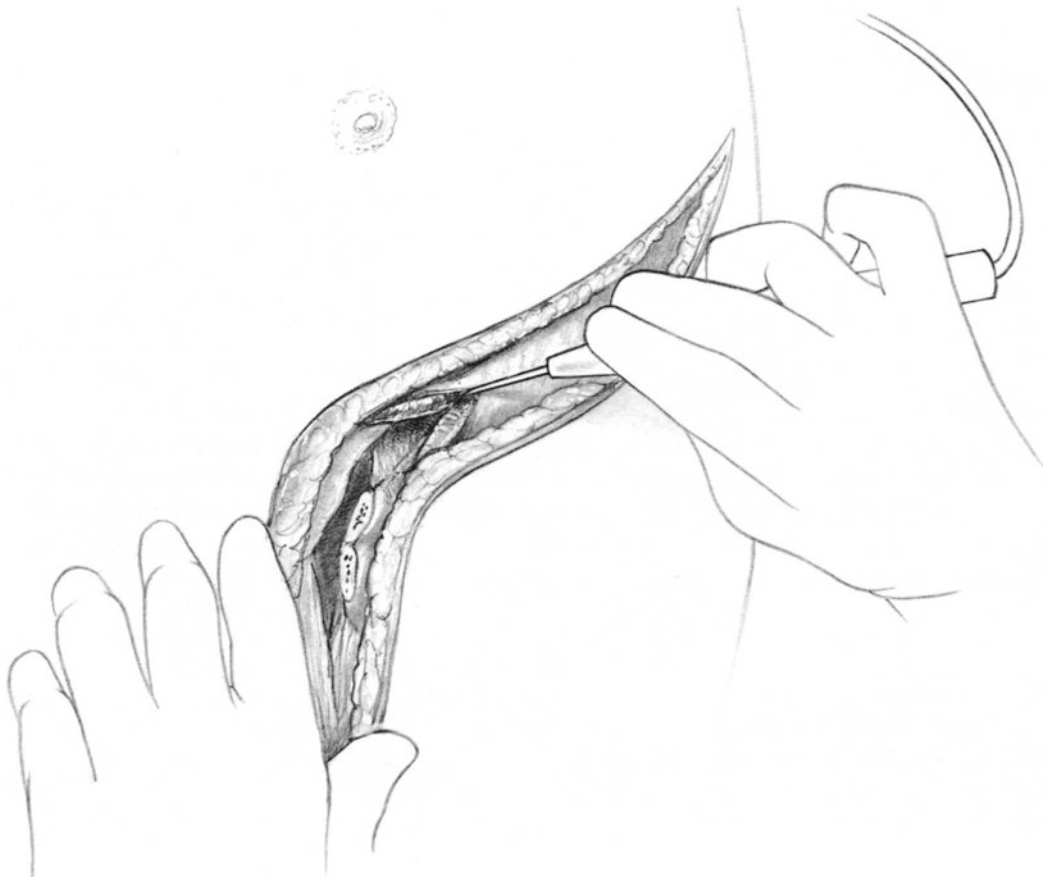


Fig. 15.4

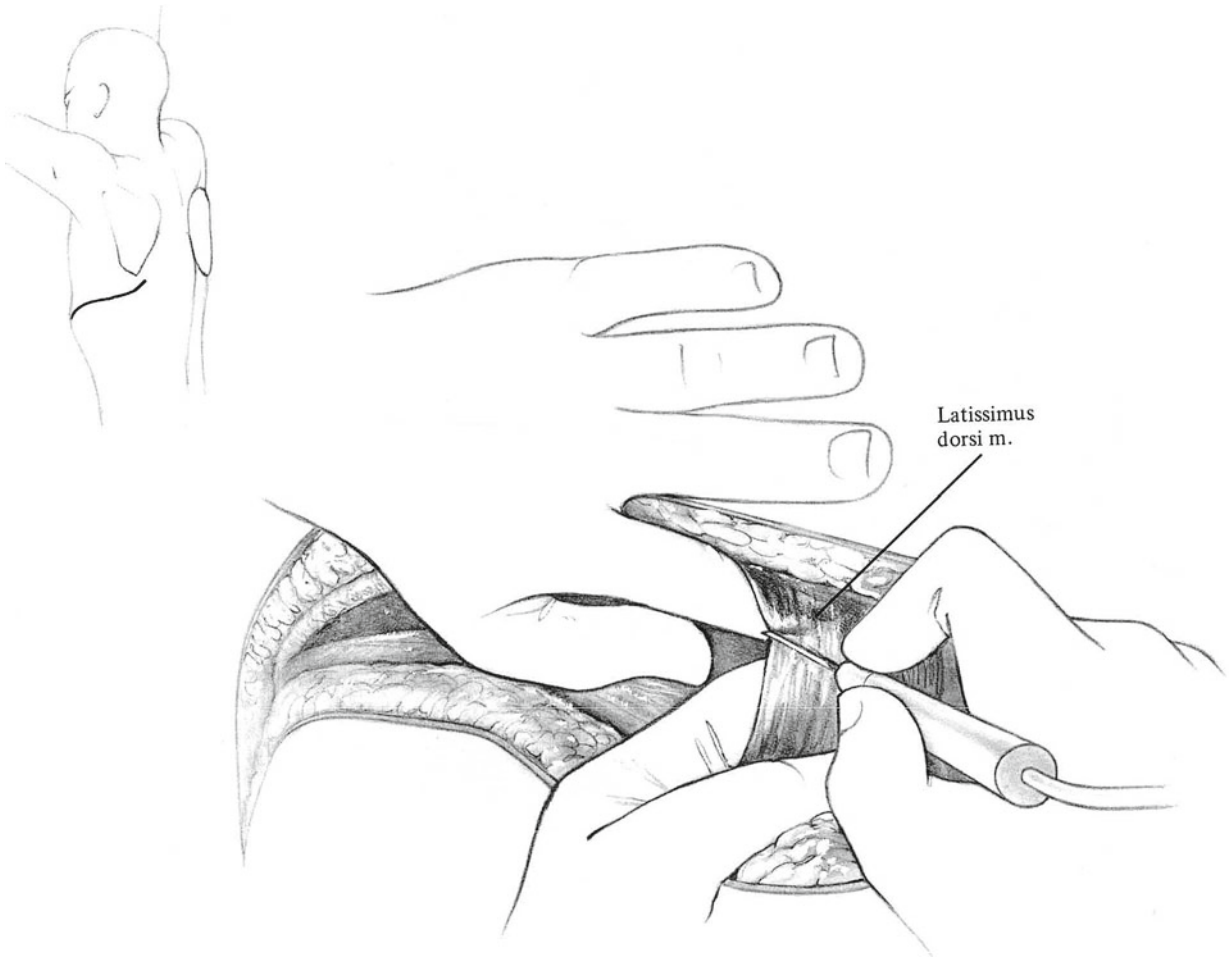


Fig. 15.5

surgeon and first assistant should be inserted side by side underneath the latissimus muscle while the electrocautery divides the muscle (Fig. 15.5). Divide the anterior serratus muscle in a similar fashion. The rhomboid muscles medial to the scapula need not be divided unless a supraaortic dissection proves necessary.

Next retract the scapula in a cephalad direction and count down the interspaces from the first rib to confirm the location of the sixth interspace. Divide the intercostal musculature by electrocautery along the superior surface of the seventh rib and enter the pleura (Fig. 15.6). Divide the costal margin where it is a wide plate with a scalpel, heavy scissors, or rib cutter. Divide the internal mammary artery, deep and slightly lateral to the costal margin, ligate or electrocoagulate it (Fig. 15.7).

Incise the diaphragm in a circumferential fashion (Figs. 15.7 and 15.8) along a line 3–4 cm from its insertion into the rib cage. Use electrocautery for this incision, which should extend laterally about 15 cm from the divided costal margin. Spread the intercostal incision by inserting a mechanical retractor. Use of a multiarm retraction system without a mechanical advantage allows retraction of the lung, diaphragm, and liver for both the thoracic and abdominal phases of the operation, and it avoids fracturing the ribs.

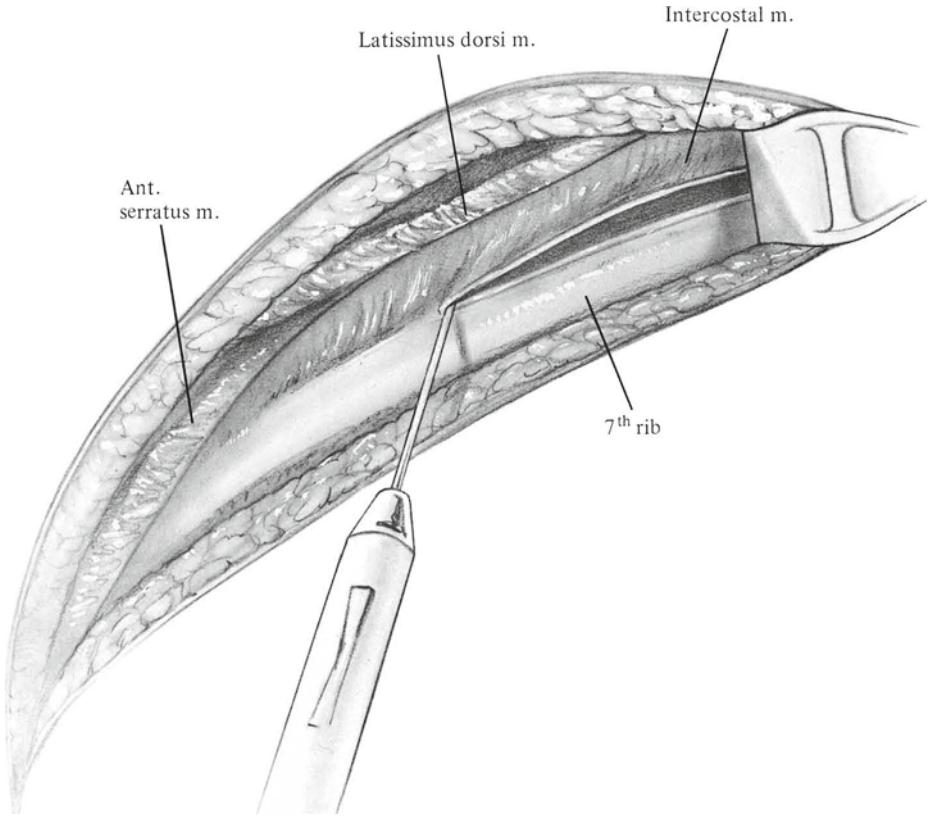


Fig. 15.6

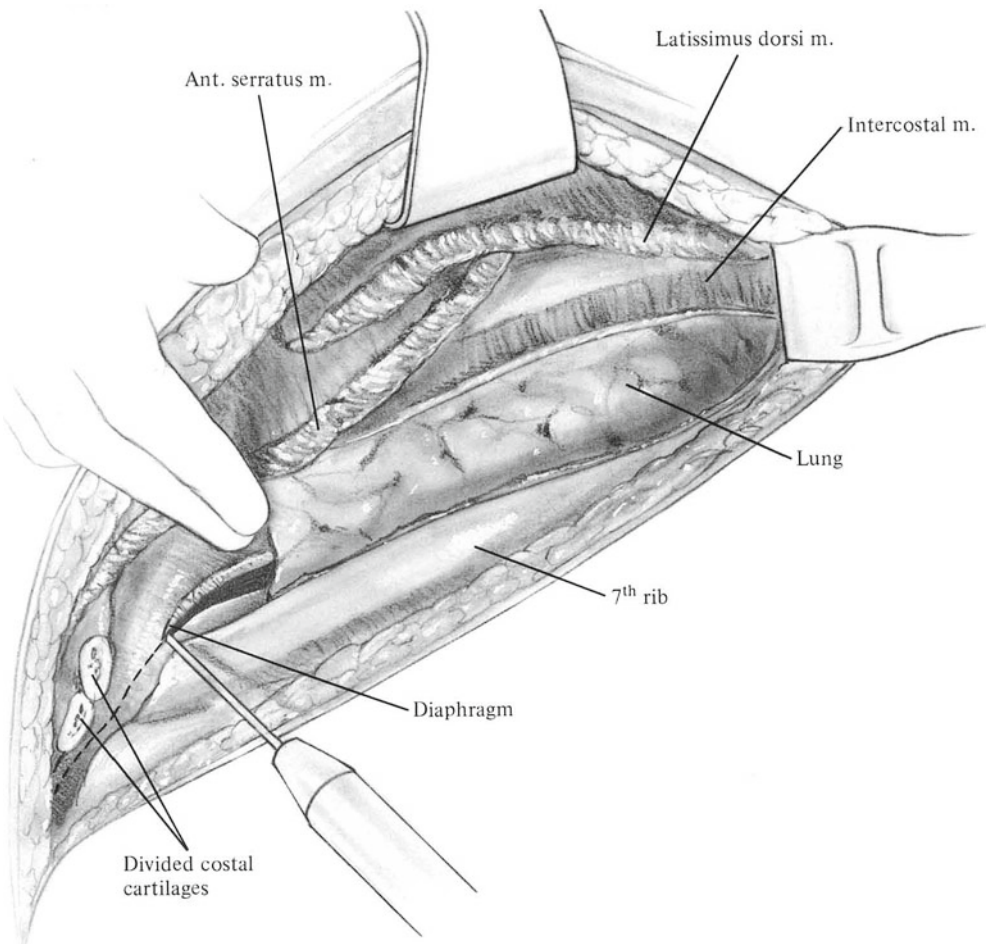
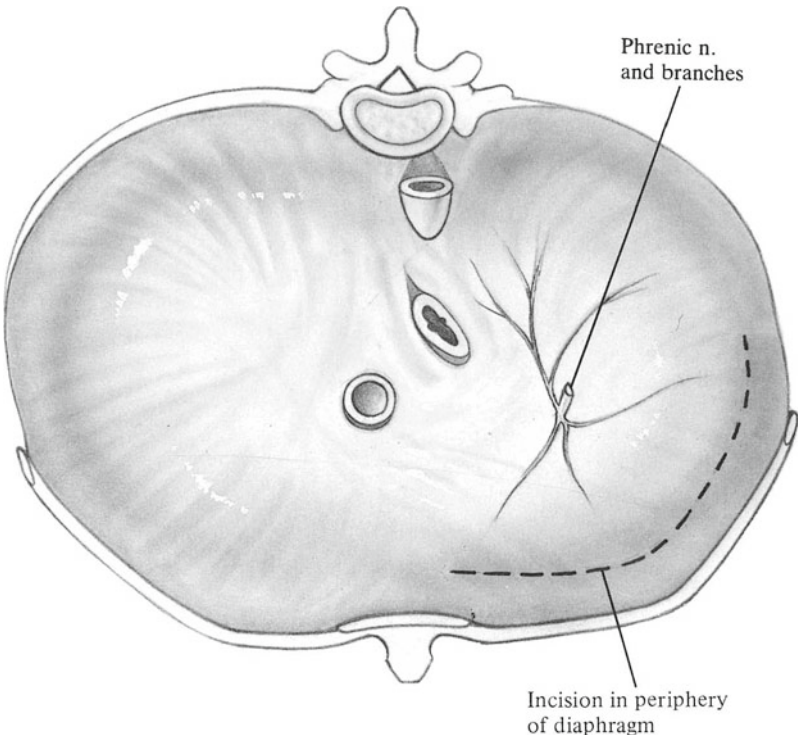


Fig. 15.7

Fig. 15.8



Liberation of Esophagus

Divide the inferior pulmonary ligament with electrocautery or long Metzenbaum scissors, progressing in a cephalad direction until the inferior pulmonary vein has been reached. Collapse the lung, cover it with moist gauze pads, and retract it in a cephalad and anterior direction with Harrington retractors.

