



## Esophageal Resection and By-pass: A 6 Year Experience with a Low Postoperative Mortality

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From 1984 to 1989, 175 esophageal cancer patients, 10 patients admitted for severe caustic esophagitis, and 1 patient with pyothorax due to iatrogenic perforation of the esophagus underwent an esophageal resection or bypass operation. One hundred sixty-eight esophageal resections were performed on 167 patients; 13 were total, 106 subtotal and 49 distal. Nineteen digestive transplants were pulled up to the neck to bypass the esophagus or re-establish continuity after an esophagectomy made elsewhere. Digestive continuity was restored by a long gastric transplant in 120 patients, a colon segment in 17, a jejunal loop in 35, and a short gastric transplant after limited esophago-gastrectomy in 14 patients. Thirty day mortality was 0 in the whole group. Hospital mortality was 1.2% in the resection group and 10.5% in the bypass group ( $p = 0.048$ ). Nonfatal postoperative complications consisted of respiratory distress in 33 patients, recurrent nerve palsy in 10, anastomotic fistula in 10 (cervical in 8 and intrathoracic in 2) and anastomotic stenosis in 18 patients. Respiratory complications were more frequent in patients with a cancer of the thoracic esophagus (29/111) than in those operated on for a cancer located in the esophago-gastric junction (4/50) ( $p < 0.01$ ). Anastomotic stenosis occurred more frequently in the neck (17/137) than in the chest (1/49) ( $p < 0.05$ ). Nine patients were reoperated on for a technical complication; intraabdominal hemorrhage (1), thoracic duct injury (2), acute cholecystitis (1), tight stricture of the esophageal anastomosis (2), jejuno-duodenal anastomotic fistula (2), or stridor related to recurrent nerve palsy (1). Low postoperative mortality may be achieved after esophageal surgery, even in a nonselected Caucasian population. However, nonfatal complications indicate that an esophageal resection or bypass operation remains a major surgical procedure. The surgical principles which we have applied to minimize postoperative mortality and severe complications are presented.

In the past, the high postoperative mortality and morbidity experienced after esophageal cancer surgery have cast a shadow on results that could be obtained in terms of palliation or cure, a factor which has strengthened the arguments of advocates of nonsurgical therapies. On the other hand, any postoperative death after esophagectomy for benign disease puts into question the operative indication. Recently, in spite of increasing experience with this type of surgery, developments in surgical techniques, and improvement of intensive care

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conditions, most Western surgical teams still report a postoperative mortality rate ranging from 10 to 15% [1-3]. The purpose of the present study is to report the low postoperative mortality that was achieved in our institution after major esophageal surgery in a nonselected Caucasian population, to identify conditions that predispose patients to postoperative complications, and to define perioperative steps to follow to minimize the risk of postoperative death.

### Material and Methods

#### Population

Over a 6 year period from 1984 to 1989, 186 patients underwent esophageal resection or bypass operation. These patients consisted of 144 males and 42 females who ranged in age from 19 to 83 years. The indications for surgery included cancer ( $n = 175$ ), caustic esophagitis ( $n = 10$ ), and iatrogenic esophageal perforation complicated by pyothorax ( $n = 1$ ). These 175 cancers represented 92% of the esophageal cancers seen by the surgical staff members during the study period. They were located in the thoracic esophagus in 111 patients, in the gastroesophageal junction with upward extension into the thoracic esophagus in 50, and in the laryngo-pharynx with involvement of the cricopharyngeus muscle and the cervical esophagus in 14. Three esophageal tumors and 2 caustic lesions had perforated into the trachea or the main stem bronchi.

Concomitant diseases are listed in Table 1. They may be classified into 5 categories: cardiovascular, respiratory, digestive, psycho-neurologic, and chemotherapy-induced. Several of these diseases may be related to alcohol or tobacco abuse. Chronic respiratory disease was the most common concomitant condition, and most psycho-neurologic disorders were evidenced in caustic esophagitis patients. Among the 5 cirrhotic patients, 2 had esophageal varices, 1 had previously undergone a portocaval shunt, and 1 had a platelet blood count below 30,000 ml. All 5 were Child's class A at the time of esophageal surgery.

