

# EEA® Stapler and Omental Graft in Esophagogastrectomy

## Experience with 30 Intrathoracic Anastomoses for Cancer

F. FEKETE, PH. BREIL, H. RONSSE, J. C. TOSSEN, F. LANGONNET

Experience with the EEA stapler device used in 30 esophago-gastric resections for cancer with intrathoracic anastomosis, is reported. The mortality rate was 13.3%. The anastomotic failure rate was 3.3% (1/30) with only one death; three asymptomatic blind fistulas were found on a routine contrast examination of the anastomosis. It is felt that esophago-gastric EEA stapled anastomosis associated with an omental graft is a very safe technique.

SINCE THE AVAILABILITY of the EEA® (end-to-end anastomosis) stapling device, some papers<sup>10,17,20</sup> have been published concerning its use in gastrointestinal or colorectal surgery. Recently Steichen<sup>22</sup> described a technique applied to esophageal surgery. In this paper, the first results obtained in a specialized Department for Esophageal Surgery are reported, concerning 30 stapled anastomoses for esophago-gastric resections made for cancer of the esophagus or cardia.

### Materials and Methods

Between January 1978 and March 1980, 100 operations were performed on 92 patients with cancer of the esophagus or of the esophago-gastric junction (Table 1). Among these patients, 46 underwent an esophago-gastric resection for squamous cell carcinoma (37 patients) or for adenocarcinoma (9 patients). During the first part of this series, a manual end-to-side esophago-gastric anastomosis was performed in 16 patients. In the second period, the anastomosis was made with the EEA stapling device, which is reported in detail.

Among the 30 patients, 25 had squamous cell carcinoma and five had adenocarcinoma. The mean age of the patients was  $57 \pm 8$  years. The sex ratio showed a male predominance: 27/30. The mean weight loss was  $8 \pm 6$  kg. Several predisposing factors were found: six

*From the Department of Surgery University Paris VII  
Xavier Bichat, Hospital Beaujon,  
Clichy, France*

patients had alcoholic cirrhosis, four patients received preoperative cortisone therapy, and two patients had radiation therapy for head and neck cancer. The mean serum albumin level was 3.8 g/dl. Pulmonary insufficiency was moderate (20% reduction) in three patients and severe (50% reduction) in two.

Six squamous cell cancers of the lower third of the esophagus and five adenocarcinomas of the esophago-gastric junction were resected through a left thoracotomy with peripheral division of the diaphragm. A combined laparotomy and right thoracotomy approach was used in 19 cancers of the middle third of the esophagus.

In all but three patients, the operation was seemingly satisfying, in consideration of the rules for radical surgery. The surgical procedure included the removal of lymph nodes of the left gastric artery and a complete mediastinectomy. The gastric fundus and high lesser curvature were severed with Nakayama's stapler. The EEA stapler was inserted through a stab incision made on the anterior wall of the stomach. The esophago-gastric end-to-side anastomosis was performed on the posterior wall of the stomach (Figs. 1 and 2). In 26 of 30 patients, omental mobilization made it possible to wrap the anastomosis thoroughly with a large omental graft (Fig. 3). In all patients operated on through the abdominal and right thoracic approach, a pyloroplasty was performed.

Ventilation of the patients was maintained mechanically during the first 24 hours in the intensive care unit. A water soluble radiographic swallow examination was routinely carried out on the seventh day, in search of anastomotic leakage. The presence of clinical symptoms of leakage could lead to earlier or repeated swallow examinations.

Reprint requests: F. Fekete, Department of surgery, University Paris VII Xavier Bichat, Hospital Beaujon 100 avenue du General Leclerc 92110 Clichy, France.

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TABLE 1. Procedures for 92 Patients

	Number of Cases
Sweet "manual" esophagogastrostomy after esophagogastrectomy	16
Sweet "EEA" esophagogastrostomy after esophagogastrectomy	30
Reconstruction with colon after total esophagectomy	13
Reconstruction with stomach after total esophagectomy (cervical anastomoses)	3
Total esophagogastrectomy	6
Total esophagectomy (Torek)	7
Exploratory	
laparotomy	
thoracotomy	16
cervicotomy	
Gastrostomy	9
Total	100

### Results

The 60-day operative mortality rate was 13.3% (4/30 patients). The anastomotic failure rate was 3.3% (1/30 patients). This leak was the only one in our series that was fatal. Routine radiographic swallow examinations on the seventh day revealed three small "blind fistulas" which were totally asymptomatic (Fig. 4). If an omental graft was associated, the mortality rate was 7.7% (2/26 patients) (Table 2). No death was caused by anastomotic leakage or blind fistulas. The three blind fistulas were found in this subgroup (11.5%).

