

The use of pedicled omentum flap in the prevention of esophagogastric anastomotic leak in esophageal cancer

Özofagus kanserinde özofagogastrik anastomoz kaçağını önlemede pediküllü omental flep kullanımı

Yener Aydın,¹ Atilla Türkyılmaz,¹ Atilla Eroğlu,¹ Hacı Ahmet Alici,² Nurettin Karaoğlanoğlu³

Department of ¹Thoracic Surgery, ²Department of Anesthesiology and Intensive Care, Medicine Faculty of Atatürk University, Erzurum;

³Department of Thoracic Surgery, Atatürk Training and Research Hospital for Chest Disease and Chest Surgery, Ankara

Background: In this study, we investigate the effectiveness of the pedicled omental flap in preventing leakage after Ivor Lewis (transthoracic) type esophagectomy.

Methods: The records of 132 patients (48 males, 84 females; mean age 56.7±12.5 years; range 16 to 80 years), in whom Ivor Lewis-type esophagectomy and esophagogastric anastomosis were performed between January 2000 and December 2007 in the Department of Thoracic Surgery of the Atatürk University Medical Faculty Hospital, were evaluated retrospectively. Esophagogastric anastomosis was made in the thorax and stomach was chosen for reconstruction. The esophagogastric anastomosis and gastric suture line were wrapped with a pedicled omental flap.

Results: Complications developed in 65 patients (49.2%). Anastomotic leak developed in five patients (3.8%). Hospital mortality rate (30-day mortality rate) was 5.3% (n=7). Primary causes of mortality were anastomotic leak and respiratory failure. Mean hospital stay after operation was 13.8 days. Three and five year survival rates of the patients were 39.5% and 19.6% respectively.

Conclusion: According to our clinical experiences, the use of pedicled omentum in esophagogastric anastomosis significantly reduces the incidence of anastomotic leak after esophagogastric resection for carcinoma of the esophagus.

Key words: Blood supply; esophageal cancer; esophagectomy; gastrectomy; omentoplasty; omentum/surgery; surgical flap.

Amaç: Bu çalışmada Ivor Lewis (transtorasik) tipi özofajektomide anastomoz kaçağını önlemede pediküllü omental flep kullanımının etkinliği araştırıldı.

Çalışma planı: Ocak 2000 ve Aralık 2007 tarihleri arasında Atatürk Üniversitesi Tıp Fakültesi Hastanesi Göğüs Cerrahisi Kliniği'nde özofagus kanseri nedeniyle Ivor Lewis tipi özofajektomi ve özofagogastrik anastomoz uygulanan 132 hastanın (48 erkek, 84 kadın; ort. yaş 56.7±12.5 yıl; dağılım 16-80 yıl) kayıtları geriye dönük olarak değerlendirildi. Rekonstrüksiyon organı olarak mide seçildi ve özofagogastrik anastomoz toraksta yapıldı. Özofagogastrik anastomoz ve gastrik sütür hattı pediküllü omental flep ile sarıldı.

Bulgular: Komplikasyon 65 hastada (%49.2) gelişti. Anastomoz kaçağı beş hastada (%3.8) gelişti. Hastane mortalite oranı (30 günlük mortalite oranı) %5.3 (n=7) idi. Birincil ölüm nedenleri anastomoz kaçağı ve solunum yetmezliği idi. Ameliyat sonrası ortalama yatış süresi 13.8 gün idi. Hastaların üç ve beş yıllık sağkalım oranları sırasıyla %39.5 ve %19.6 idi.

Sonuç: Klinik deneyimlerimize göre özofagus kanserinde özofajektomi sonrası özofagogastrik anastomozda pediküllü omental flep kullanımı anastomoz kaçak insidansını önemli derecede azaltmaktadır.

Anahtar sözcükler: Kan akımı; özofagus kanseri; özofajektomi; gastrektomi; omentoplasti; omentum/cerrahi; cerrahi flep.

