

Three Years' Experience with Esophageal Stapling Device

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The authors report their experience with forty patients undergoing resection of middle and lower thirds carcinomas of the esophagus or proximal stomach, with esophagogastric or esophagojejunal anastomosis using an end-to-end anastomosis (EEA) stapler. A fatal anastomotic leak occurred in the first two patients and seven other patients died in the early post-operative period from respiratory and cardiovascular complications. Four other patients developed fibrotic strictures between 6 and 24 months after their operation. The strictures were easily dilated and did not recur. The use of an EEA stapler is recommended because it reduces the operating time, the incidence of anastomotic leaks, and probably the blood loss. The majority of anastomoses can be accomplished exclusively through the left chest by using the stapler.

RECONSTRUCTION OF THE gastrointestinal tract after resection of the esophagus for malignant lesions is time consuming, particularly when a two-layered sutured anastomosis is used. The operation is further prolonged when multiple anastomoses are required for colonic interposition. Excessive operative time increases the operative serous fluid and blood loss and also the incidence of postoperative complications. Esophagogastrectomy has a significant hospital mortality rate reported to be between 2.8% and 33%.¹⁻³

The most sinister complications are anastomotic leaks, which are invariably fatal, and stricture formation at the site of anastomosis.^{2,3} To reduce the incidence of these two complications and the operative time, a stapling device has been used with increasing enthusiasm and success for gastrointestinal anastomosis. We have used the EEA stapler in 40 patients to construct the anastomosis after esophagogastric resections. We believe that by using this device, a safer anastomosis with an adequate lumen can be performed in a shorter time through the left chest only. Our operative technique, apart from some minor technical details, does not differ from that described by Dorsey et al.⁴

Materials and Methods

Forty patients with carcinoma of the esophagus or the gastroesophageal junction were operated on between

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June 1979 and June 1982, using an EEA stapler. There were 21 men and 19 women, ranging in age from 37 to 82 years (Table 1). Twenty-eight patients had squamous cell carcinoma in the middle third and 12 patients had adenocarcinoma in the lower third of the esophagus. Three patients were approached by a left thoracoabdominal route, and 14 patients underwent a two-stage (Ivor Lewis) procedure for middle third carcinomas of the esophagus. This procedure was subsequently abandoned in favor of left thoracotomy, and in the remaining 23 patients, resection was performed exclusively through the left chest. Access to the abdomen was achieved through a peripheral incision in the diaphragm.

Thirty-nine patients underwent esophagogastrectomy with esophagogastrostomy; total gastrectomy with splenectomy was carried out in the remaining patient, restoring continuity of the gastrointestinal tract by esophagojejunostomy and jejunojunctionostomy.

Results

Two patients developed anastomotic leaks. One leak in the first patient occurred on the third day after operation. The other leak occurred in a patient in whom access had been difficult, and when the stapler was removed, it was discovered that the entire circumference of the esophagus has not been secured between the cartridge and the anvil. The anastomosis, therefore, was reinforced with interrupted linen sutures. Both patients died and the leaks were confirmed at post mortem examination. There were seven more hospital deaths, four from respiratory complications, one from septicaemia and renal failure, another from left heart failure and uraemia and the seventh as a result of a fatal stroke. These seven patients were over 65 years of age, and no anastomotic leak was discovered at autopsy. There were three late deaths related to the malignant disease. Thirty-one patients (87.5%) had an uneventful recovery from their operations. Four patients were readmitted with anastomotic strictures after 6, 9, 12, and 24 months following surgery. These strictures were dilated easily and recurrence of growth or stricture has not been observed.

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The blood loss during the operations varied from 220 ml to 850 ml (mean, 500 ml). The postoperative chest drainage in the first 24 hours varied from 250 ml to 800 ml (mean, 400 ml).

Operative Technique

In patients with carcinoma of the cardia, a small upper abdominal incision was made initially to determine the extent of the growth. If the tumour was resectable, the incision was then extended into the left chest.

For lesions involving the lower third of the esophagus, a left thoracotomy through the bed of the seventh rib was performed. After assessing the lesion for resectability, the abdomen was exposed by dividing the diaphragm circumferentially about 2 cm from the costal margin.

Upper thoracic esophageal lesions were approached through two separate incisions in the first part of the series. The stomach was mobilised through an upper abdominal midline incision and an esophagectomy with esophagogastronomy performed through a right thoracotomy after repositioning and redraping the patient. During the abdominal stage, the stomach was fully mobilized up to the cardia, preserving the gastroepiploic vascular arcade. To facilitate mobilization, a splenectomy was carried out if necessary. The left gastric pedicle was dissected carefully and the vein and artery divided separately. The site for gastric transection was selected, and the stomach was divided between a TA90 stapler and a proximal clamp in the single-stage procedures. This step was delayed in two-stage procedures until the esophagus has been mobilized and the stomach safely delivered into the chest. A right thoracotomy was then performed appropriate to the level of the lesion. The esophagus was transected at least 5 cm above the lesion and the resected specimen removed.

In the latter part of the series, all lesions, irrespective of their location, were approached through the left chest.