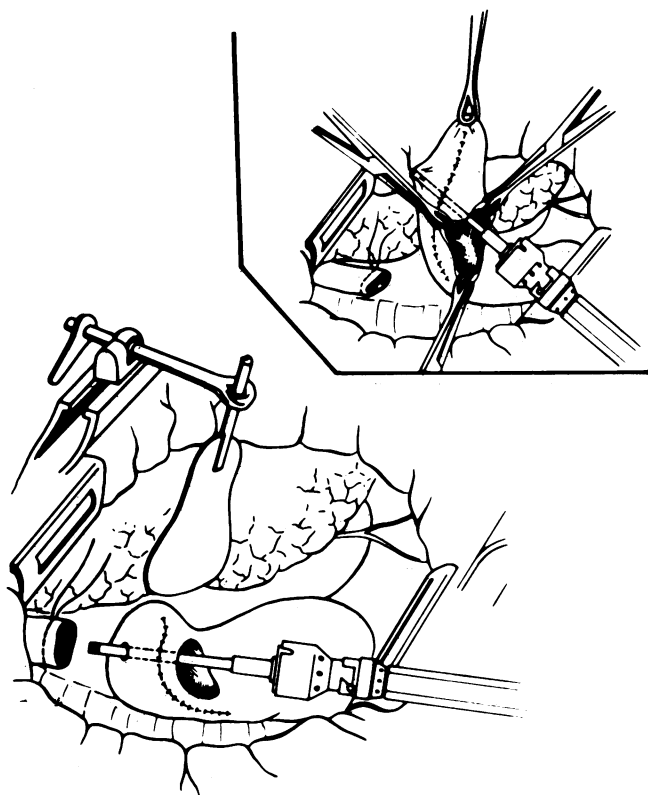


FIG. 2. Inversion of the EEA stapler through an anterior gastrotomy (right thoracotomy).

Table 3 analyses the four deaths in the series. The only death (patient #2) connected with an anastomotic failure was a patient with liver cirrhosis who died of an esophagoaortic fistula on the twelfth postoperative day. No anastomotic leakage was proved on the repeated

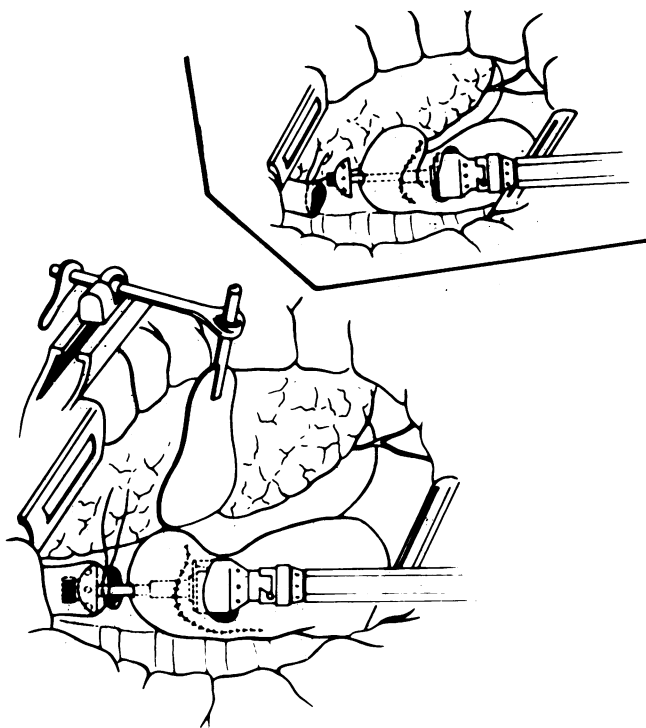


FIG. 1. The anvil is secured to the shaft and inserted into the esophagus.