**Table 1.** Medical history and concomitant conditions.

Medical condition	No. of patients
<b>Cardiovascular</b>	
Myocardial infarction	7
Angina pectoris	2
Arrhythmia	4
Pulmonary valvular stenosis	1
Aortic valvular insufficiency	1
Obstructive cardiomyopathy	1
Cerebral vascular accident	2
Arterial hypertension	7
Pulmonary embolism	1
Severe peripheral arteritis	1
<b>Respiratory</b>	
Chronic respiratory disease	31
Asthma	4
Thoracoplasty	1
Lung resection	2
<b>Digestive</b>	
Zenker diverticulum	2
Nissen hiatus repair	2
Colon cancer	2
Inflammatory bowel disease	1
Pancreatitis	1
Liver steatosis	1
Cirrhosis	5
Duodenal ulcer	7
Gastrectomy	4
<b>Psycho-neurologic</b>	
Psychosis	1
Suicide attempt	8
Cerebellar syndrome	1
Epilepsy	1
<b>Chemotherapy-induced</b>	
Renal insufficiency	1
Bone marrow hypoplasia	2
<b>Others</b>	
Breast cancer	2
ENT neoplasm	6

### Preoperative Work-up

The first goal of the preoperative work-up was to assess the extent of the neoplastic process, the caustic damage, or the site of perforation. The second goal was to detect the operative risk factors in order to improve the basic condition of the patients and to plan what should be done if an acute complication due to an underlying illness arose during or after the operation. Chest x-ray, electrocardiogram (EKG), respiratory function tests and blood gas analysis were routine, and further investigations were carried out on the basis of both the medical history and a meticulous clinical examination, e.g. aminopyrine breath test, posthepatic veins and right heart catheterization, 24-hour EKG monitoring, echocardiogram, and even coronary angiography.

Routine preparation for surgery consisted of cessation of smoking for at least 15 days prior to the operation, oral and colonic decontamination, intensive respiratory physiotherapy, and parental nutritional support for severely dysphagic patients. Any recorded organic disorder was corrected or improved by initiating or optimizing medical therapy or by performing concomitant operations. For instance, 2 patients who presented with both severe angina pectoris and a limited neoplastic tumor underwent a coronary bypass operation: prior to esophageal resection in 1 case, and during the same operating session in the other.

Eleven (5.9%) patients were submitted to a preoperative chemotherapy regimen consisting of two courses of cis-platinum and 5-fluorouracil.

### Intraoperative Management

All operations were performed by fully trained surgeons. The choice of surgical procedure for each individual case was made according to 2 main parameters: (1) the extent of the neoplastic process or the caustic damage as assessed by both preoperative investigations and intraoperative findings, and (2) the patient's general condition. For example, in cancers of the thoracic esophagus, esophagectomy without thoracotomy was performed either in patients with an obviously advanced neoplastic process for palliation or in those with an underlying chronic respiratory disease to avoid thoracotomy-induced lung damage. Surgery itself was performed as carefully as possible by taking the amount of time and patience required for a meticulous dissection. Particular attention was paid to prevent lymphatic fluid weeping after resection of the thoracic duct, bleeding from the different dissected areas, and iatrogenic damage to the remaining organs, and to detect any gross technical defect at the level of intrathoracic anastomoses by methylene blue-stained water instillation through the nasogastric catheter. Moreover, intraoperative blood loss was minimized by careful dissection and fluid balance was closely monitored in order to assure both good blood flow to the esophageal substitute and to protect the lungs against any fluid overload.

### Postoperative Care

Postoperatively, most patients were admitted to the intensive care unit. Assisted mechanical ventilation was provided for at least 36 hours until the patient could be extubated and participate actively in physiotherapy exercises. Continuous positive airway pressure (CPAP) or intermittent positive pressure breathing (IPPB) was commonly used after weaning the patient off the ventilator. The nasogastric catheter was removed only when bowel movements started in order to prevent aspiration pneumonia. Oral feeding was allowed on the 7th postoperative day after the integrity of the cervical anastomoses was checked by the methylene-blue swallow test and the intrathoracic anastomoses were checked by gastrografin swallow study. The most appropriate therapy for postoperative complications was initiated at an early stage, when minor procedures were sufficient to bring the patient back into a normal postoperative course.