This approach is easy and adequate to provide access both to the esophagus and to the stomach. Second, it has less postoperative respiratory complications compared with a two-stage procedure. Third, if the tumor is behind the aortic arch, the aorta can be mobilized easily, and anastomosis with the help of the stapler can be achieved either below, above, or lateral to the arch. Finally, if the lesion is unresectable, a Celestin tube can be placed in position through the same incision.

Initially, the United States Surgical Corporation's pursestring instrument was used to control the proximal esophagus, but its application in fashioning a pursestring proved very difficult, especially high up in the chest. Therefore, an ordinary pursestring suture around the proximal esophagus was placed manually. A small incision was made into the gastric remnant. The rod of the stapling device was now pushed against the stomach

TABLE 1. Age and Sex Distribution of Patients

Age in Years	Men	Women	Total
30-39	1	—	1
40-49	1	3	4
50-59	6	6	12
60-69	5	3	8
70-79	6	6	12
80-89	2	1	3
Total	21	19	40

wall at the proposed site of the anastomosis, which should be well away from gastric suture line, and then passed through a very small incision into the stomach, obviating the necessity for a pursestring suture on the gastric side. The anvil was secured on to the stapling rod and then carefully introduced into the proximal esophagus before it was transected completely. The intact back wall of the esophagus facilitated the introduction of the anvil. Great care must be taken not to strip off the esophageal mucosa or to tear the esophagus. In difficult cases, a smaller 25-mm cartridge was inserted. The esophageal transection was completed and the pursestring then tied around the rod, the stapler was screwed together and then fired. The stapler could then be unscrewed and gently removed. All the anastomoses were completed in under 5 minutes. Two complete circular segments from the esophageal and gastric ends were checked and the anastomoses reinforced with interrupted non-absorbable sutures if there was any doubt of their integrity. A nasogastric sump drainage tube was advanced into the stomach beyond the anastomosis. A chest X-ray after 24 hours should show a complete ring of staples. The patients were started on clear fluids as soon as bowel sounds returned. Barium swallow was not routinely performed, unless the ring of staples was disrupted on X-ray.

Comment

The use of mechanical stapling devices for intestinal anastomoses has been described by Ravitch.⁵ The EEA stapler was designed for end-to-end anastomoses, and its use for esophagogastric anastomoses has been described recently.^{4,6}

Chassin² reviewed the literature over a 10-year period from 1968 and reported an average mortality rate of 20% for gastroesophageal resection. Half of the deaths were attributed to leaks from the anastomoses. Schuchmann et al.³ have reported an operative mortality rate after esophagogastronomy of 18.9% and 33% after colonic interposition, with an anastomotic leak for each group of 10%.

Using the EEA stapler for esophagogastric anastomosis, Dorsey et al.⁴ had no anastomotic leaks and no

postoperative deaths in 15 patients. One of their patients (6.6%) developed a fibrotic stricture after 5 months. Similar results have been published by Molina et al.,⁶ who had no anastomotic leak or stricture formation in their nine patients, but they had one postoperative death (11%) from respiratory complications. Comparing the results of hand-sewn and EEA stapler anastomoses, Fekete et al.⁷ reported an incidence of anastomotic leak of 12.5% and 2.5%, respectively, with a corresponding hospital mortality rate of 25% and 13.2%.

In our series of 40 cases, we had two (5%) anastomotic leaks, but one occurred in the first patient of the stapling series and could be attributed to our lack of experience. The second occurred because of technical problems with the stapler. As our experience has grown, the technical difficulties have diminished and, in the last 38 patients, there has been no anastomotic leak.

The incidence of stricture formation at the anastomotic site using hand-sewn anastomosis has been reported to be between 2.3% and 10%.^{3,8,9} In our series of stapling anastomoses, four patients (10%) developed fibrotic strictures at 6, 9, 12, and 24 months after operation. These strictures, unlike those that follow a suture technique, were soft, dilated very easily, and were not observed to recur.

Unfortunately, our hospital mortality rate remains high (22.5%). Two of the patients who died, however, were old (77 and 82 years) chronologically and biologically. If these patients are excluded, the mortality rate is 18% and compares with that reported by others.^{2,3,10} Our postoperative mortality rate may have been higher than that of others^{4,6,7} because we had 15 patients over 70 years of age. Also, their^{4,6} follow-up period was shorter than ours and the incidence of stricture formation, therefore, cannot be compared.

The main cause of postoperative mortality, related more to age than to the stapling technique, is respiratory complications. As suggested by Wong,¹¹ efforts should be directed against these complications. Better selection of patients, preoperative assessment and care, understanding of the physiological derangements caused by these operations, and energetic postoperative management would probably reduce these problems.

Conclusion

Our experience suggests that the EEA stapler is a useful addition to the surgeon's armamentarium. Its suc-

cessful use, however, requires adequate practice and attention to detail, when its application reduces the time of operation and, hence, presumably blood and fluid loss. It appears to reduce the risk of anastomotic leak and obviates the need for a two-stage procedure for middle third esophageal lesions. The incidence of anastomotic stricture formation may not be significantly different from hand-sewn anastomoses, but the strictures that may occur many months after surgery require only one dilatation.

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Addendum

Since this paper was accepted for publication, seven additional patients have undergone successful surgery without morbidity.