Incise the mediastinal pleura from the aorta to the hiatus, beginning at a point above the tumor (Fig. 15.9). Encircle the esophagus first with the index finger and then with a latex drain (Fig. 15.10). Divide the vagus nerves as they approach the esophagus from the hilus of the lung. Dissect the tumor and the attached vagus nerves away from the mediastinal structures. If the pleura of the right thoracic cavity or pericardium has been invaded by tumor, include it in the resection. Dissection of the esophagus should free this organ from the arch of the aorta down to the hiatus, including all the periesophageal areolar tissue. Generally, only two or three arterial branches of the descending aorta join the esophagus. They should be occluded by hemostatic clips and divided. Use an umbilical tape ligature or a 55-/3.5-mm linear stapler to occlude the lumen of the proximal esophagus (above the tumor) to prevent cephalad migration of tumor cells (Fig. 15.11). The esophagus may be divided at this time and reflected into the abdomen once hiatal mobilization is complete, or it may be delayed until the stomach is mobilized.

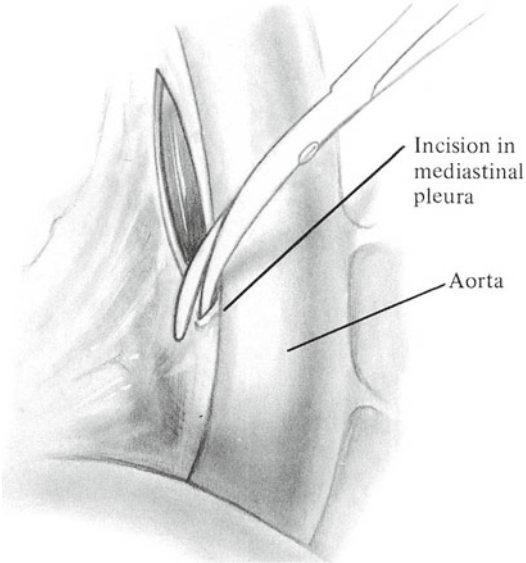
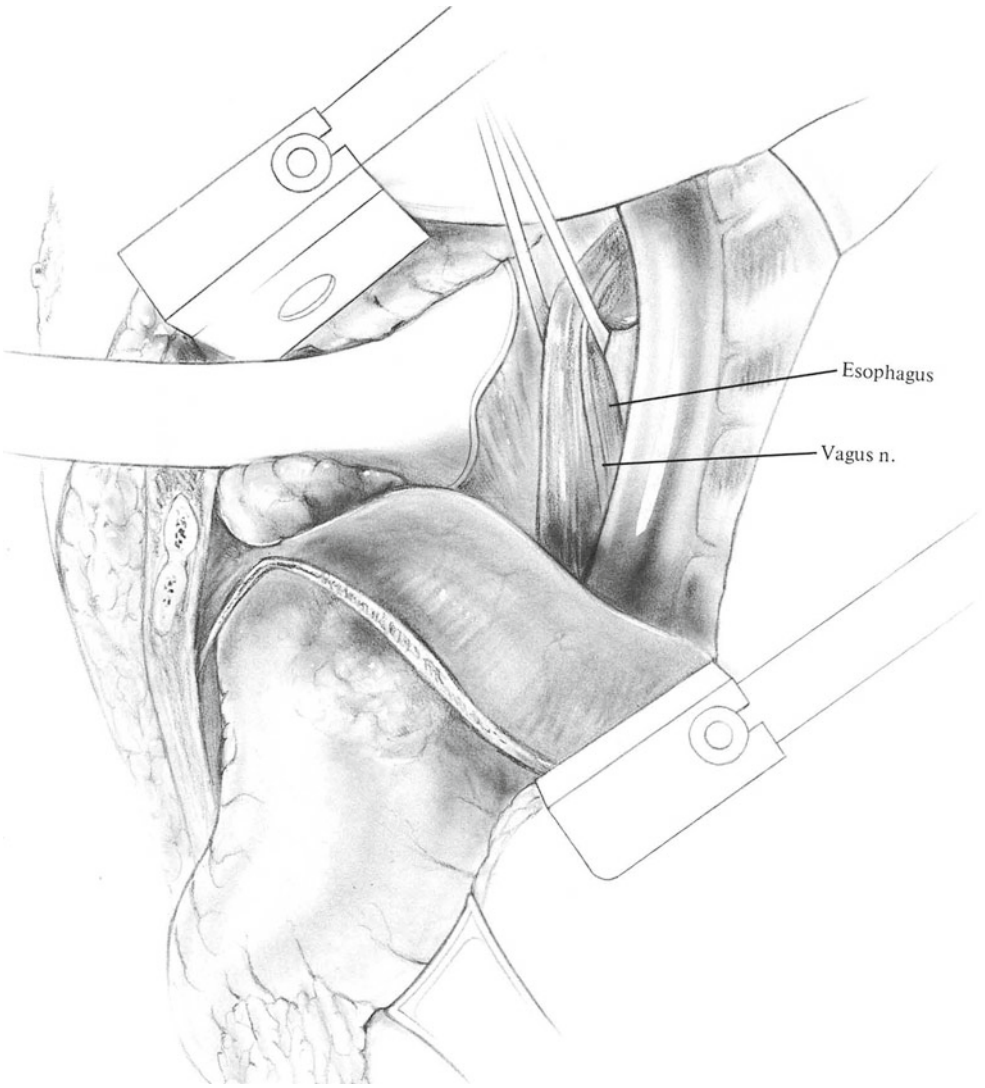


Fig. 15.9

Fig. 15.10



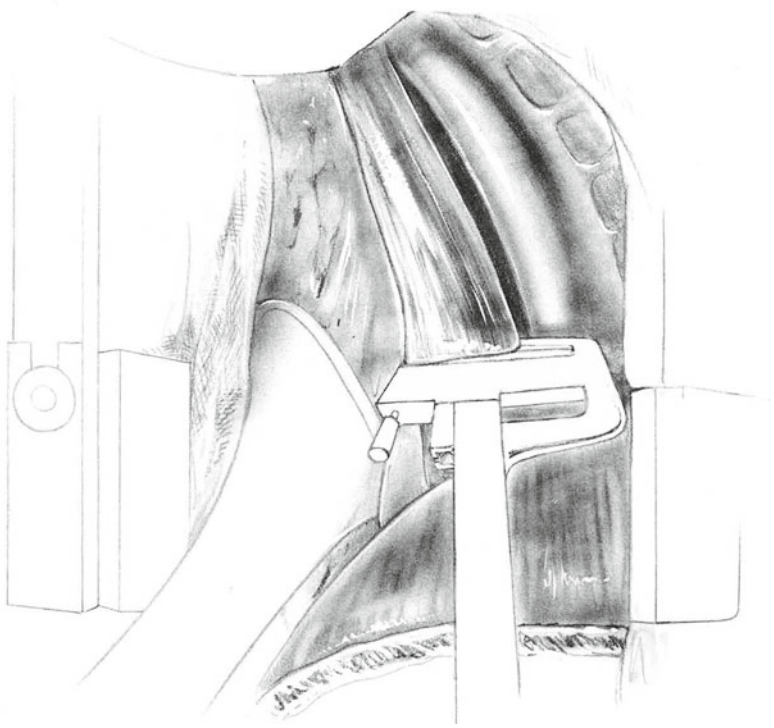


Fig. 15.11

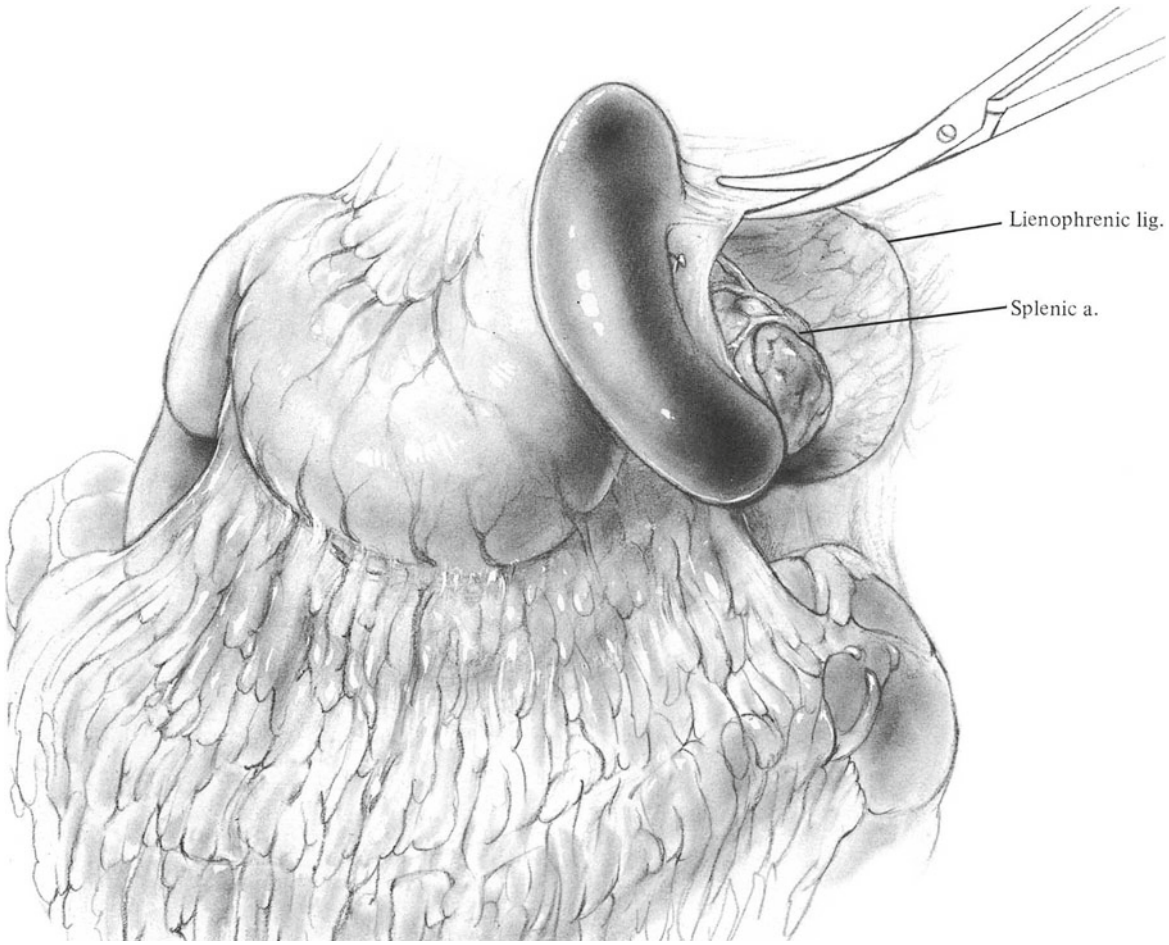


Fig. 15.12

Splenectomy

If the proximity of the carcinoma makes splenectomy necessary, retract the spleen medially and divide the lienophrenic ligament (Fig. 15.12). Gently elevate the spleen and the tail of the pancreas from the retroperitoneal tissues by finger dissection. Divide the lienocolic ligament. Identify the splenic artery and vein on the posterior surface of the splenic hilus. Each should be divided and ligated with 2-0 silk. It may be convenient to remove the spleen as a separate specimen after dividing each of the short gastric vessels. Do this on the anterior aspect of the stomach to visualize the greater curvature accurately, thereby avoiding any possibility of trauma to the stomach. If splenectomy is not necessary, enter the lesser sac through the avascular space above the left gastroepiploic vessels and individually control and divide the short gastric vessels.

Gastric Mobilization

The gastroepiploic arcade along the greater curvature of the stomach *must be preserved with compulsive attention to detail*, as the inadvertent occlusion of this vessel in a clamp or ligature results in ischemia of the gastric pouch and anastomotic leakage. Working from above down, divide the left gastroepiploic vessels and open the lesser sac to identify the gastroepiploic arcades from both front and back. Be sure always to *leave 3–5 cm of redundant omentum attached* to the vascular arcade. Identify the plane separating the colon mesentery from the gastroepiploic arcade. Continue the dissection to a point 6–8 cm cephalad to the pylorus (Fig. 15.13a, b). The greater curvature now should be elevated. Complete posterior mobilization of the stomach by incising the avascular attachments that connect the back wall of the stomach to the posterior parietal peritoneum overlying the pancreas (gastropancreatic folds) and continue the dissection to the pylorus. Carefully preserve the subpyloric vessels (right gastroepiploic and right gastric).

Identify the celiac axis by palpating the origins of the splenic, hepatic, and left gastric arteries. Dissect lymphatic and areolar tissues away from the celiac axis toward the specimen. Skeletonize the coronary vein and divide and ligate it with 2-0 silk. Immediately cephalad to this structure is the left gastric artery, which should be doubly ligated with

2-0 silk and divided (Fig. 15.14a, b). Incise the gastrohepatic ligament near its attachment to the liver (Fig. 15.15). An accessory left hepatic artery generally can be found in the cephalad portion of the gastrohepatic ligament. Divide the artery and ligate it with 2-0 silk; then divide the remainder of the ligament and the peritoneum overlying the esophagus.