### Surgical Techniques

A total of 168 esophagectomies were performed on 167 patients, 1 patient having been reoperated on for upward extension of a distal esophagectomy. Eighty-six esophagectomies were carried out by right thoracotomy, 55 by left thoraco-phreno-laparotomy, 3 by median sternotomy according to Ong [4], and 24 without thoracotomy [5]. A total esophagectomy was performed in association with a total laryngectomy and a circular pharyngectomy on 13 patients with tumors of the laryngo-pharynx extending to the cricopharyngeus muscle and the cervical esophagus [6]. Ninety-seven subtotal esophagectomies were performed for cancer of the thoracic esophagus, 7 for

**Table 2.** Types of esophageal substitute (n = 186).

Type of transplant	No. of patients
Cervical anastomosis	
Tubulized gastric transplant (10)	86
Entire denuded stomach (11)	18
Esophageal bypass by Postlethwait (12)	9
Esophageal bypass by Kirschner (13)	5
Gastric transplant by Ioshida (9)	1
Non-typical gastric transplant	1
Isoperistaltic colon segment (14)	14
Reverse colon segment (14)	3
Intrathoracic anastomosis	
Jejunal interposition	24
Roux-en-Y loop	11
Short gastric transplant	14

severe caustic burn, 1 for iatrogenic perforation of the thoracic esophagus, and 1 for upward extension of a previous distal esophagectomy. Subtotal esophageal resections for cancer consisted of a posterior mediastinectomy [7, 8] in 70 patients, a standard transthoracic esophagectomy without extensive node dissection in 12, a transhiatal esophagectomy in 12, and a transternal esophagectomy in 3 patients. Thirty-five tumors of the gastro-esophageal junction were resected by distal esophagectomy and total gastrectomy, and a distal esophagectomy, proximal gastrectomy and esophago-gastrostomy were performed in 14 patients for palliation.

Sixteen patients underwent an esophageal bypass operation: 11 for a nonresectable tumor of the thoracic esophagus and 5 for an esophago-bronchial fistula that was neoplastic or caustic in origin in 3 and 2 cases, respectively. Three patients who had undergone an esophagectomy in another institution were referred for restoration of digestive continuity.

Digestive continuity was restored using various transplants (Table 2). In cancers of the upper two-thirds of the esophagus, we have experimented with an original gastroplasty technique [11]. The terminal branches of both the right and left gastric vessels are severed close to the gastric wall without resection of the lesser curvature. The top of the "entire denuded stomach" is vascularized by the right gastroepiploic vessels through the whole submucosal vascular network that has been preserved. The esophageal substitute was placed in the posterior mediastinum in 125 patients and the substernal space in 61 patients. One hundred thirty-seven esophageal anastomoses were performed in the neck and 49 in the chest. In 46 patients the esophageal anastomoses were hand-sewn in 1 layer of interrupted absorbable stitches. A 1 layer continuous suture technique has been used in 137 patients. Three intrathoracic anastomoses were performed using the EEA stapler® (Autosuture Instruments, Norwalk, Conn., U.S.A.).

## Results

### Intraoperative Complications

There were 2 major intraoperative complications: severe hemorrhage while removing the spleen of a cirrhotic patient and an iatrogenic tracheal tear which was covered using the greater omentum in another patient.

**Table 3.** Hospital mortality (n = 4).

Pt.	Risk factor	Surgical procedure	Cause of death
1	Chronic respiratory disease	Subtotal esophagectomy by right thoracotomy Gastric transplant	Respiratory distress
2	Cirrhosis	Subtotal esophagectomy by right thoracotomy Gastric transplant	Hepatic failure with ascites
3	Esophago-bronchial fistula	Esophageal bypass by Kirschner	Respiratory infection
4	Chemotherapy-induced renal insufficiency	Esophageal bypass by Postlethwait	Renal failure

### Postoperative Mortality

No patient died within the first 30 postoperative days (0/187 procedures). Hospital mortality (Table 3) was 1.2% (2/168) in the resection group and 10.5% (2/19) in the bypass group (Fischer's exact test:  $p = 0.048$ ). There was no death in the group of patients operated on for benign disease. In cancer patients, hospital mortality was significantly higher after esophageal bypass operations (2/16 = 12.5%) than after resections (2/160 = 1.25%) (Fischer's exact test:  $p = 0.039$ ). Late postoperative mortality was 0.6%; 1 patient operated on for adenocarcinoma of the esophago-gastric junction died from an aorto-esophageal fistula 3 months after he had been discharged from the hospital.