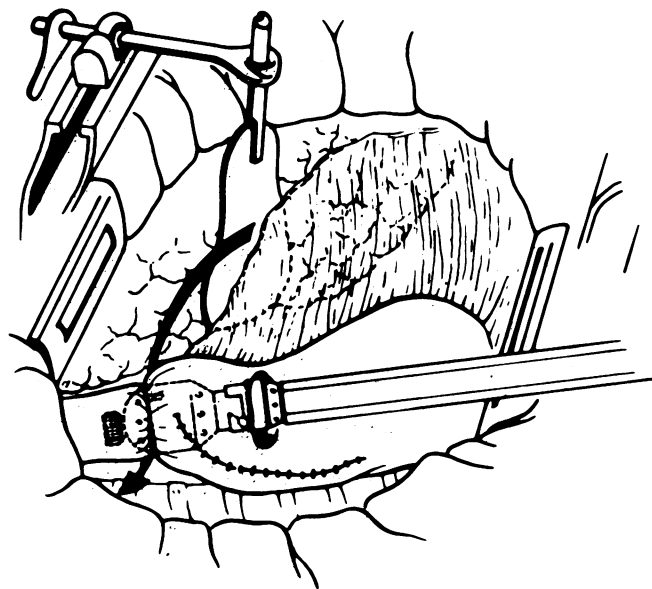


FIG. 3. Anastomosis course of the great omentum meant to wrap thoroughly the anastomosis and the gastric remnant.

radiographic contrast meals in patients #1, 3 and 4, or at reoperation (patient #4), or postmortem examination.

Table 4 summarizes postoperative complications other than anastomotic failure. Pulmonary complications were most common. Only one of these complications was lethal (patient #4). There was no complication in connection with the method of anastomosis itself. Particularly, no postoperative hemorrhage occurred. The follow-up period is not yet long enough to assess the risk of anastomotic stricture.

### Discussion

Several papers have been published about the EEA stapling device.<sup>9,17,20</sup> Its use in esophageal surgery has

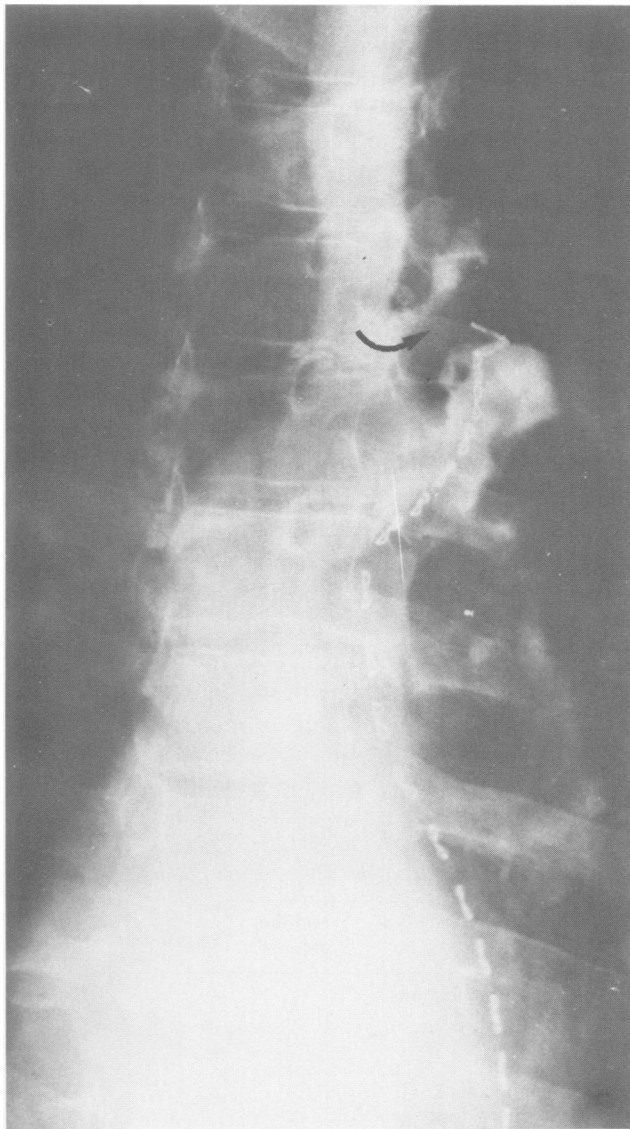


FIG. 4. Postoperative control on the seventh day with gastrografine (R) blind fistula asymptomatic, on the left edge of the anastomosis.