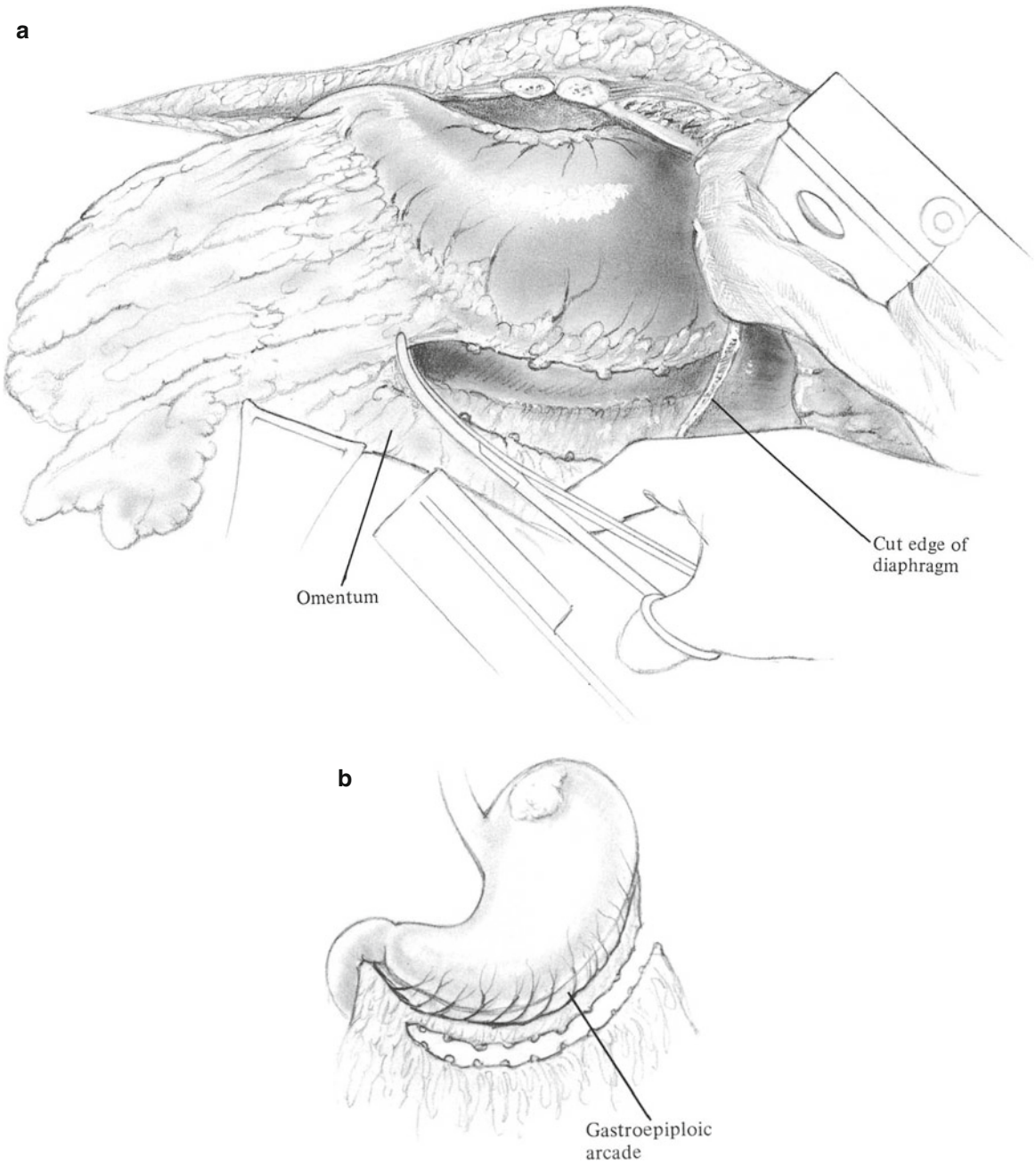


Fig. 15.13

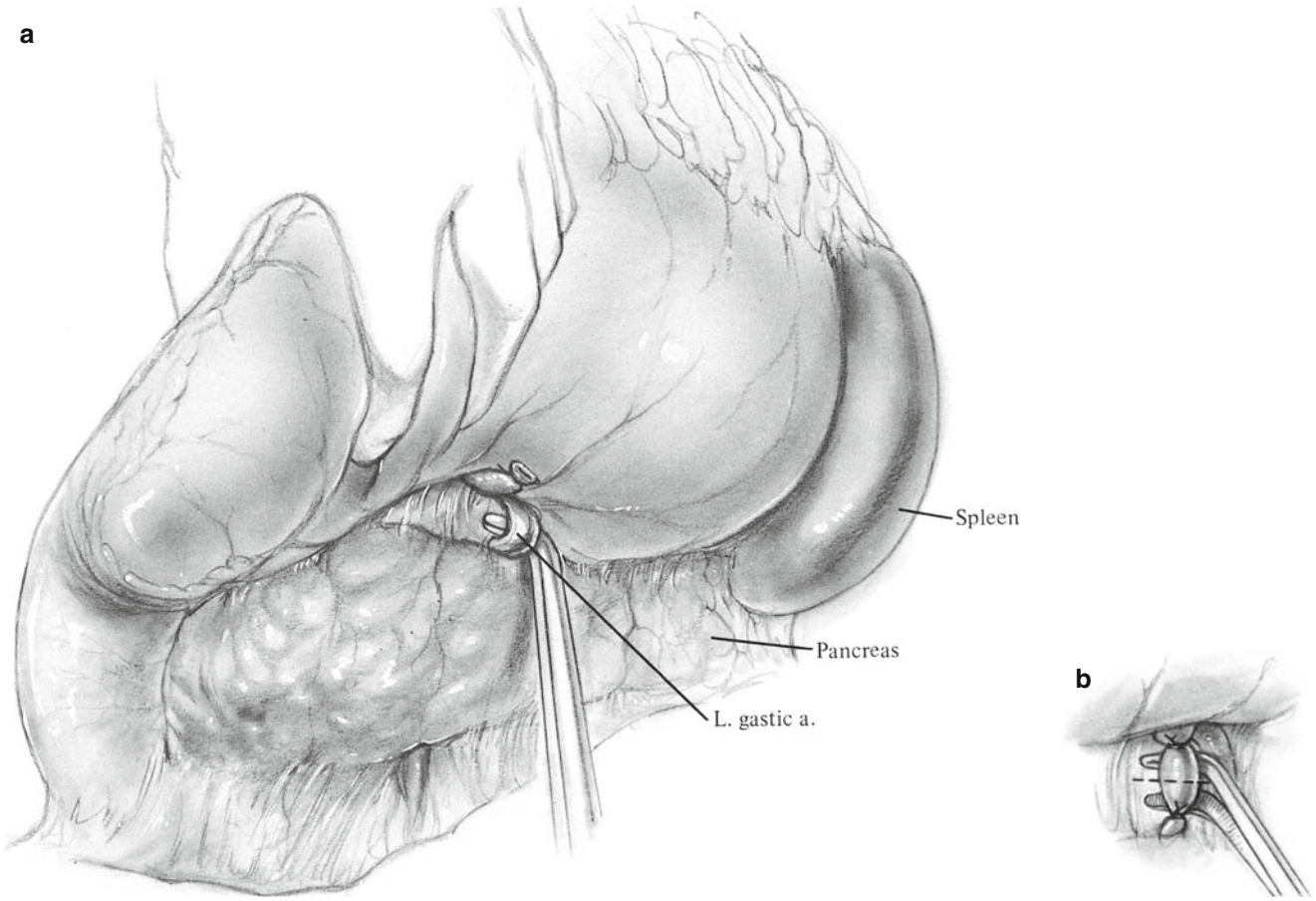


Fig. 15.14

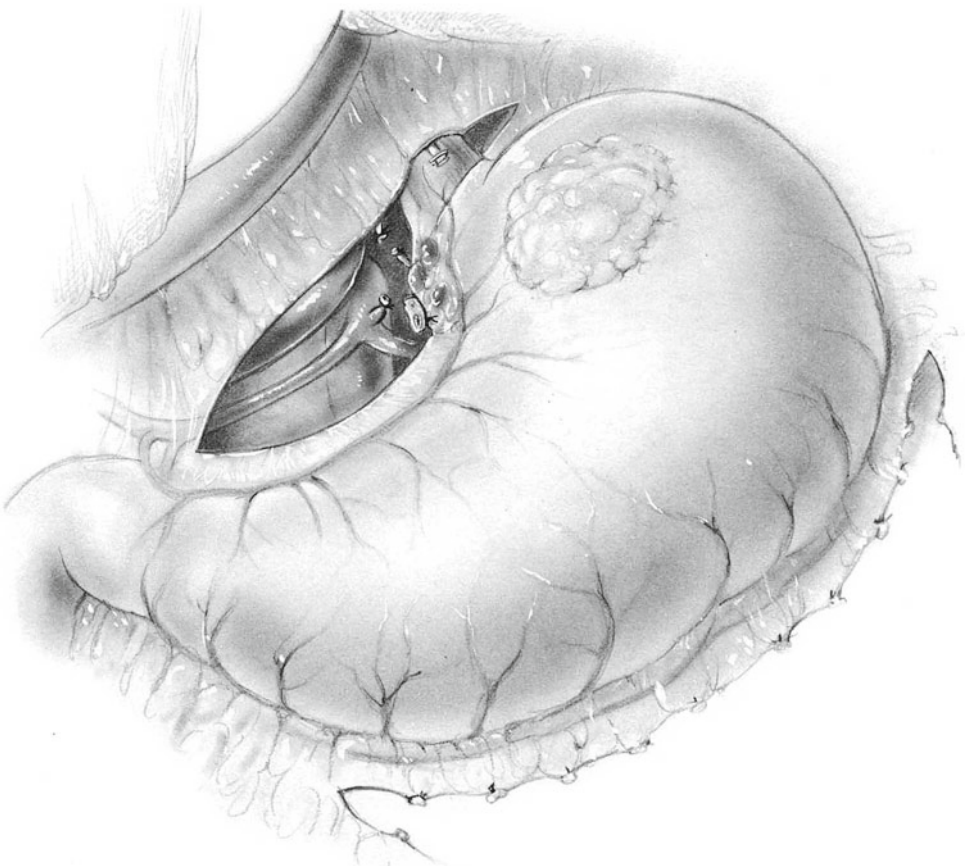


Fig. 15.15

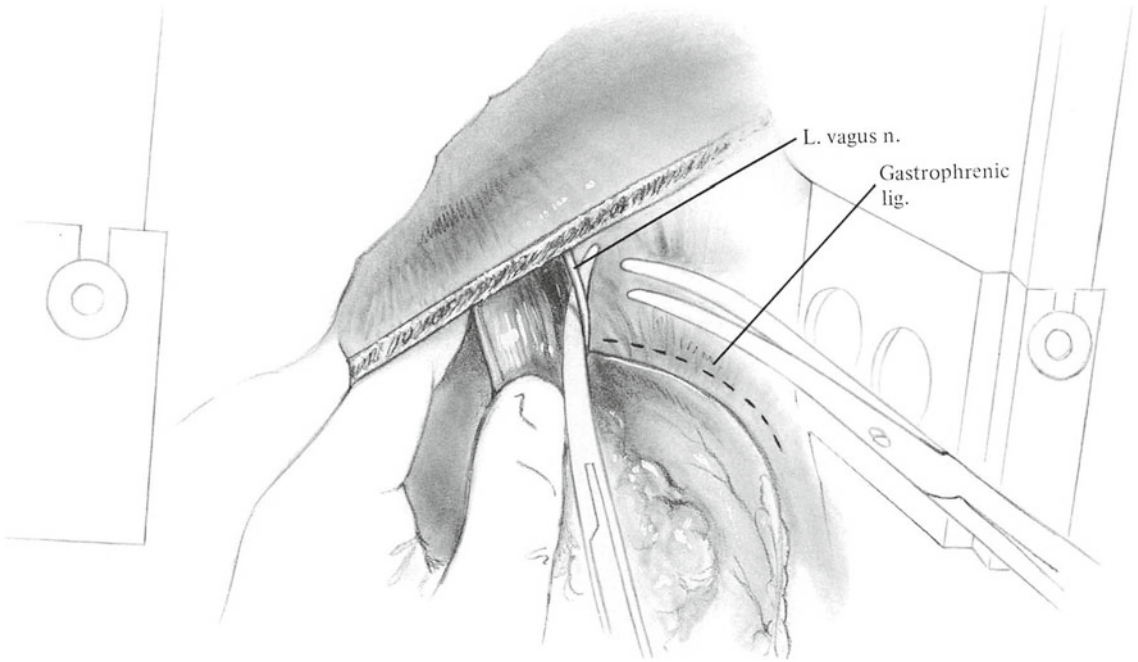


Fig. 15.16

Hiatal Dissection

A gastrophrenic ligament attaches the posterior aspect of the gastric fundus to the posterior diaphragm. Divide the ligament using the left index finger as a guide. If tumor has encroached on the hiatus, leave crural musculature attached to the tumor and divide it from the surrounding diaphragm with electrocautery. This may require division and ligature of the inferior phrenic artery. Divide the vagus nerves just below the hiatus (Fig. 15.16) and divide the phrenoesophageal ligaments; this frees the esophagus and stomach from the arch of the aorta down to the duodenum.

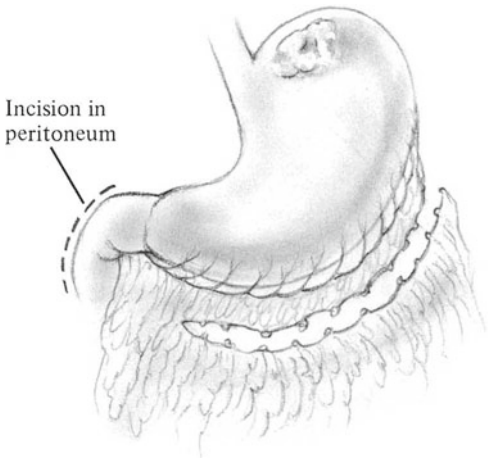
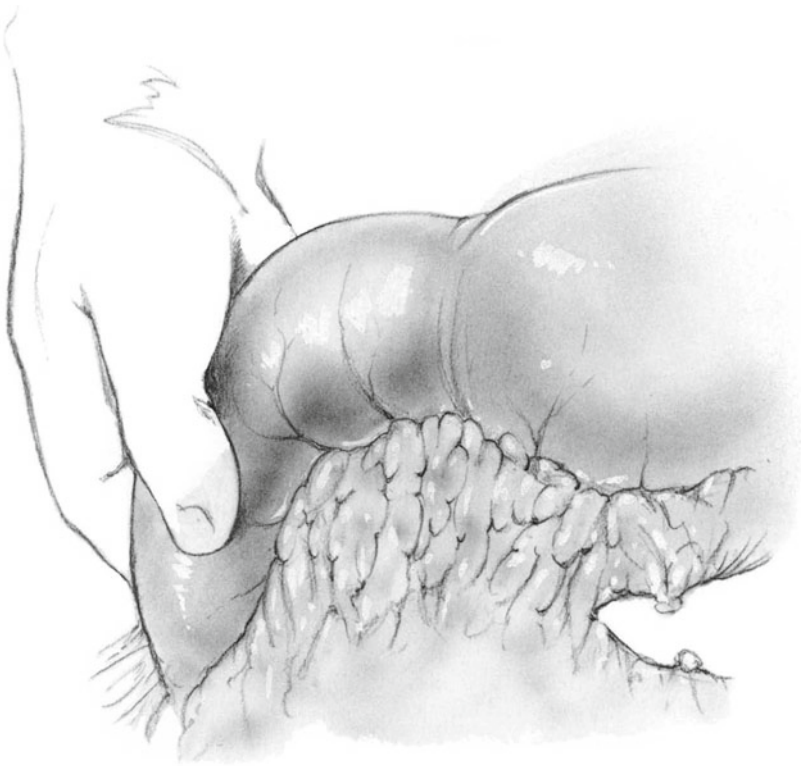


Fig. 15.17

Kocher Maneuver

To achieve maximum upward mobility of the gastric pouch, divide the avascular lateral duodenal ligament and pass a hand behind the duodenum and the head of the pancreas (Figs. 15.17 and 15.18). If necessary, continue this Kocher maneuver along the duodenum as far distally as the superior mesenteric vein (see Figs. 14.15 and 14.16). Additional freedom of the mobilized stomach can be achieved by dividing the attachments of the greater omentum to the duodenum beyond the right gastroepiploic vessels.

Fig. 15.18



Pyloromyotomy

Perform a pyloromyotomy as described in Chap. 14 (see Figs. 14.17, 14.18, and 14.19).

Transection of Stomach and Esophagus

To treat a primary tumor of the lower esophagus, apply either a long linear cutting stapler or a 90-mm linear stapler (loaded with 4.8-mm staples) in an oblique fashion to remove the stump of the left gastric artery, the celiac lymph nodes on the lesser curvature of the stomach, and 5–6 cm of the greater curvature.