### Postoperative Respiratory Complications

Nonfatal respiratory complications were defined as pneumonitis, atelectasis, aspiration of digestive juice or persistent bronchial hypersecretion requiring fiberoptic bronchoscopy for bronchial cleaning, pulmonary embolism, or the need for prolonged mechanical ventilation. These accounted for prolongation of the hospital stay of 33 (17.7%) patients, 31 patients having cancer and 2 patients having caustic esophagitis. Residual pleural effusion related to any transthoracic surgical procedure and bronchial hypersecretion requiring routine respiratory physiotherapy only were not taken into account. Including the two patients who died from respiratory distress, this made for a total of 35 (18.8%) respiratory complications. They occurred more frequently in patients operated on for cancer of the thoracic esophagus (29/111 = 26.1%) than in those operated on for cancer of the esophago-gastric junction (4/50 = 8%) ( $\chi^2$ : 6.95;  $p < 0.01$ ). Temporary tracheostomy was required to wean 2 patients off the ventilator.

### Esophageal Anastomotic Fistulas and Stenoses

Cervical fistulas which presented as weeping of saliva through the cervical drain occurred in 8 patients. Only 1 was complicated with cervical sepsis. An asymptomatic intrathoracic fistula was detected by gastrografin swallow study in 2 patients. All fistulas were healed by prolonged fasting and total parenteral nutrition. Eighteen anastomotic stenoses developed in the

**Table 4.** Postoperative fistulas and stenoses (n = 186).

Site/technique	Fistulas n/total (%)	Stenoses n/total (%)
Cervical esophago- or pharyngo-colostomy	2/17 (12)	1/17 (6)
Cervical esophago- or pharyngo-gastrostomy	6/120 (5)	16/120 (13)
Intrathoracic esophago-jejunosotomy	2/35 (6)	1/35 (3)
Intrathoracic esophago-gastrostomy	0/14 (0)	0/14 (0)
Cervical anastomosis	8/137 (5)	17/137 (12) <sup>a</sup>
Intrathoracic anastomosis	2/49 (4)	1/49 (2) <sup>a</sup>
Interrupted suture	2/46 (4)	6/46 (13)
Continuous suture	7/137 (5)	11/137 (7)
Mechanical suture	1/3 (33)	1/3 (33)

<sup>a</sup>p < 0.05 (X<sup>2</sup> = 4.43)

early follow-up period. Sixteen cervical anastomotic stenoses were treated by endoscopic dilatations and 2 tight strictures, 1 cervical and 1 intrathoracic, were revised surgically. The occurrence of a fistula or stenosis did not significantly depend on the method of suturing, manual vs mechanical, interrupted vs continuous suture, or on the type of esophageal substitute, stomach vs colon vs jejunum. In contrast, anastomotic stenoses occurred more frequently in the neck than in the chest. These results are summarized in Table 4.

#### Other Postoperative Complications

Necrosis of the esophageal substitute was never experienced. A case of mucosal ischemia of a nontypical gastric transplant resolved spontaneously. Recurrent nerve palsy was diagnosed in 10 non-laryngectomized patients and 1 of them underwent an arytenoidectomy to enlarge the glottic channel. Six patients were reoperated on for an acute thoracic or abdominal complication: 2 for thoracic duct injury, 1 for acute cholecystitis, 1 for acute intraabdominal hemorrhage and 2 for partial leakage of a jejuno-duodenal anastomosis. Severe behavioral disorders with disorientation were recorded in 5 patients and transfusion induced chronic hepatitis was diagnosed in 2 patients.

#### Discussion

Our current experience with major esophageal surgery shows that a very low postoperative mortality, similar to that reported by only a few other teams in the literature (Table 5), may be achieved in a nonselected Caucasian population. Most of the esophageal cancer patients came from the Belgian population [25], in whom the incidence of esophageal cancer is very low, and only patients in a preterminal status (8%) were excluded from surgery. However, considering nonfatal postoperative complications, it appears that an esophageal resection or bypass operation remains a major surgical procedure.