TABLE 2. *Anastomotic Failures*

	Number of Cases	Mortality Rate	Lethal Anastomotic Failures
EEA	30	4 (13.3%)	1 (3.3%)
EEA and omental graft	26	2 (7.7%)	0

been seldom mentioned, except for one instance, by Escat,<sup>9</sup> and two cases by Nance.<sup>17</sup>

Steichen and Ravitch<sup>22</sup> recently described various stapling techniques suitable for esophageal surgery. In the technique they advised for intrathoracic esophago-gastric anastomosis following Sweet's procedure, the anastomosis was performed on the anterior wall of the stomach. This procedure allowed for the reconstruction of antireflux mechanisms. These authors found this stapling technique very difficult in cancers of the middle third of the esophagus, because of the insufficient length of the EEA stapler if used through an abdominal approach, or because of its awkward handling through a right thoracotomy.

In our technique, insertion of the stapler is easy on the anterior wall of the stomach through a right thoracotomy, but the anastomosis is performed on the posterior wall of the gastric tube. This makes it possible to perform an anastomosis at the chest apex, allowing the section of the esophagus at a sufficient distance from the tumor (Fig. 5). Our series includes 19 proximal anastomoses performed through right thoracotomies. We have never had to abandon the use of the EEA stapler because of difficulties of insertion. We think it unnecessary to associate an antireflux procedure with this technique. The use of the ASP 50® device was not reliable in our experience, so we prefer to make the purse-string suture manually.

Our series is still limited but is the first published until now, and brings encouraging results, attested by reduced mortality rate and very low incidence of lethal anastomotic breakdowns, when compared with other series of the literature. Table 5 summarizes the recent reports of esophago-gastric resections for cancer with intrathoracic anastomosis. The mortality rate ranges between 11 and 28%, except for the small series of Chassin,<sup>3</sup> or the Chinese report.<sup>23</sup> The incidence of anastomotic failures ranges between 3, 5 and 18%, and 70–100% of them are lethal.<sup>2,5,8,19,21</sup> All these series concern manual anastomosis. With identical surgical conditions and in the same intensive care unit, 16 patients in our series underwent manual anastomoses. The mortality rate was 25%, with two mediastinal anastomotic failures (12.5%). These high mortality and morbidity rates influenced us to use the EEA stapler.

The mortality rate in our series is 13.3%, with one

TABLE 3. Analysis of Deaths

Patient Number	Age in Years	Sex	Associated Disease	Type of Cancer	Omental Graft	Day of Death After Operation	Anastomotic Failure	Cause
1	75	F	0	Adenocarcinoma (cardia)	No	14th	No	Pulmonary embolism
2	51	M	Diabetes cirrhosis	Squamous cell (low. 1/3)	No	12th	Yes	Esoaortic fistula
3	49	F	Cirrhosis	Squamous cell (Mid. 1/3)	Yes	16th	No	Liver failure
4	55	M	0	Squamous cell (Mid. 1/3)	Yes	35th	No	(ARDS)*

\* ARDS: adult respiratory distress syndrome.