Currently, esophageal cancer can be treated effectively with surgical approaches. Although different methods are available for the treatment of esophageal cancer, two approaches are most commonly used: the Ivor Lewis (transthoracic esophagectomy) and Orringer (transhiatal esophagectomy) methods.^[1-3]

Significant morbidity and mortality has been observed following esophagectomy. Reported complication and hospital mortality rates are as high as 50% and 5-10%, respectively.^[1,2] Anastomotic leaks and pulmonary complications are the most common early complications following esophagectomy. Although

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Correspondence: Atilla Eroğlu, M.D. Atatürk Üniversitesi Tıp Fakültesi Göğüs Cerrahisi Anabilim Dalı, 25240 Erzurum, Turkey. Tel: +90 442 - 316 63 33 / 2180 e-mail: atilaeroglu@hotmail.com

some authors perform manual anastomosis in order to prevent anastomotic leakage, others claim stapling is a more effective method of prevention. Furthermore, many authors recommend that anastomosis should be supported either with one of the pedicled tissue flaps of the omentum, muscle, pleura and pericardium, or with adipose tissues.^[4] Among these, omental flaps are more commonly used for the following reasons: omental flaps are easily prepared at the surgical site; they have better vasculature and can wrap totally due to their ability to cover broad spaces and have immunogenic properties.^[5,6]

The aims of our study are to analyze the morbidity, mortality and survey results of our omentoplasty procedures performed in esophageal cancer cases and to compare our results with the literature.

PATIENTS AND METHODS

Between January 2000 and December 2007, 132 consecutive patients (48 males, 84 females, mean age 56.7 ± 12.5 years; range 16 to 80 years) underwent Ivor Lewis-type esophagectomy and omentoplasty as treatment for esophageal cancer in the Department of Thoracic Surgery of the Medical Faculty Hospital of Atatürk University. Patients were studied retrospectively from hospital records. Patients excluded from the study population were those who underwent esophagectomy for palliative reasons, those treated with neoadjuvant chemotherapy, those who underwent another surgical procedure together with Ivor Lewis esophagectomy and those reconstructed with any tissue other than from the stomach.

A median laparotomy was done in all patients. Paying attention to the preservation of supplies to the greater omentum, it was mobilized along with the stomach (Fig. 1). The abdomen was closed after dilatation of

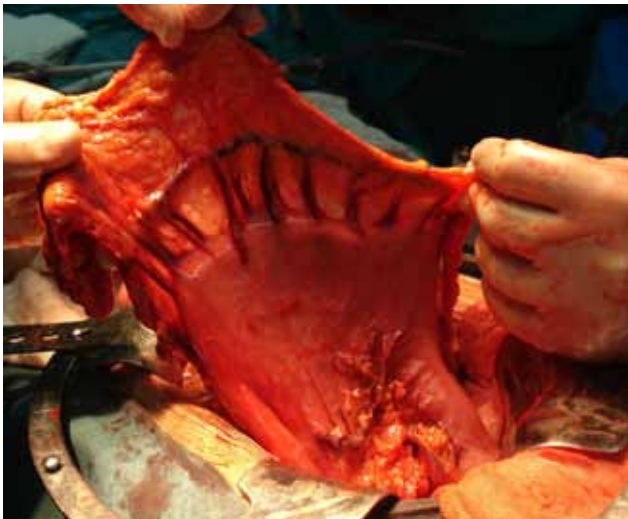


Fig. 1. The greater omentum was mobilized along with stomach.

the esophageal hiatus. The surgeon entered the thoracic cage through a right thoracotomy at the fifth intercostal space, and the esophagus was dissected. Proximal and distal tumor negative margins 7 to 8 cm in length were excised, and reconstruction was performed (Fig. 2). Two-field lymph node dissection was performed in all patients. After esophagogastric anastomosis was performed via stapling, the omentum was wrapped around the anastomosis and around the gastric suture line (Fig. 3). The operation is finished following the placement of a nasogastric tube and two thoracic tubes.