To treat lesions of the proximal stomach, which is the operation illustrated in Figs. 15.19a, b, apply the stapler so 5–6 cm of normal stomach distal to the lesion is removed. *Ascertain that the nasogastric tube has been withdrawn* and divide the stomach with a long linear cutting stapler or with two 90-mm linear staplers applied in a parallel fashion. Make an incision with the scalpel flush with the stapler attached to the residual gastric pouch. If two 90-mm linear staplers are not available, the first stapler should be applied to the stomach, fired, and then reapplied 1 cm lower on the gastric wall. The transection should be made flush with the stapler on the gastric pouch. Control individual bleeding vessels with electrocautery after removing the device. This staple line should be oversewn with fine inverting sutures. The gastric wall is of variable thickness, and we have seen isolated leakage from this staple line when it was not reinforced. If multiple applications of the cutting stapler were required, a running 4-0 polypropylene Lembert suture conveniently reinforces the staple line without excess inversion.

In a previous step the esophageal lumen proximal to the tumor was occluded with a row of staples (Fig. 15.11). If the esophagus has not yet been divided, transect it now 8–10 cm proximal to the tumor and remove the specimen (Fig. 15.20). Submit the proximal and distal margins of the specimen to frozen section examination. Clean the lumen of the proximal esophagus with a suction device (Fig. 15.21).

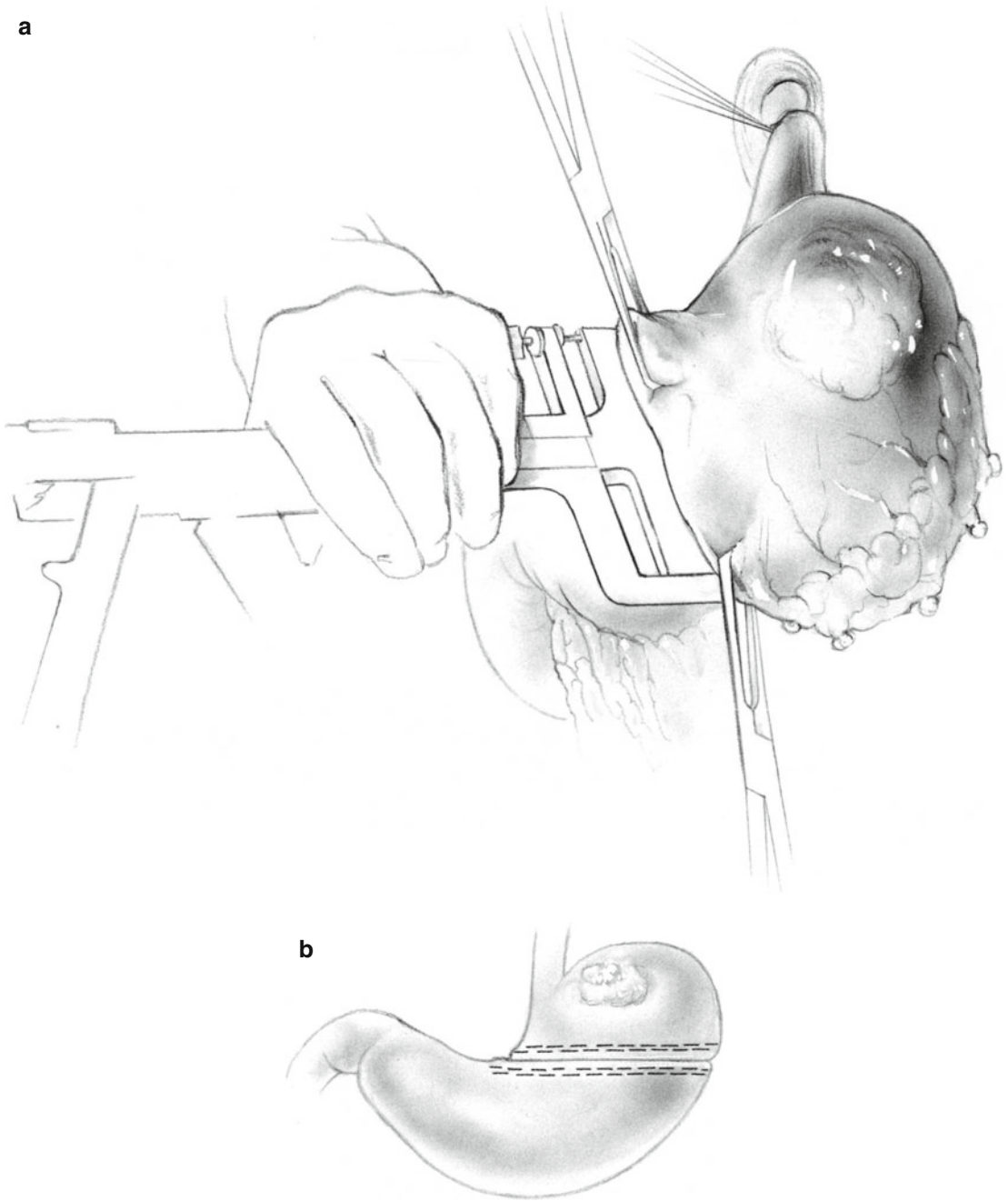


Fig. 15.19

Fig. 15.20

Fig. 15.21

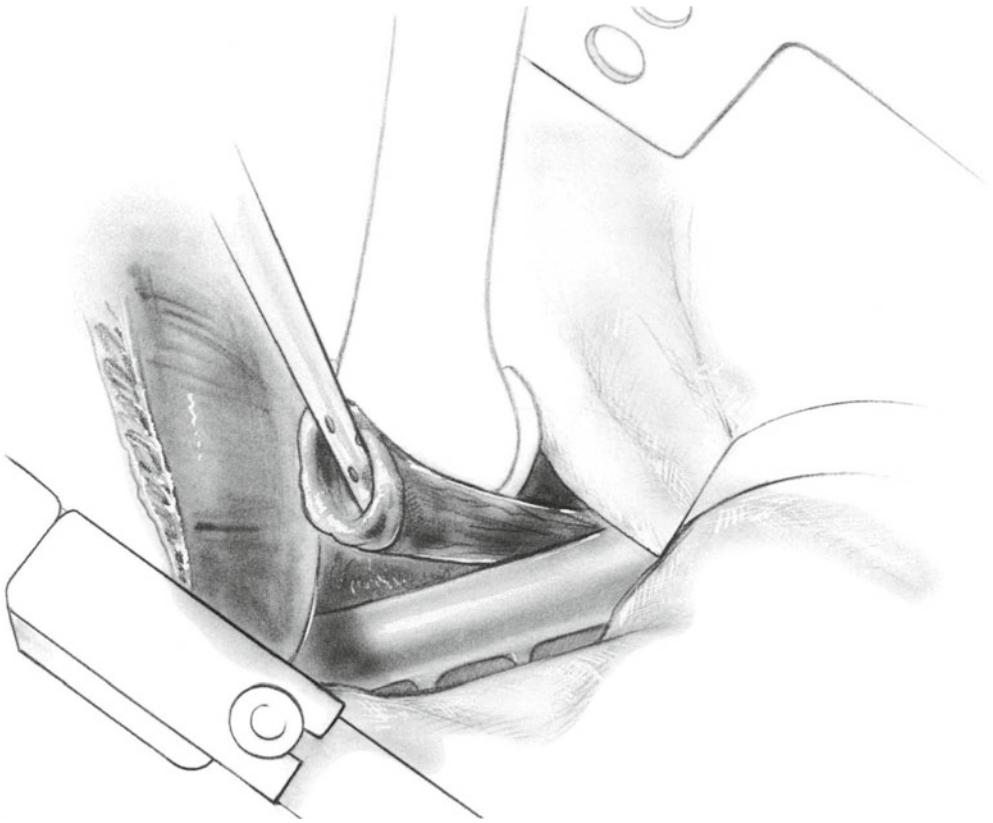
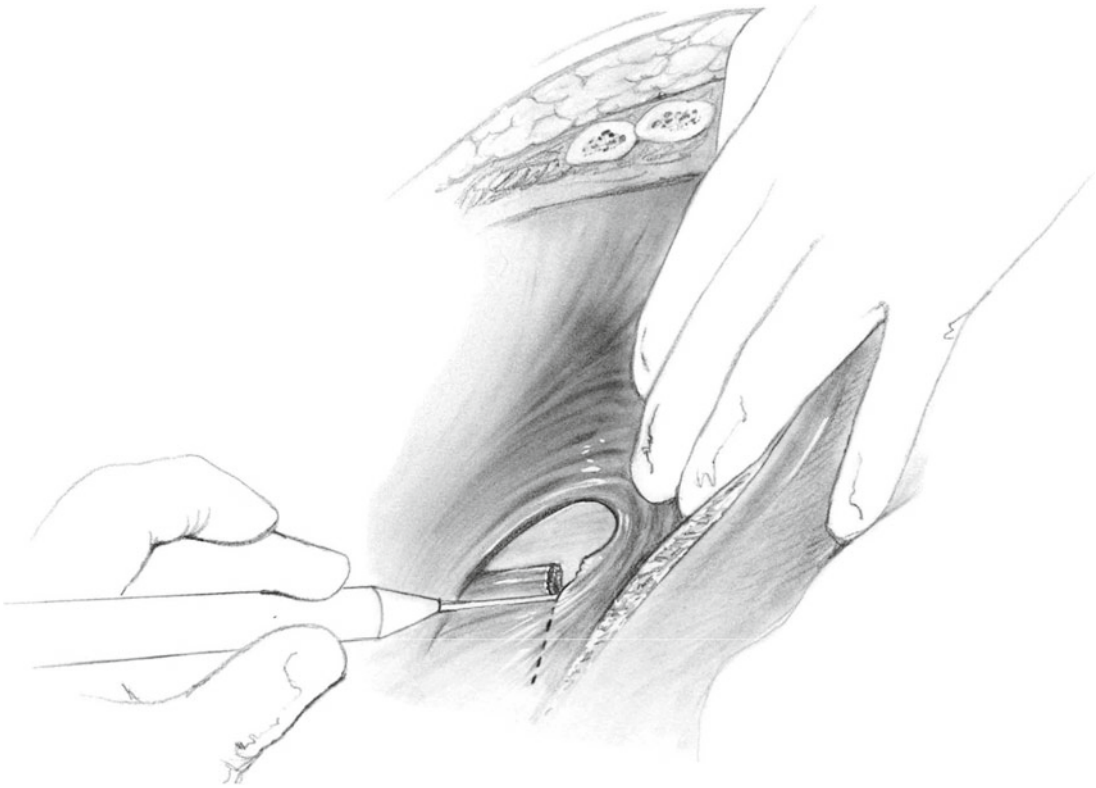


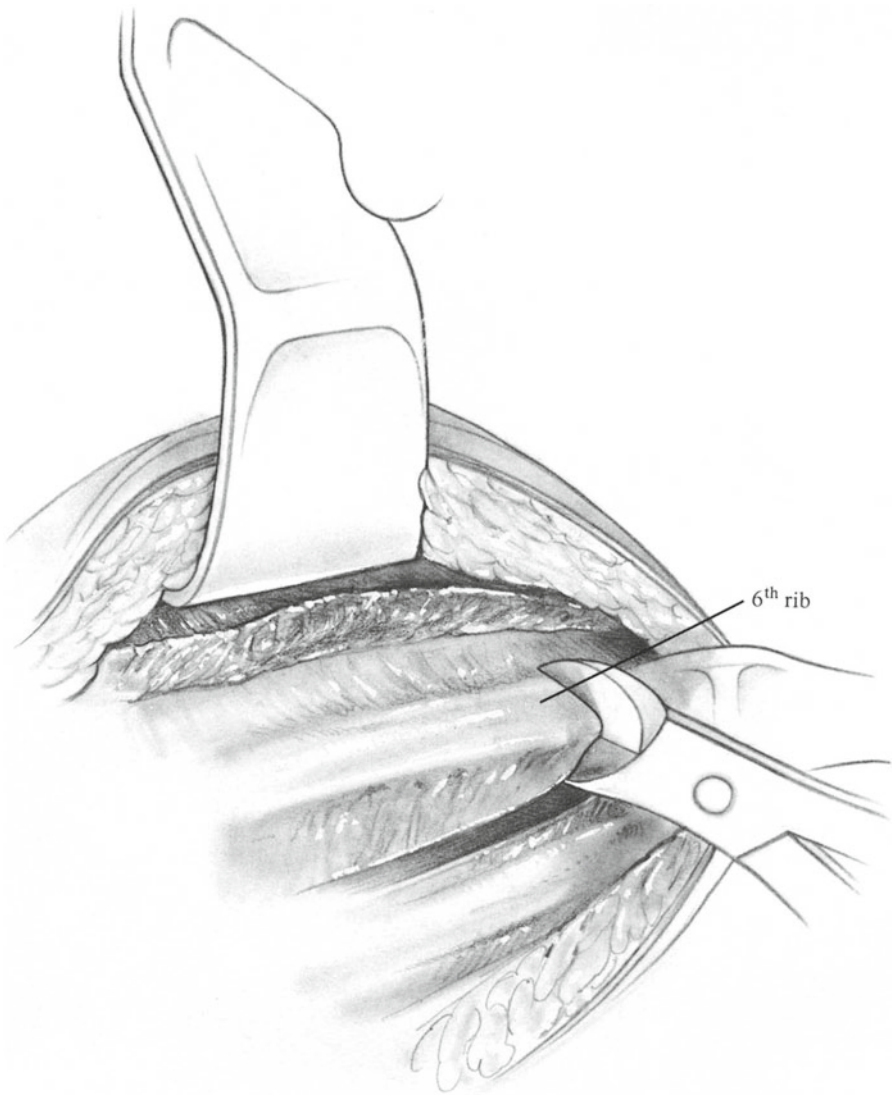
Fig. 15.22



Enlargement of Hiatus

Enlarging the hiatus is rarely necessary if the crura have been skeletonized as described by division of the phrenoesophageal ligament. If the hiatus appears tight, make a transverse incision by electrocautery in the left branch of the crux (Fig. 15.22). The incision should be of sufficient magnitude to allow the gastric pouch to pass into the mediastinum *without constriction* of its venous circulation.

Fig. 15.23



Enlargement of Thoracic Incision if Supraaortic Anastomosis Is Necessary

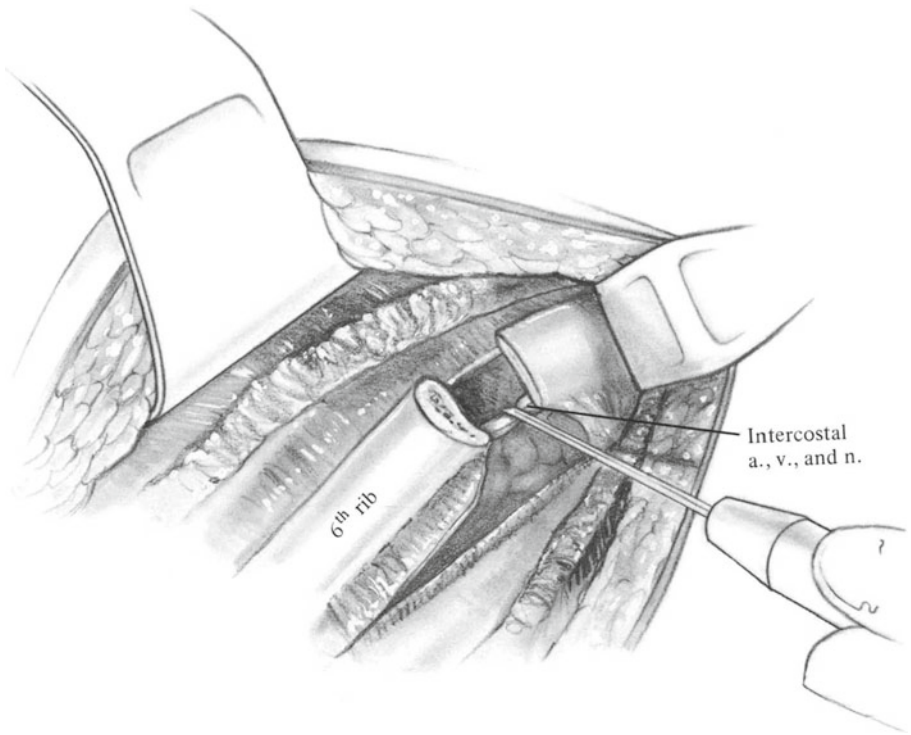
A properly fashioned end-to-side esophagogastric anastomosis requires the presence of 6–8 cm of esophagus below the aortic arch. If there is not 6–8 cm of esophagus below the aortic arch, the surgeon should not hesitate to enlarge the thoracic incision so the esophagus can be passed behind the arch into a supraaortic position. This makes the anastomosis far simpler and safer to perform and requires only a few minutes to accomplish.