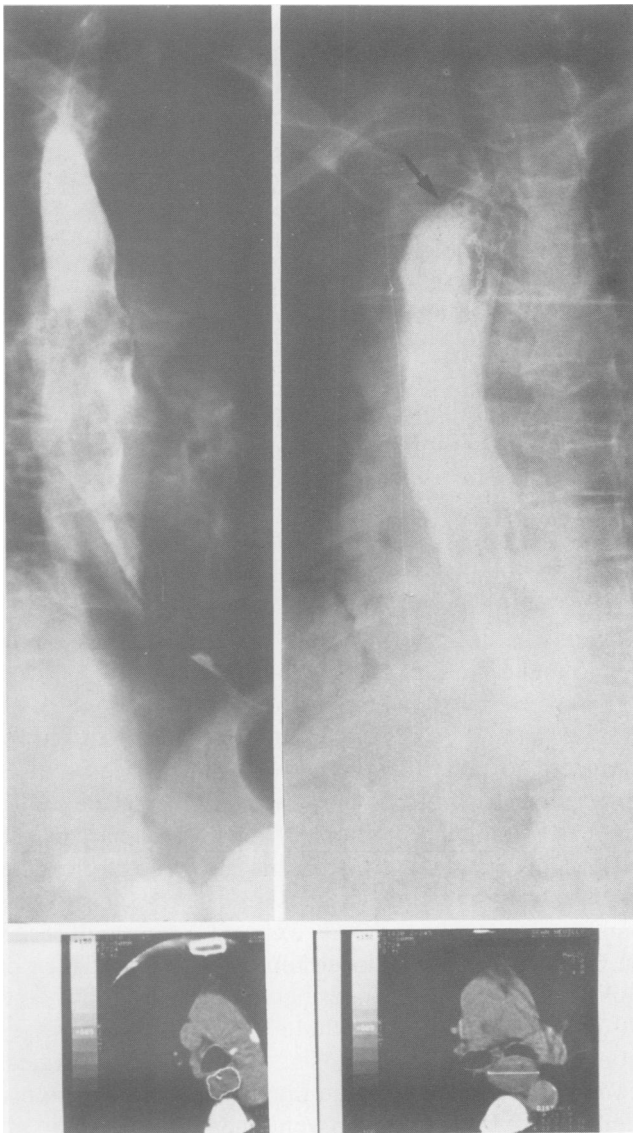


FIG. 5. Cancer of the middle third of the esophagus. (top left), Preoperative (bottom), mediastinal A.C.T. (top right), postoperative control.

lethal anastomotic failure (3.3%). In fact, if we only consider the group of patients who underwent omental graft, the mortality rate falls to 7.7%, and no death is the result of an anastomotic breakdown.

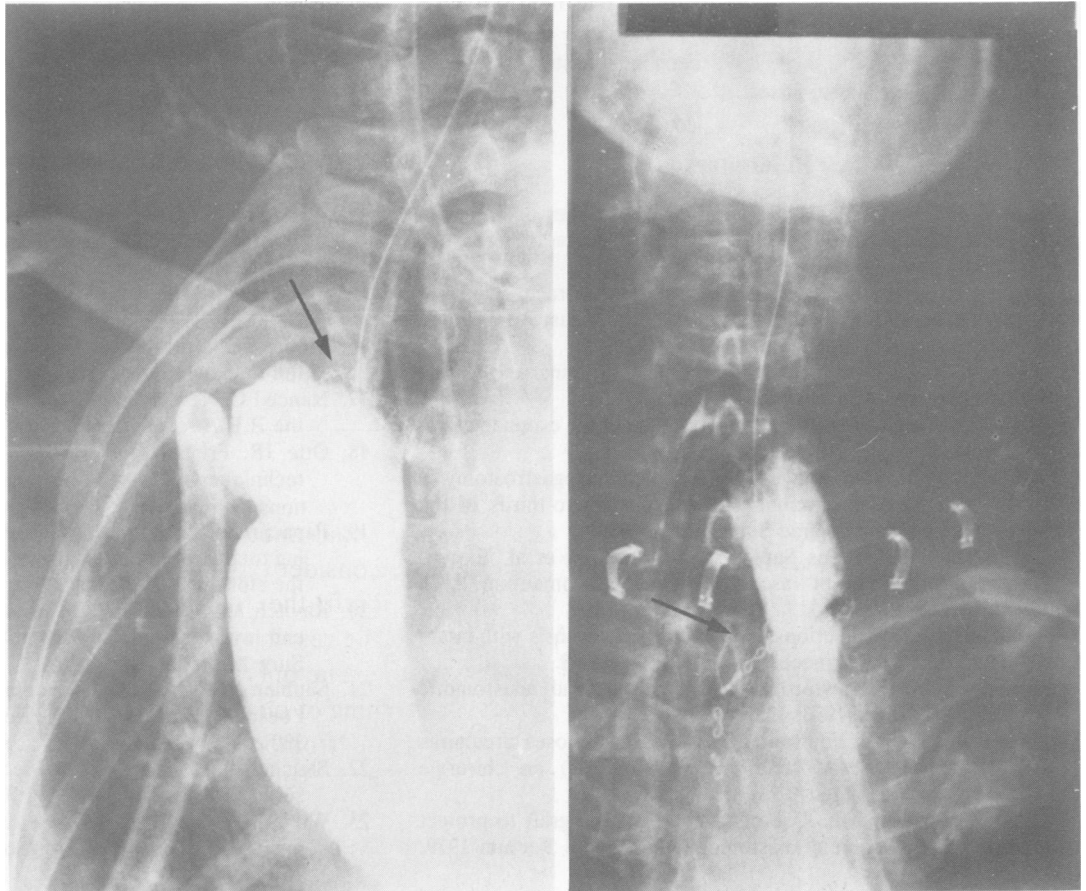
The only anastomotic failure occurred in the beginning of our experience and prompted us to protect the anastomosis with an omental graft. However, routine hydrosoluble radiographic swallow examinations, performed repeatedly, if necessary, evidenced three radiologic images which we called "blind fistulas." The absence of clinical features and evolving complications, confirmed that they were limited. The stapler did not completely eliminate the risk of anastomotic failure, but the latter appeared small enough to have their mediastinal spread limited by the omental graft.