Patient information was extracted from hospital records, outpatient clinic visit notes and endoscopy, operation and pathologic examination reports. Patients were classified according to age, gender, concomitant diseases, endoscopic localization of tumor, pathologic type of tumor, stage of tumor, hospital stay, and rates of morbidity, mortality and survey results. Our patients' results were then compared with those in the literature.

RESULTS

Of the males, the mean age was 56.8 ± 10.7 years (range: 28 to 73 years). The mean age of the females was 56.6 ± 12.6 years (range: 16 to 80 years). The ratio of males to females was 0.57, and, in both the male and female groups, the number of cases intensified around 50 to 70 years of age.

Concomitant diseases were present in 46 patients (34.8%). Hypertension was notified in 22 patients (16.7%), diabetes mellitus in nine patients (6.8%), chronic obstructive pulmonary disease in nine patients (6.8%), hyperthyroidism in eight patients (6.1%), heart failure in seven patients (5.3%), peptic ulcer disease in six patients (4.5%), deep venous thrombosis in two patients (1.5%) and lymphoma in one patient (0.8%).

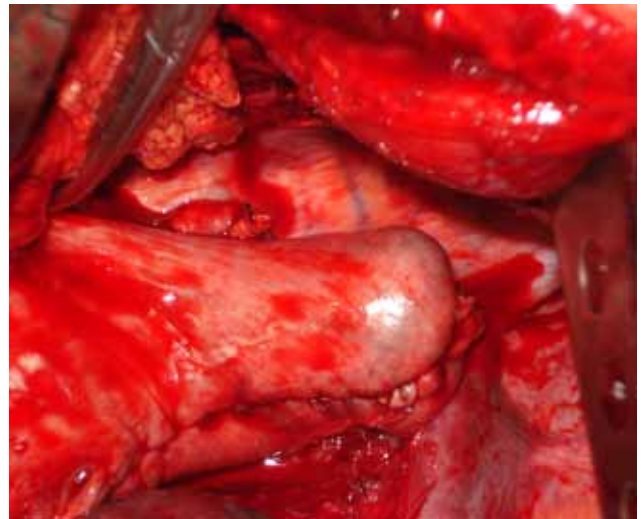


Fig. 2. Esophagogastric anastomosis was performed.



Fig. 3. The omentum was wrapped around the anastomosis and around the gastric suture line.

In our study, the rate (number) of cases with tumor localization at the cardia and lower end of the esophagus was 53.8% (71 patients). There were 57 patients (43.2%) and four patients (3%) with mid and upper-end esophageal tumor respectively.

Histopathologic classification of our cases is as follows: squamous cell carcinoma in 115 patients (87.1%), adenocarcinoma in 11 patients (8.3%), adenosquamous carcinoma in four patients (3%). Sarcomatoid an signet-ring pathology were found in one-patient each.

Staging of patients was done postoperatively according to American Joint Committee on Cancer (AJCC) staging and pathologic examinations. According to this staging, four patients (3%) were at stage I, 56 patients (42.4%) at stage IIA, 24 patients (18.2%) at stage IIB and 48 patients (36.4%) at stage III.

Peroperative, early and late postoperative complications occurred totally in 65 patients (49.2%). Complication characteristics are given in table 1.

Anastomotic leaks were observed in five patients (3.8%). Although female gender was not found as a statistically significant risk factor ($p=0.17$; Fisher's exact test) for anastomotic leak, all patients in whom anastomotic leak occurred were female. The mean age of the female patients was 56.6, while the mean age of patients with observed anastomotic leak was 64.2. Although the mean age of patients with observed anastomotic leak was higher than those without anastomotic leak, this difference in the mean age of groups was not found to be statistically significant ($p=0.27$; T-test). Anastomotic leaks were diagnosed postoperatively (range: 4 to 10 days). One patient with anastomotic leakage had hypertension, and another had diabetes mellitus. In three patients, anastomotic leak occurred at esophagogastric anastomosis, and in two patients,

at the gastric suture line. Three of these five patients died (60%).