Move to a position on the left side of the patient. Extend the skin incision up from the tip of the scapula in a cephalad direction between the scapula and the spine. With electrocautery divide the rhomboid and trapezium muscles medial to the scapula. Retract the scapula in a cephalad direction and free the erector spinal muscle from the necks of the sixth and fifth ribs. Free a short (1 cm) segment of the sixth (and often of the fifth) rib of its surrounding periosteum and excise it (Fig. 15.23). Divide and ligate or electrocoagulate the intercostal nerves with their accompanying vessels (Fig. 15.24). Reinsert the Finochietto or other mechanical retractor (Fig. 15.25). If the exposure is still inadequate, a segment of the fourth rib may also be excised, but this is rarely necessary.

Enter the space between the anterior wall of the esophagus and the aortic arch with the index finger (Figs. 15.26a, b, c). There are no vascular attachments in this area. The index finger emerges cephalad to the aortic arch behind the mediastinal pleura. Incise the mediastinal pleura on the index finger, making a window extending along the anterior surface of the esophagus up to the thoracic inlet. Now dissect the esophagus free of all its attachments to the mediastinum in the vicinity of the aortic arch. Avoid damage to the left recurrent laryngeal nerve, the thoracic duct, and the left vagus nerve located medial to the esophagus above the aortic arch. One or two vessels may have to be divided between hemostatic clips.

Deliver the esophagus from behind the aortic arch up through the window in the pleura between the left carotid and subclavian arteries (Fig. 15.27). If the space between the

Fig. 15.24



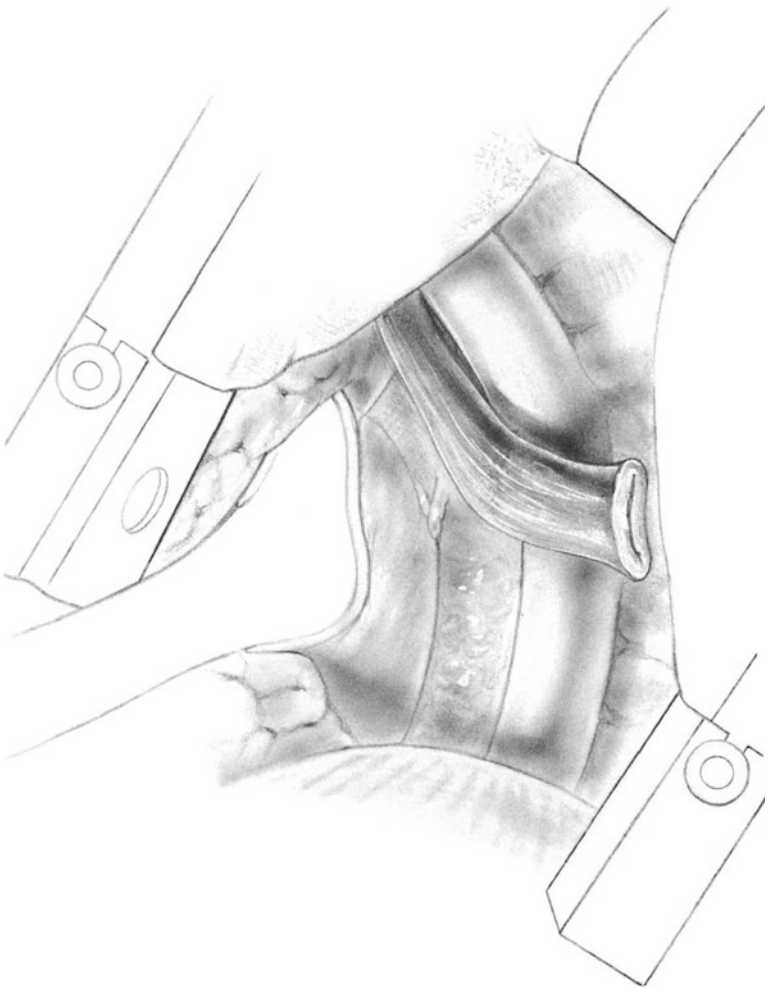


Fig. 15.25

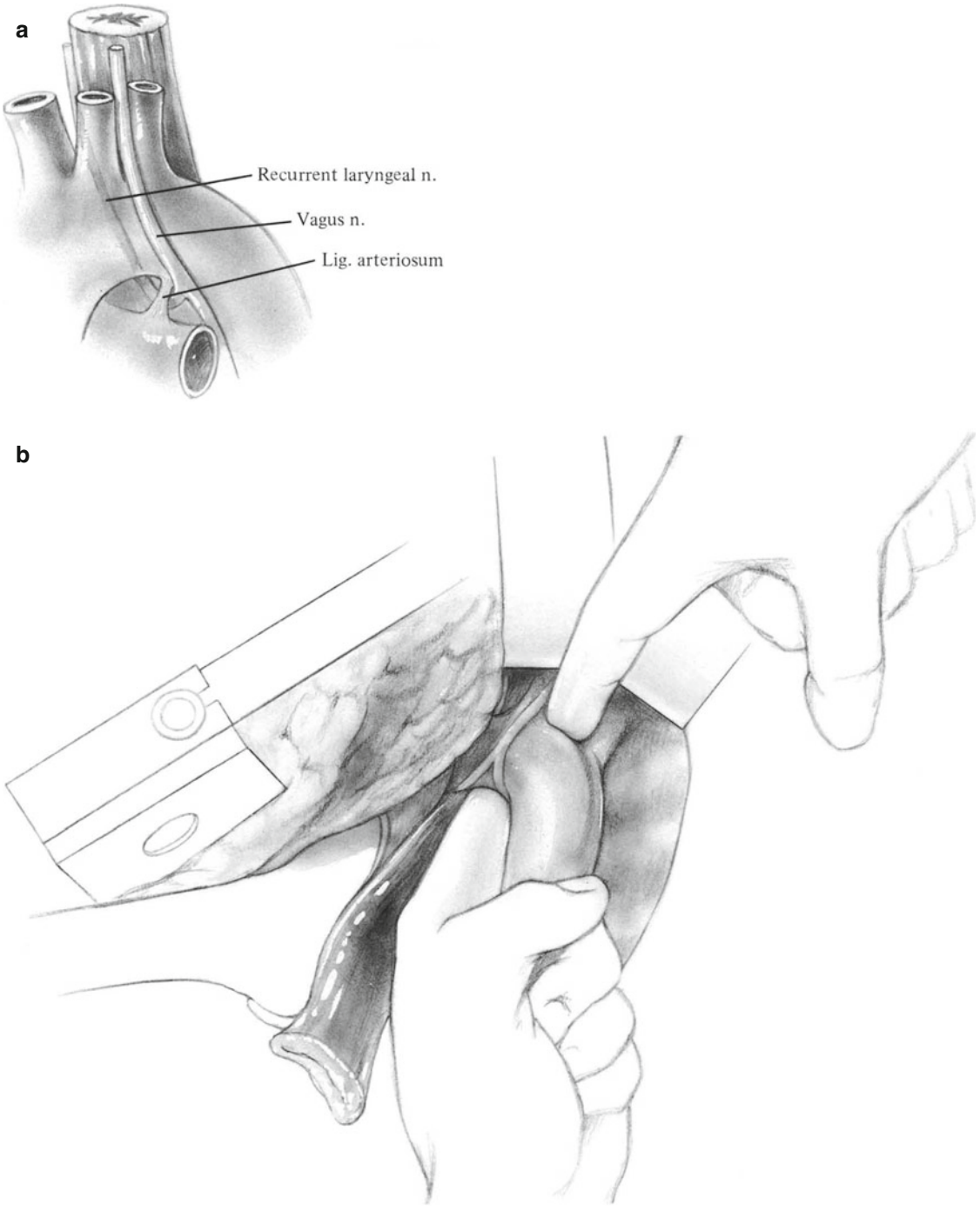
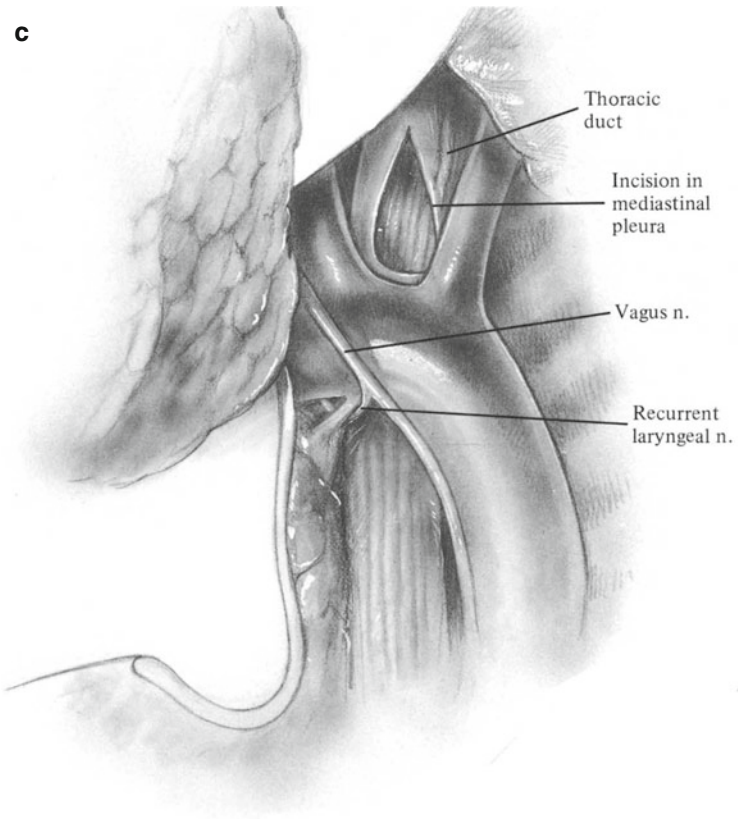


Fig. 15.26

Fig. 15.26 (continued)



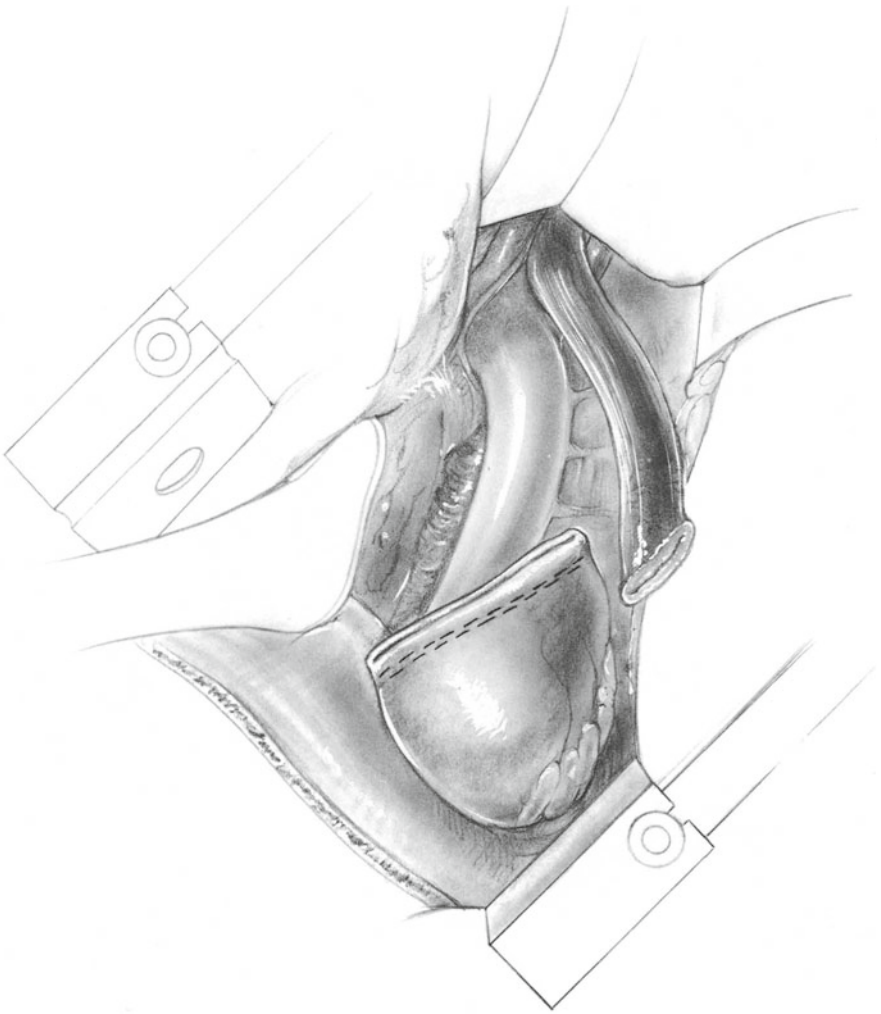


Fig. 15.27

carotid and subclavian arteries is narrow, bring the esophagus out through a pleural incision lateral to the subclavian artery.

The esophagogastric anastomosis, as described below, should be constructed in a position lateral and anterior to the aortic arch. Exposure for the anastomosis in this location is excellent. Bring the esophagus down over the anterior wall of the stomach for a sutured anastomosis. An overlap of 6–7 cm is desirable. If the esophageal dissection has been carried out without undue trauma, the esophageal segment has an excellent blood supply even though its distal 10 cm has been liberated from its bed in the mediastinum. The anastomosis can readily be performed as high as the apex of the thorax by this method, and a level of resection comparable to that achieved by adding a cervical incision can often be used. Use of the circular stapling technique to perform the anastomosis high in the chest is an excellent alternative to sutured intrathoracic or cervical anastomosis. For this technique, the stomach is placed in front of the esophagus for the end-to-side anastomosis.

Esophagogastric Anastomosis, Suture Technique

The technique for sutured esophagogastric anastomosis is described and illustrated in Chap. 14.

Esophagogastric Anastomosis, Stapling Technique (Surgical Legacy Technique)

In 1978, Chassin described a linear stapling technique for esophagogastric anastomosis. Although circular staplers are more commonly used currently, this method is still occasionally useful and applicable when other methods are difficult. It involves attaching the posterior aspect of the distal esophagus to the anterior wall of the stomach. It requires an overlap to enable 7–8 cm of the esophagus to lie freely over the front of the stomach. If a 7- to 8-cm overlap is not available, this stapling technique is contraindicated.