The use of omental graft in alimentary tract surgery has been mentioned many times.<sup>7,10,12,14</sup> However mobilization of the omentum to enable an omental graft around the anastomosis after esophagogastric resections has been rarely described. Experimental<sup>16</sup> and clinical<sup>18</sup> studies have reported perforations of the esophagus, but they are exceptional as far as intrathoracic anastomoses are concerned.<sup>11</sup> The greater omentum promotes sealing of the digestive tract suture lines,<sup>12</sup> and its immunologic properties<sup>1</sup> are likely to limit the spread of infection. Moreover, one may think, by analogy with its use in vascular surgery, that

TABLE 4. Complications (Anastomotic Failure Excepted)

	Number of Cases	Per Cent	Number of Deaths
Pulmonary complications			
pneumonia	5	16.5	1
Atelectasis	4	13.2	
Septicaemias	3	10	0
Ascites (liver failure)	4	13.2	1
Disorders of the heart beat	2	6.6	0
Pulmonary embolism	1	3.3	1

FIG. 6. Comparison between a right transthoracic anastomosis and an anastomosis in the cervix after the stomach has been brought up in the anterior mediastinum. The site of anastomosis is nearly at the same level.



omental grafts may prevent the occurrence of esophagoaortic fistulas, which are a rare, but dreadful, complication following esophagogastric resections.

Factors influencing the occurrence of anastomotic failure after esophagogastric resections are well documented.<sup>13,19</sup> Surgical expertise plays a critical part, even though Papachristou<sup>19</sup> finds no statistically significant difference between experienced surgeons and residents under supervision. With an EEA stapled anastomosis, individual factors, in connection with the surgeon's expertise, are eliminated. In our series, the operations were performed by six surgeons of varying experience.

TABLE 5. Mortality Rate

	Number of Patients	Overall Mortality Rate (Per Cent)	Anastomotic Failure (Per Cent)	Lethal Anastomotic Failure (Per Cent)
Collis <sup>4</sup>	400	19	?	?
Fisher <sup>5</sup>	31	13	3.5	100
Belsey <sup>2</sup>	140	28	12	75
Hermreck <sup>8</sup>	28	21	18	80
Chassin <sup>3</sup>	36	0	6	0
Saubier <sup>21</sup>	167	17	6	90
Mohansingh <sup>15</sup>	70	11	7	?
Papachristou <sup>19</sup>	91	?	9	87

This technique of intrathoracic esophagogastric anastomosis seems, to us, very safe, and makes the morbidity rate in the Sweet-procedure comparable with techniques for anastomosis of the stomach to the cervical esophagus. It allows an anastomosis of good quality at the chest apex, using a well-vascularized stomach easily brought up to the anastomotic site (Fig. 6).

### Conclusion

The quality of esophagogastric anastomosis carried out with the EEA stapler device is probably identical with the best manually sutured anastomosis. Anastomotic failure may occur, but the leakage is small enough to allow an omental graft to reduce morbidity and mortality.

### Acknowledgment

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### Addendum

Since submission of this paper, another 15 esophagogastric resections have been performed for carcinoma. Two patients died after operation without any anastomotic leakage. No anastomotic failures or even "blind fistulas" were found. Overall, among 45 patients with

EEA esophageal anastomoses, the mortality rate remains 13.2% and the anastomotic dehiscence rate is now one of 45 (2.2%). With the omental graft, there have been no anastomotic dehiscences in 41 stapled anastomoses.

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