Hospital mortality was 5.3% ($n=7$). The most common cause of mortality was anastomotic leak, and all of these patients were female. Other causes of mortality were respiratory failure ($n=2$), multi-organ failure ($n=1$) and renal failure ($n=1$). Mean hospital stay of patients who died in hospital was 25.1 days (range, 8 to 81 days). Mean age of patients with observed mortality was 64.8 years (range, 53 to 80 years), and the mean age of all patients was 56.7 years. Increased mortality rates were found statistically significant for both female gender ($p=0.807$, T-test) and advanced age ($p=0.095$, Fisher's exact test).

The overall postoperative one-year survival rate was 87.3%, and the five-year survival rate was 19.6%. Mean survival time was 20.1 months (range: 2 to 96 months). Properties pertaining to patient surveys are shown in figure 4.

Mean postoperative hospital stay was 13.8 days (range: 8 to 81 days).

DISCUSSION

Anastomotic leak is the most serious complication following esophagectomy. To reduce the rate of anastomotic leak, different types of surgical techniques and addition-

Table 1. Peroperative, early and late stage postoperative complications

	n	%
Peroperative complications		
Bronchial rupture (secondary to Carlen's tube)	1	0.8
Unplanned splenectomy	1	0.8
Injury to thoracic duct	1	0.8
Early postoperative complications		
Wound infection	16	12.1
Contralateral hydrothorax	10	7.6
Cardiac complications	7	5.3
Gastric dilatation	6	4.5
Anastomotic leak	5	3.8
Empyema	4	3.0
Sepsis	3	2.3
Respiratory failure	3	2.3
Kidney dysfunction	2	1.5
Hemorrhage	2	1.5
Neurological disturbance	2	1.5
Pneumothorax	2	1.5
Thrombophlebitis	1	0.8
Late postoperative complications (n=90)		
Recurrence-distant metastasis	27	30.0
Anastomotic stricture	15	16.7
Fistula	1	1.1

al procedures have been defined. These include stapler usage, end-to-side anastomosis, preparation of gastric tube with rich blood flow, routine control of anastomosis site with Doppler ultrasonography, fine applications to reduce hematoma development at anastomotic site, payment of attention to suture technique, maintenance of good vascular supply, wrapping of gastric anastomosis without stretching wrap, tunnel esophagogastrotomy, application of LigaSure™ (Valleylab, Boulder, Co, USA) vessel sealing system to reduce intraoperative hemorrhage and support of anastomosis with omental grafts.^[7-12]

The usefulness of the omentum relates to its wide surface and rich blood supply.^[5] The omental flap is molded to the desired shape more easily than a muscle flap and also molds to fill gaps easily. Furthermore, it is more effective than a muscle flap in the treatment of complications due to sepsis because of its immunogenic properties and ability to reach the lymphatic network.^[6]

The omentum leads to hemorrhage during the separation of adhesions, a condition that indicates its revascularization capability.^[5] The omentum is a tissue that has both a rich blood supply from capillary vessels and the capacity to maintain the blood supply of tissue via neovascularization.^[13,14] The omentum maintains neovascularization by increasing collateral blood flow with a lipid angiogenic factor. As a result, it is an ideal tissue for sites that need vascular support. It has been shown that, even after many years of translocation, omental vessels were still open and new vascular networks had developed both in the capillaries and great vessels.^[13]

Anastomotic leak is commonly accompanied by later events such as infections, necrosis and local abscess formation. On the other hand, the use of pedicled omentum while supporting gastroesophageal anastomosis also enhances new vessel formation and unites with subjacent tissue via an adhesive effect. In case of infection at the anastomotic site, histiocytes, monocytes and granulocytes of the omentum play a phagocytic role. In addition, local abscess formation is prevented by

omental absorption of bacterial products and toxins. As a result, the anastomosis is strengthened. Ischemic necrosis and gastric remnants have been attributed as causes of intrathoracic anastomotic leakages following re-explorations.^[15] We think that, pedicled omentum use will supply blood flow and also prevent the occurrence of gastric remnants from ischemia.