Make a stab wound, 1.5 cm long, on the anterior wall of the gastric pouch at a point 7–8 cm from the cephalad margin of the stomach (Fig. 15.28). Insert one fork of the cutting linear stapler through the stab wound into the stomach and the other fork into the open end of the overlying esophagus (Fig. 15.29). Insert the stapling device to a depth of 3.5–4.0 cm. Fire and remove the stapling device. This step leaves both the end of the esophagus and a large opening in the stomach unclosed (Fig. 15.30). The posterior layer of the anastomosis has already been accomplished by the stapling device. Complete the anastomosis in an everting fashion by triangulation with two applications of the 55-mm linear stapler. To facilitate this step, insert a 4-0 temporary guy suture through the full thickness of the anterior esophageal wall at its midpoint, carry the suture through the center of the remaining opening in the gastric wall (Fig. 15.31), and tie the suture. Apply Allis clamps to approximate the everted walls of the esophagus and stomach. Apply the first Allis clamp just behind termination of the first staple line on the medial side. Hold the suture and the Allis clamps so the linear stapler can be applied just underneath the clamps and the suture (Fig. 15.32). Tighten and fire the stapling device. Excise the esophageal and gastric tissues flush with the stapling device with Mayo scissors. Leave the guy suture intact.

Use an identical procedure to approximate the lateral side of the esophagogastric defect. Apply additional Allis clamps. Then place the 55-mm linear stapling device into position deep to the Allis clamps and the previously placed guy suture. Close and fire the stapler and remove the redundant tissue with Mayo scissors (Fig. 15.33). It is essential that a small portion of the lateral termination of the stapled anastomosis be included in the final linear staple line. Include the guy suture also in this last application of the linear stapler. These measures eliminate any possibility of leaving a gap between the various staple lines. Test the integrity of the anastomosis by inserting a sterile solution of methylene blue through the nasogastric tube into the gastric pouch. The appearance of the completed stapled anastomosis is shown in Fig. 15.34.

Whether a Nissen fundoplication is to be constructed following this anastomosis depends on the judgment of the surgeon and the availability of loose gastric wall. In some cases partial fundoplication can be done.

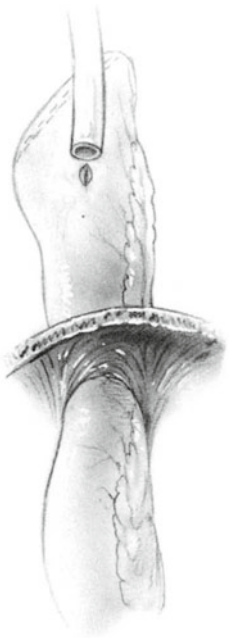


Fig. 15.28

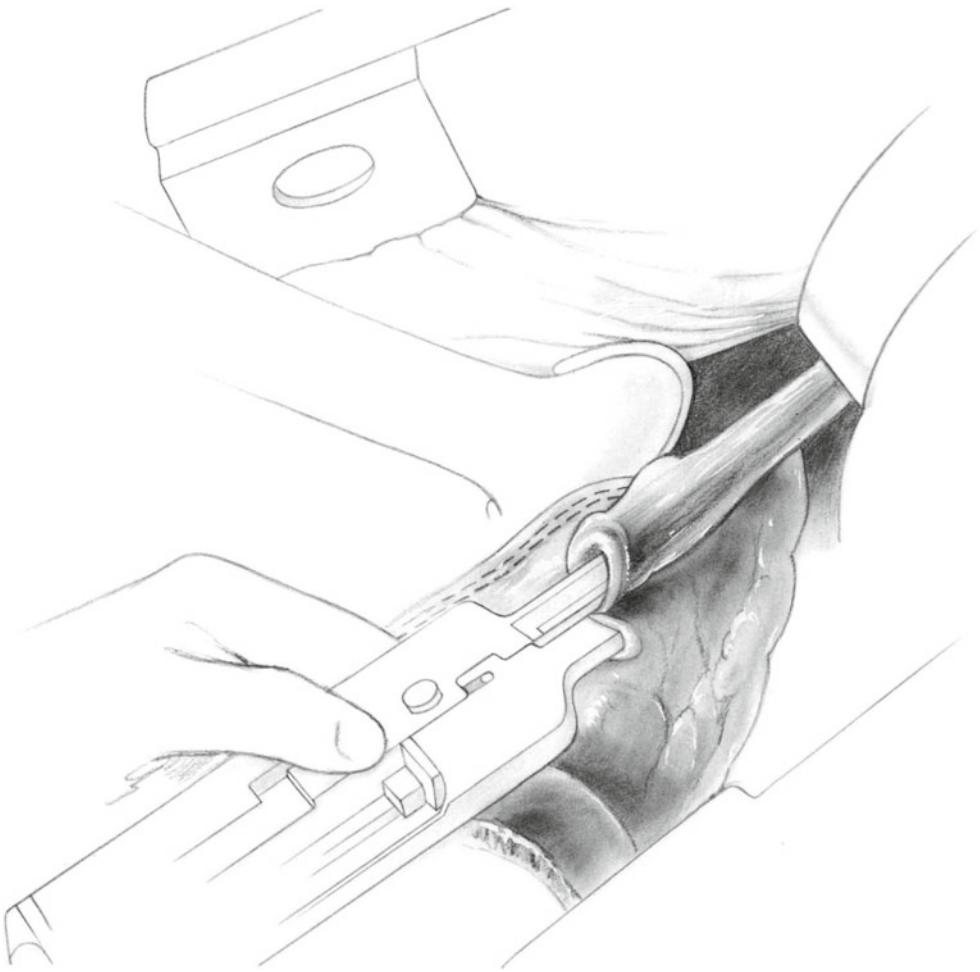
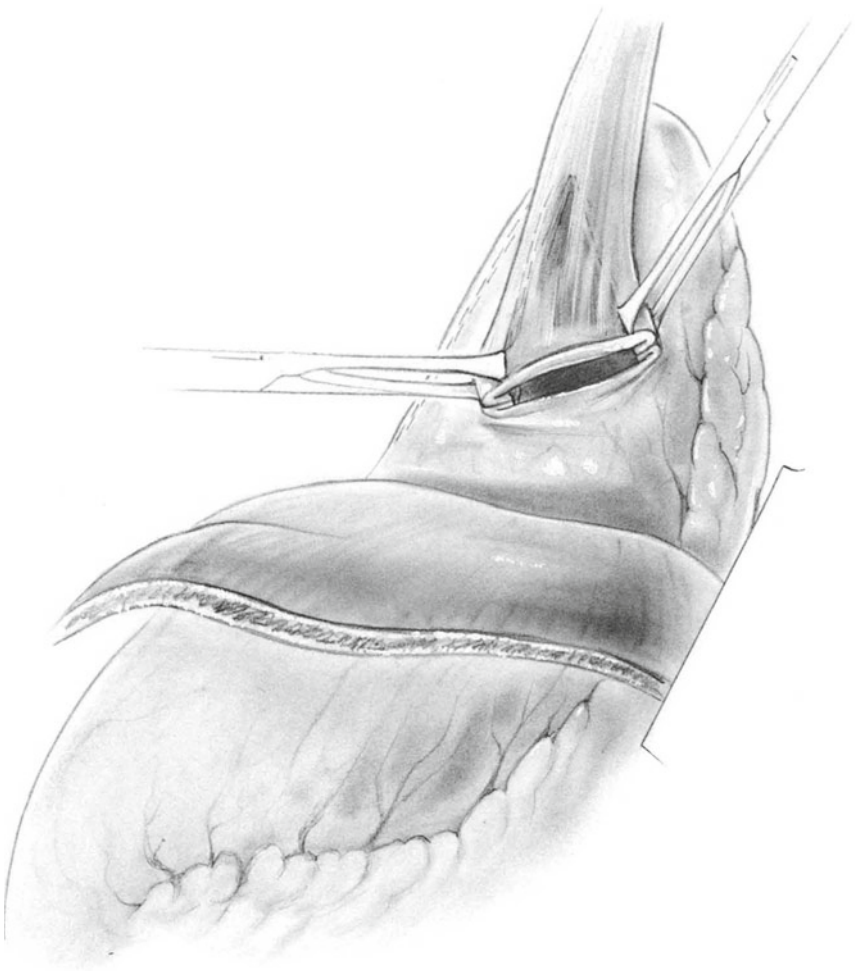


Fig. 15.29

Fig. 15.30



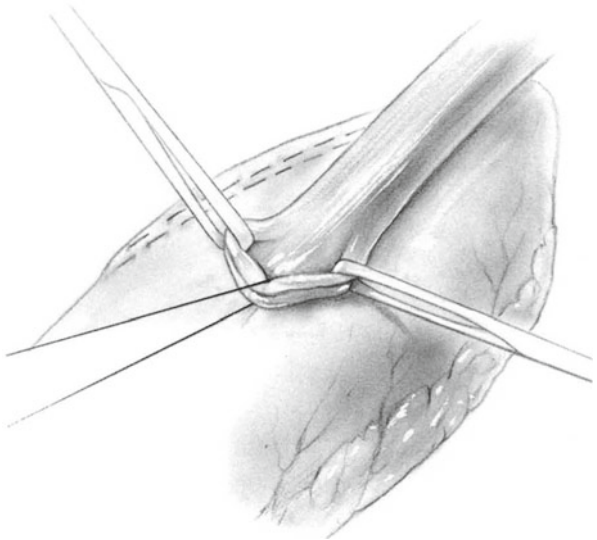


Fig. 15.31

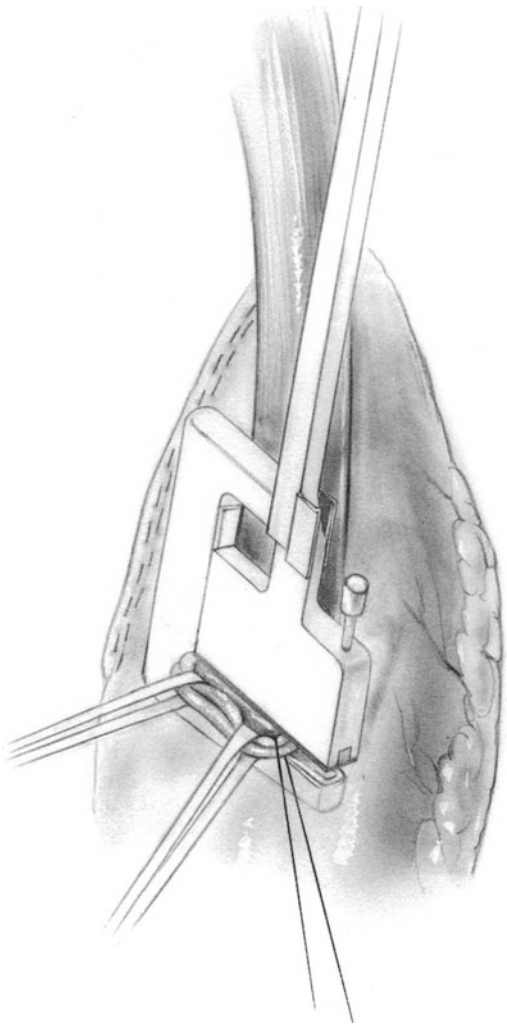


Fig. 15.32

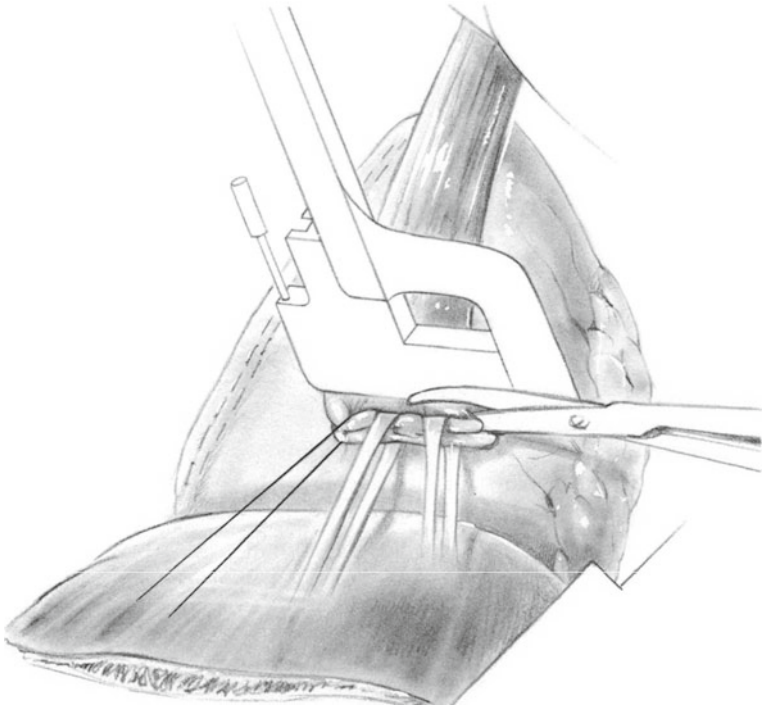


Fig. 15.33

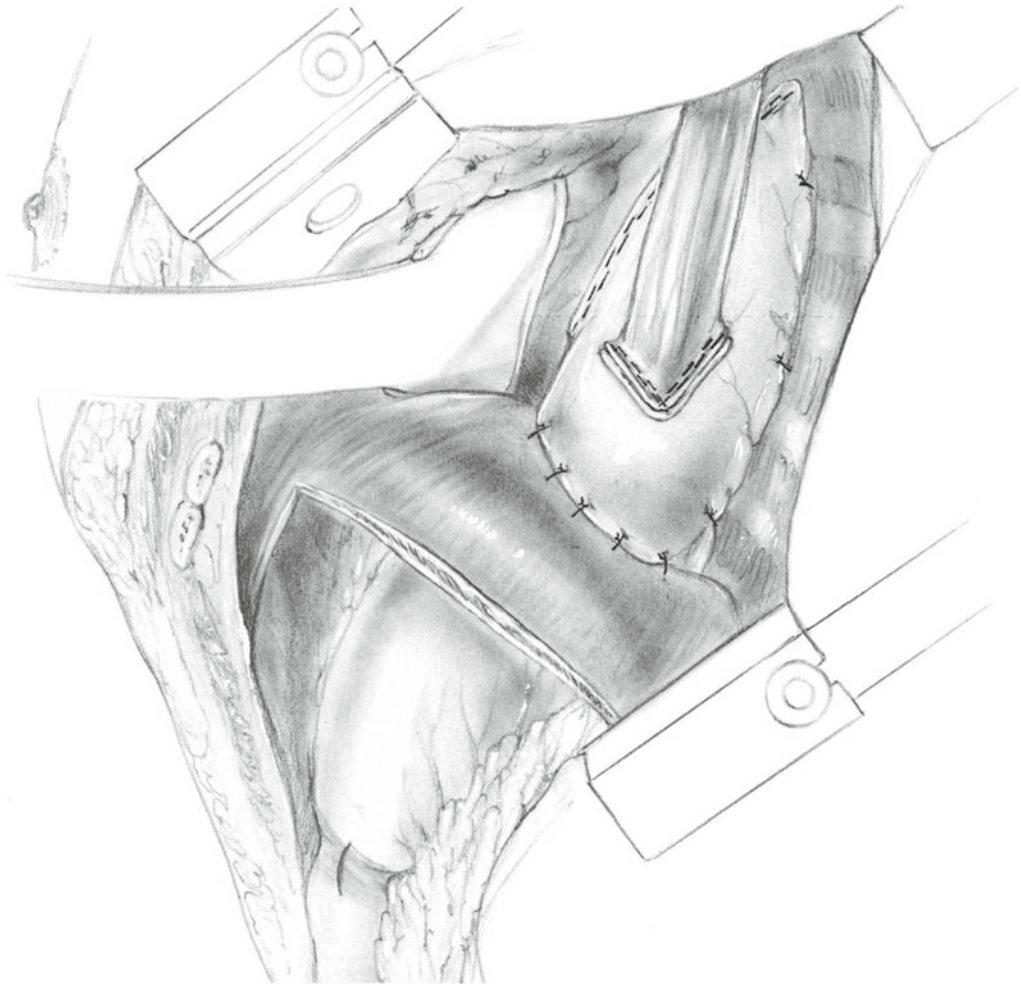


Fig. 15.34

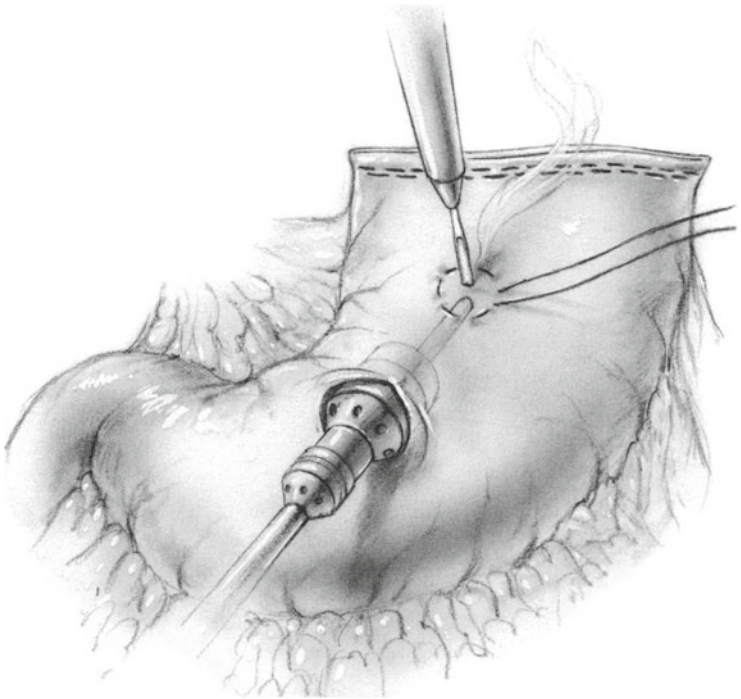
Esophagogastric Anastomosis Performed by Circular Stapling Technique

The circular stapling technique is especially suitable for patients in whom the lumen of the esophagus is large enough to admit a 28- or 31-mm circular stapling device. The esophageal lumen can be measured by attempting to insert sizers (which come in 25-, 28-, and 31-mm sizes). It is dangerous to stretch the esophagus with these sizers, because it can result in one or more longitudinal tears of the mucosa and submucosa. Gentle dilatation with a Foley catheter balloon is the safest way to achieve lumen of adequate size for anastomosis. Use a 16-F Foley catheter with a 5-cc balloon attached to a 20-cc syringe filled with saline. Insert the Foley catheter well above the site for anastomosis and inflate the balloon in 2.5-cc increments. Withdraw the inflated balloon slowly after each inflation. A 28-mm circular staple can almost always be inserted with ease (use the largest size that can be inserted easily). Place four long Allis clamps or guy sutures equidistant around the circumference of the esophagus to maintain a wide lumen and minimize difficulty with insertion of the stapler head.

If a tear is detected, resect an additional segment of the esophagus to remove the laceration. If the tear is not detected and a stapled anastomosis is constructed, postoperative leakage is a potentially dangerous complication.

Next, insert the 25-mm sizer and then the 28-mm sizer. If the 28-mm sizer passes easily, the circular stapling technique is a good one. If only the 25-mm sizer can be inserted, there is danger of postoperative stenosis when this size staple cartridge is used. Although this type of stenosis frequently responds well to postoperative dilatation, we prefer to utilize the alternative technique described above (Figs. 15.28, 15.29, 15.30, 15.31, 15.32, 15.33, and 15.34), which corrects for the narrow esophagus without requiring postoperative dilatation. Use a purse-string suture to tighten the esophagus around the shaft of the stapler. After inserting a 28- or 31-mm sizer, place one or two purse-string sutures of 0 or 2-0 Prolene, making certain to include the mucosa and the muscularis in each bite.

Fig. 15.35



The anastomosis can be done to the anterior or posterior wall of the stomach. We generally prefer to use the posterior wall if the anastomosis is high in the chest, as it allows an easy anterior hemifundoplication.

Make a 3-cm linear incision somewhere in the antrum of the gastric pouch utilizing electrocautery. Through this opening in the anterior wall of the gastric pouch, insert the cartridge of a circular stapling device after having removed the anvil.

Then choose a point 5–6 cm from the proximal cut end of the gastric pouch and use the spike of the stapler to puncture it. Advance the shaft as far as it will go and then insert a small purse-string suture of 2-0 Prolene around the shaft. Alternatively, place the purse-string suture first; then make a stab wound in the middle of it (Fig. 15.35) and permit the shaft of the circular stapler to emerge from the stab wound. Tie the purse-string suture around the shaft. Remove the spike. Gently insert the anvil of the device into the open end of the esophagus. Draw the esophagus down over the anvil. When this has been accomplished, tie the purse-string suture around the instrument's shaft, fixing the esophagus in position (Fig. 15.36). Ensure that there is no axial rotation of the stomach. Now attach the anvil to the shaft of the device and approximate the anvil to the cartridge of the circular stapling device by turning the wing nut in a clockwise direction to the indicated tightness. Be certain that the purse-string suture fits snugly around the shaft and that it does not catch on grooves in the shaft. After this has been accomplished, fire the stapling device.

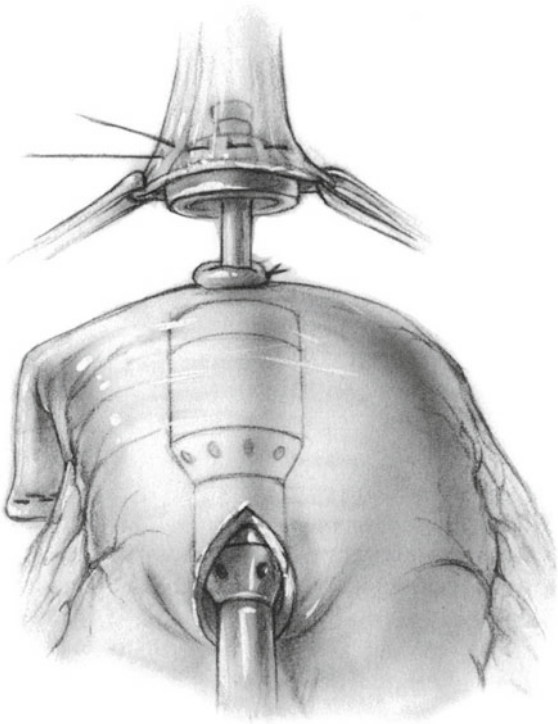


Fig. 15.36

Now rotate the wing nut the appropriate number of turns in a counterclockwise direction, gently disengage the anvil from the newly created anastomosis, and remove the entire device from the gastric pouch. Carefully inspect the newly

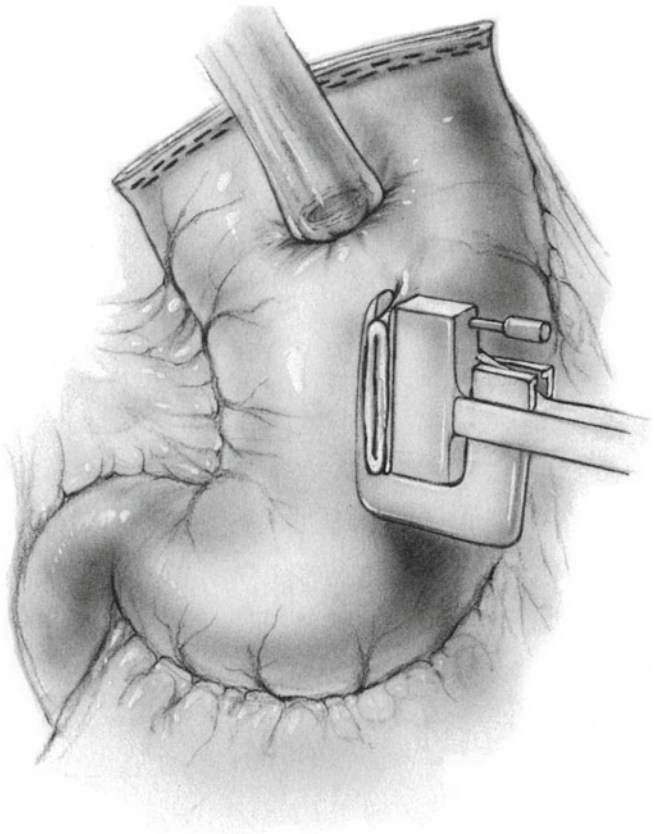


Fig. 15.37

constructed circular anastomosis between the open end of the esophagus and the gastric pouch to see that all the staples have fired and that the anastomosis is intact. Confirm this by inserting the index finger through the previously made gastrotomy incision and pass the finger into the esophagus, confirming the presence of an open lumen. Now apply Allis clamps to the gastrotomy incision on the anterior wall of the gastric pouch. Apply a linear stapling device for thick tissue (4.8 mm) and fire. Excise any redundant gastric tissue, remove the stapler, and lightly electrocoagulate bleeding vessels. Carefully inspect the staple line to be sure all of the staples have closed. Many surgeons oversew the gastrotomy incision with a layer of continuous or interrupted Lembert sutures of a nonabsorbable nature, although this step may not be essential if 4.8-mm staples are used (Fig. 15.37). Do not convert the linear gastrotomy to a transverse closure as you would for a pyloroplasty because it increases tension on the suture line.

Muehrcke and Donnelly reported four leaks from stapled gastrotomies in 195 patients undergoing esophageal resection using circular stapling instruments. A possible explanation for failure of the stapled gastrotomy closure to heal properly is the use of a 3.5-mm staple. In a stomach of normal thickness, using a small staple can produce a line of necrosis. We prefer that a 4.8-mm staple be used when closing the stomach. These authors found that there was a reduction in the leak rate from their gastrotomy closures if they oversewed the gastrotomy staple line with a continuous noninverting layer of 3-0 Mersilene. We have used a 4-0 polypropylene running, inverting seromuscular suture to cover the staple line and have seen leaks only .when this step was omitted.

Stabilizing the Gastric Pouch

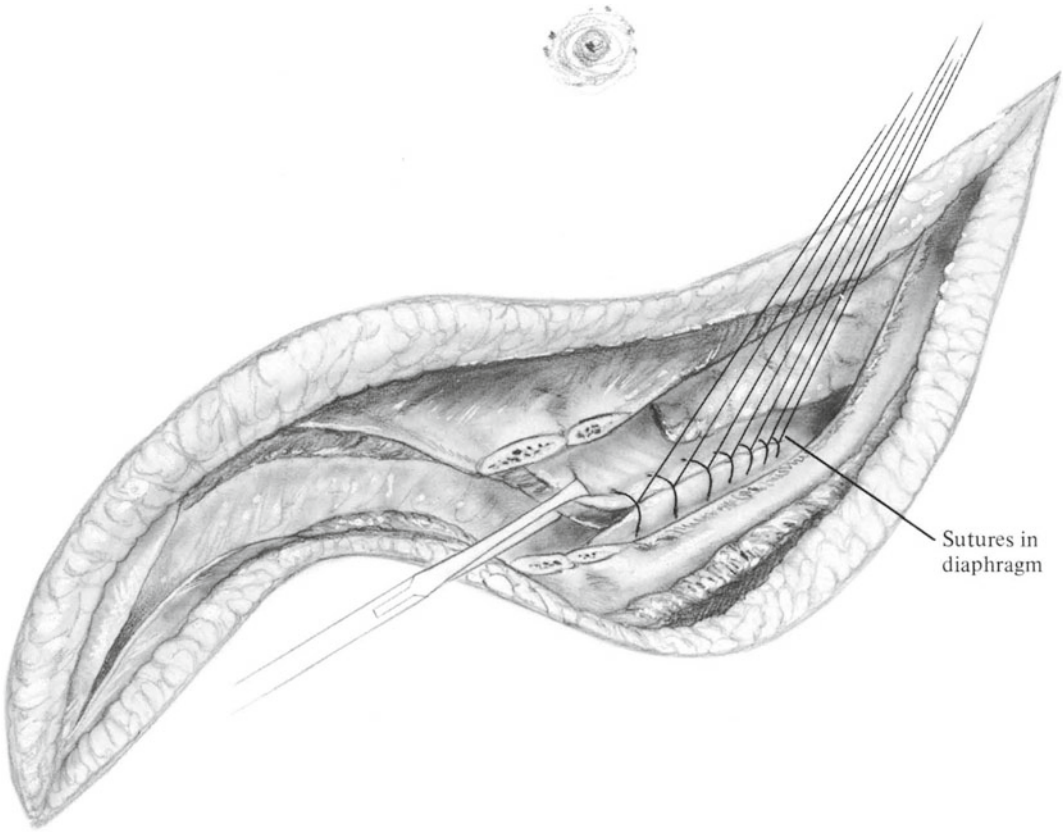
To prevent any gravity-induced tension on the anastomosis, the apex of the gastric pouch should be sutured to the mediastinal pleura or the prevertebral fascia with 2-0 or 3-0 nonabsorbable sutures. The gastric pouch should then be fixed to the enlarged diaphragmatic hiatus with interrupted 2-0 or 3-0 nonabsorbable sutures, which attach the gastric wall to the margins of the hiatus (Fig. 15.34). These sutures should be 2 cm apart and should not penetrate the gastric mucosa lest they induce a gastropleural fistula. Consider performing a jejunostomy for immediate postoperative enteral alimentation.

Closure

Irrigate the thoracic and abdominal cavities and close the incision in the diaphragm with interrupted sutures of 2-0 Tevdek or a running suture of 0 monofilament (Fig. 15.38). In either case, take fairly large (1 cm) bites, as dehiscence of this suture line can have serious consequences, such as herniation of small intestine into the chest. Do not try to complete this closure until the costal margin has been approximated to avoid tearing the diaphragm.

Excise approximately 1 cm of cartilage from the costal margin to improve apposition (Fig. 15.39). Close the incision in the costal margin with one or two sutures of monofilament stainless steel wire (Fig. 15.40). Either 2-0 or no. 5 wire may be used. Insert four or five pericostal sutures of no. 1 PDS to approximate the ribs (Fig. 15.41). Bring a 30-F chest tube through the ninth intercostal space in the anterior axillary line and carry it up to the level of the anastomosis. Place it under direct vision. If it does not sit comfortably, suture it to the parietal pleura posterior to the aorta using fine absorbable sutures. Inflate the lung to eliminate any atelectatic patches. If a significant number of air leaks from the lung are noted, pass a second chest catheter anterior to the lung up to the apex of the thorax. Tie the pericostal sutures and the final diaphragm sutures and close the muscles in two layers with a continuous 2-0 or 0 PG atraumatic synthetic absorbable suture in each (Figs. 15.42 and 15.43).