Bhat et al.^[4] designed a prospective randomized study composed of two groups of 97 patients, with omentoplasty applied to one group. Anastomotic leak was observed in three patients (3.09%) in the omentoplasty-applied group, whereas it was observed in 14 patients (14.4%) in the control group. They claimed pedicled omental transpositioning enhances the refreshing of the anastomosis suture line, significantly decreases the incidence of anastomotic leaks after esophagectomy in cases of esophageal cancer and, in this way, decreases morbidity and mortality.

In 1980, Fekete et al.^[8] performed intrathoracic anastomosis following esophagectomy with a stapler and omental flap in 30 patients. Their mortality rate was 13.3% and rate of anastomotic failure was 3.1% (n=1). They detected three asymptomatic fistulas during routine contrast-enhanced investigation of anastomosis.

The omental flap has been used not only in esophago-gastric anastomosis of the thoracic cavity, but also used in cervical anastomosis. Good results were reported.^[16-19]

Thakur et al.^[16] compared the application and non-application of omentoplasty in 50 patients with esophageal and gastric cardia cancer. No anastomotic leak was observed in the 37 patients in whom omentoplasty was applied. On the other hand, anastomotic leak was observed in three of the 13 patients in whom omentoplasty was not applied.

Zhang and Yang^[15] investigated their 100 cases in which they supported anastomosis with the application of pedicled omentum. They applied end-side anastomosis after resection. They observed no cases of anastomotic leak.

Stretching of the pedicled omentum should be avoided with adequate mobilization, and the blood supply should be preserved. In case of stretching, necrosis and hematoma may develop. Massive ligation, torsion and compression endanger applications of the omental flap. In case of tightness of the diaphragmatic hiatus, omental necrosis can be seen due to compression of the vascular pedicle. In these cases, debridement of the gastroesophageal flap is required.^[20] On the other hand, if the diaphragmatic hiatus is wide enough, diaphragmatic hernias may occur. The transverse colon may be herniated into the thoracic cavity in case of inadequate mobilization of the omentum. In our study, we obtained

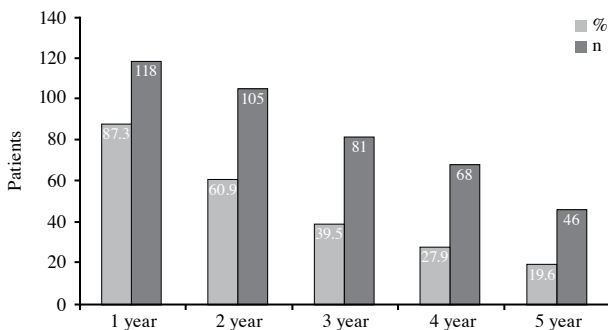


Fig. 4. Followed patients who were alive at specific time-points.

adequately long omental flaps with proper mobilization and preservation of the flap blood supply. We observed no instances of omental necrosis or diaphragmatic hernia in our cases.

Anastomotic leak was observed after esophagectomy in five (3.8%) of our 132 patients. In three patients, anastomotic leak resulted from esophagogastronomy and in two patients, from the gastric suture line. We have routinely supported esophagogastric anastomosis with omental flap following esophagectomy since 2000. Based on our clinical observations and experiences since 2000, the rates of anastomotic leak and mortality in our patients have significantly decreased due to omental flap application.^[21]

In summary, anastomotic leakage after esophageal resection remains a dangerous complication. Many different methods have been recommended to prevent this complication. We recommend supporting esophagogastric anastomosis with omental flap as the most effective way to decrease the occurrence of this complication.

Declaration of conflicting interests

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