Fig. 15.38



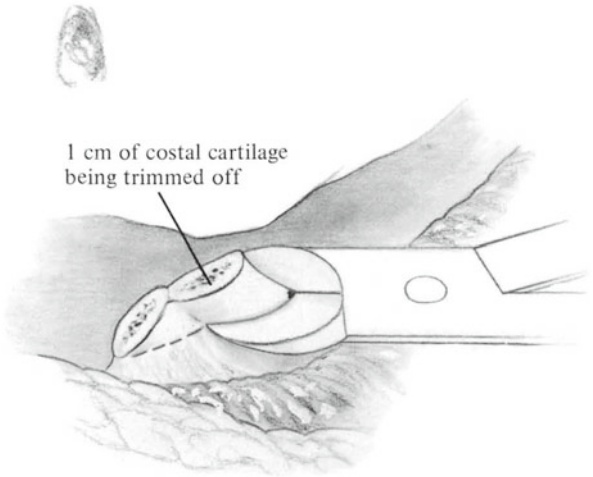
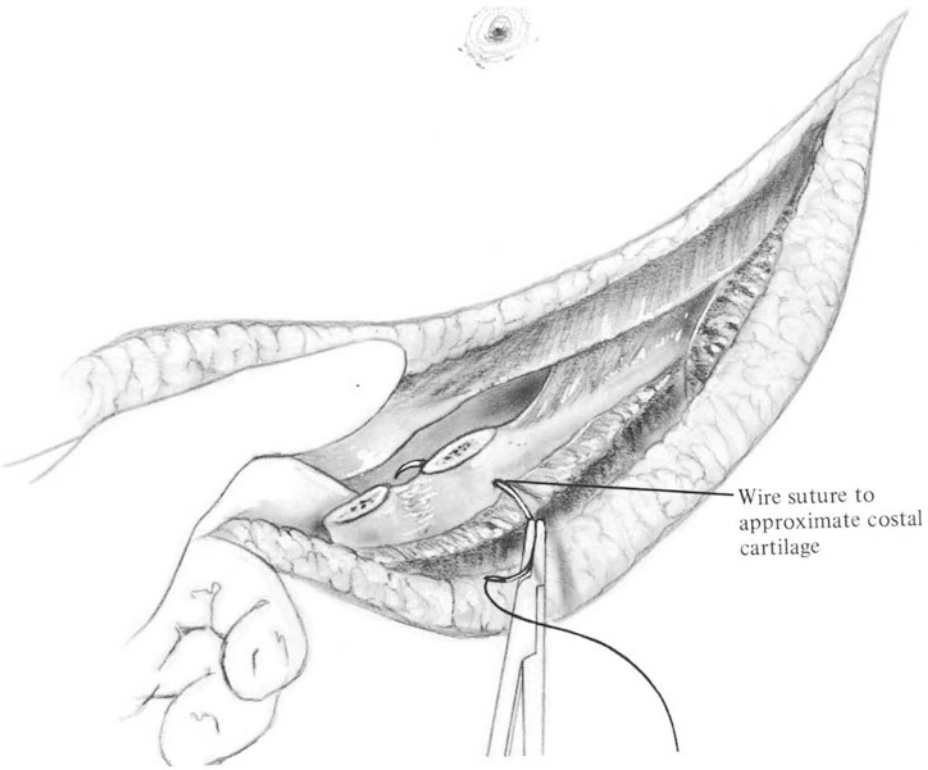


Fig. 15.39

Fig. 15.40



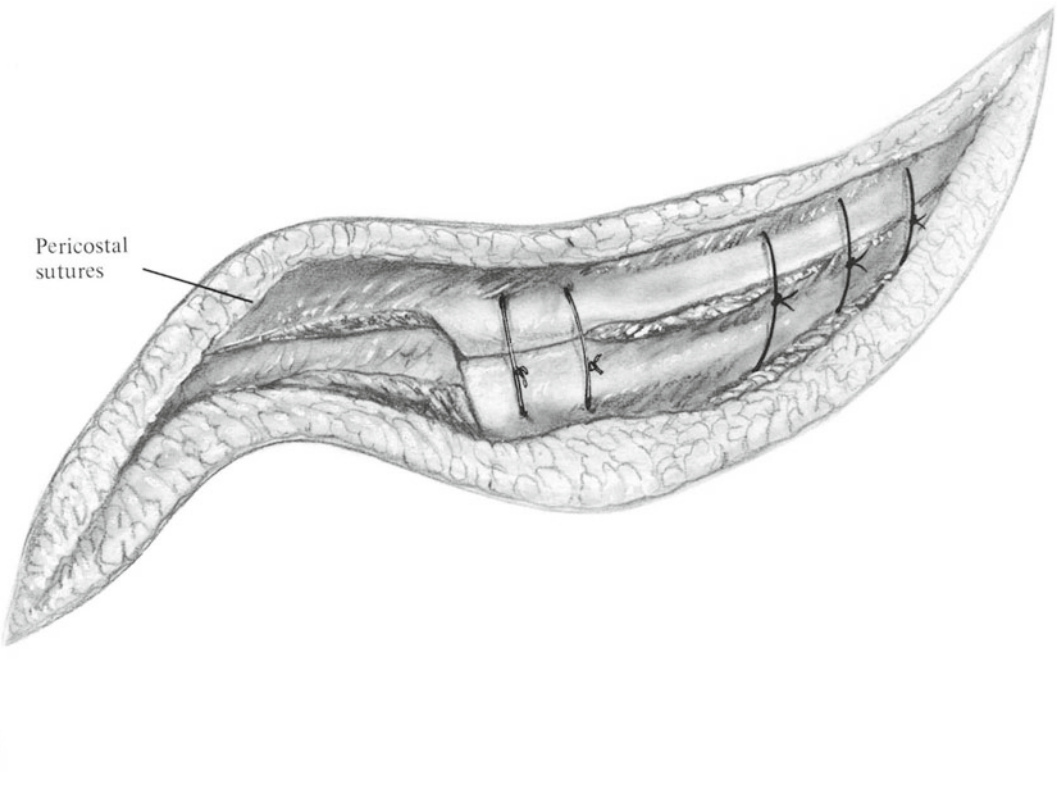


Fig. 15.41

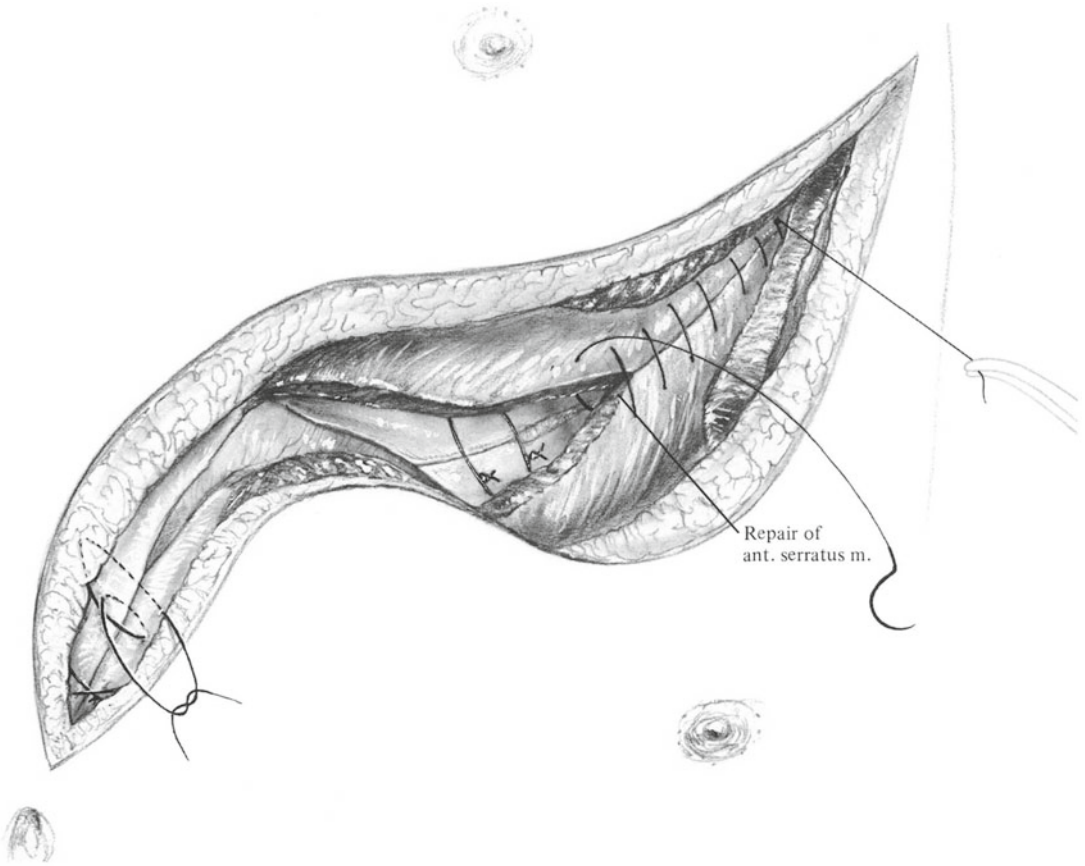


Fig. 15.42

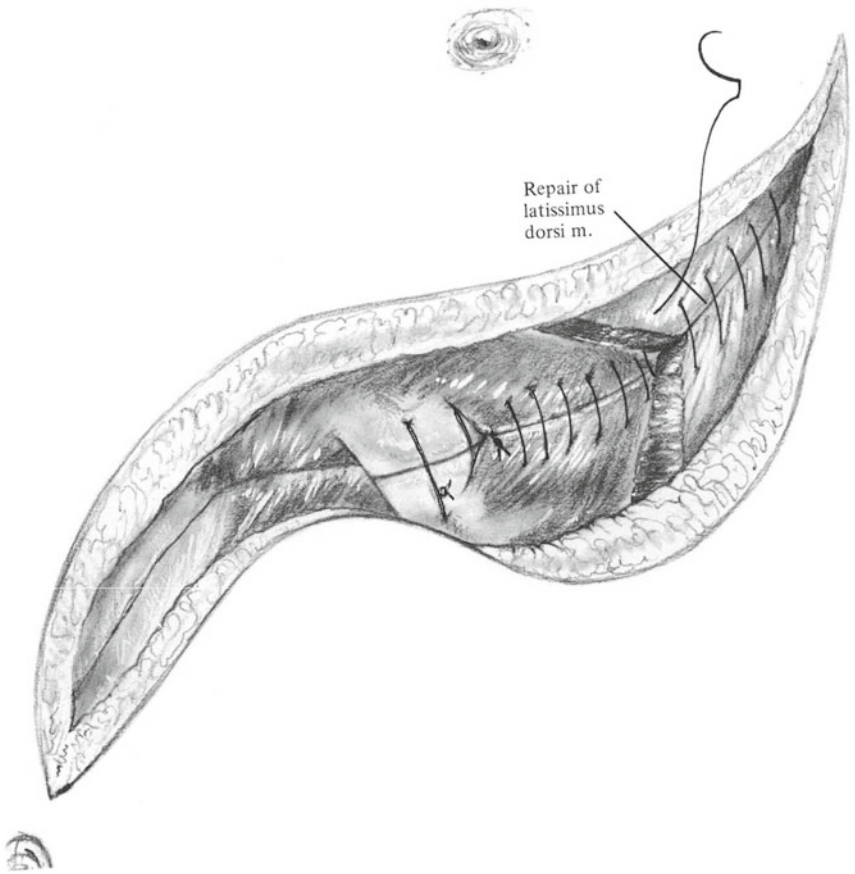


Fig. 15.43

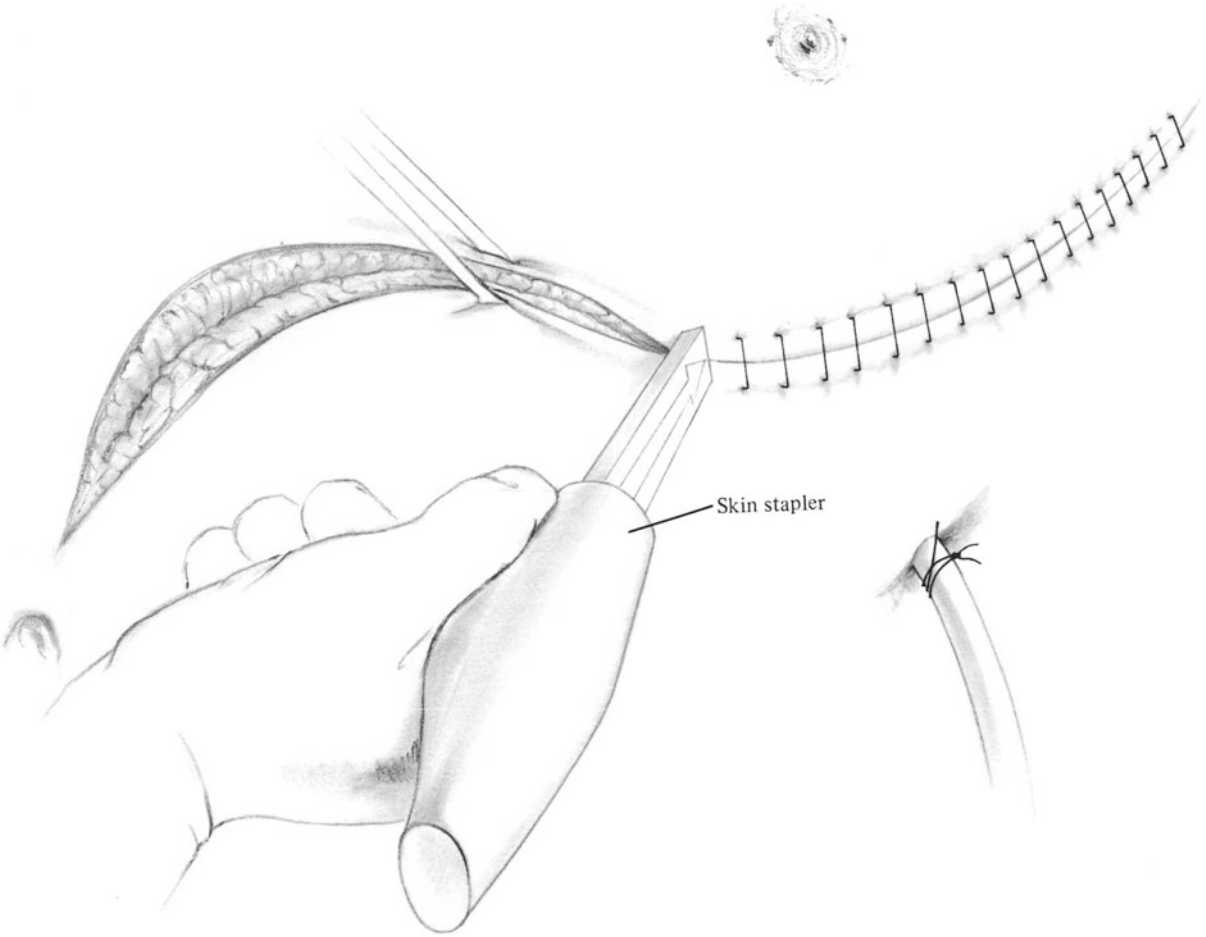


Fig. 15.44

Close the abdominal portion of the incision with interrupted no. 1 PDS Smead-Jones sutures as described in Chap. 3. The diaphragm is continuous with the endoabdominal fascia, and separate closure of this layer to meet the diaphragmatic closure facilitates closure of both diaphragm and abdominal wall. Use staples or a subcuticular suture to close the skin (Fig. 15.44). No drains should be needed in the abdominal cavity.

Postoperative Care

See Chap. 14.

Complications

See Chap. 14.

Further Reading

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