It emerges from the current study that postoperative complications may be related to 4 key-factors: (1) the basic general condition of the patients, (2) the presentation of the esophageal disease, (3) the sequelae of preoperative therapies, and (4) the complexity of the surgical procedure itself. In Western countries, esophageal cancer is caused by alcohol and tobacco abuse [26], and is commonly associated with conditions such as chronic respiratory disease [27], coronary disease, pancreatitis

**Table 5.** Review of the literature showing less than 5% postoperative mortality after esophageal resection.

Author (reference)	Year	No. of resections	Postoperative mortality (period)
Akiyama (15)	1981	210	1.4 (30 d)
Wu (16)	1982	92	2.2 (NR)
Ellis (17)	1985	191	2.1 (30 d)
Shao (18)	1985	3155	4.1 (NR)
Ishida (19)	1987	145	0 (30 d)
Kodama (20)	1987	122	4 (30 d)
Lu (21)	1987	1025	4.9 (hosp.)
King (22)	1987	100	3 (30 d)
Iizuka (23)	1988	287	3.8 (NR)
Mathisen (24)	1988	104	2.9 (NR)
Present series	1991	168	{ 0 (30 d) 1.2 (hosp.)

30 d: mortality during the first 30 postoperative days; hosp: mortality during the postoperative hospital stay; NR: period not reported.

or cirrhosis [28] which may compromise postoperative recovery (Table 1). One cirrhotic patient in our series died from hepatic failure and 2 patients with an initially poor respiratory condition died from respiratory distress. Deterioration of the general condition of some patients may be ascribed to the esophageal disease itself, e.g. loss of body weight and protein deficiency due to dysphagia, or respiratory infection related to an esophago-bronchial fistula [29], which may explain, as previously reported by Postlethwait [30], why postoperative mortality was higher in the current series after palliative bypass operations for advanced malignancies than after esophageal resections. Moreover, preoperative chemotherapy may produce side-effects, such as bone marrow hypoplasia or renal failure, that may interfere with the postoperative course [31], as was the case for 1 of our patients who died from cisplatin-induced renal failure.

In benign diseases, surgery is often performed on critically ill patients with severe metabolic disorders due to caustic esophageal necrosis [32], severe organic damage such as caustic esophago-bronchial fistula, or sepsis related to perforation. Furthermore, the existence of a disturbed psychological background, such as a suicide attempt, predisposes some caustic esophagitis patients to postoperative behavioral disorders.

Major esophageal surgery calls for numerous sophisticated procedures that are carried out through different anatomical areas, utilize different organs to restore digestive continuity (Table 2) and take from 6 to 12 hours to complete, which may explain why technical defects and postoperative complications are more likely to occur in teams in which this type of surgery is not routine [33, 34].

As reported by previous studies [30, 35], the most common complications recorded in our series were respiratory in nature. They occurred in 18.8% of the patients, which was similar to the 16.5% rate recorded in the Association Française de Chirurgie survey [2] and 13.3% reported by Akiyama [15]. Respiratory complications may be classified into two categories: (1) those which are secondary to a technical complication such as an intrathoracic anastomotic leak, and (2) those which are related to the magnitude of the surgical procedure in patients with a poor initial respiratory condition. Recovery from the former depends on the outcome of the underlying technical complication whereas the latter, because they are primary in origin, are

more likely to be preventable by intensive respiratory preparation prior to surgery and to resolve with respiratory support techniques only. All respiratory complications in the present series belonged to the second category, and developed more frequently in patients operated on for thoracic esophageal cancer than in those who underwent a distal esophagectomy for cancer of the gastroesophageal junction. Predisposing factors in the former patients might be the higher proportion of alcohol and tobacco-induced squamous cell carcinomas arising in individuals with a poor respiratory condition, the need for an extensive peritracheal dissection, the longer duration of the operation, especially when it consisted of a 3 stage procedure including thoracotomy, laparotomy and cervicotomy, and the occasional occurrence of a recurrent nerve palsy resulting in impairment of mechanisms which condition closure of the glottis during coughing [5, 8].

Anastomotic leak [30, 35] did not pose major problems, with the exception of a late aorto-esophageal fistula, the outcome of which is well known to be invariably fatal, whatever the management [36]. Cervical fistulas, as opposed to intrathoracic ones, do not produce life threatening sepsis, and may be healed by prolonged fasting only. In this regard, pulling up the left part of the greater omentum with the stomach to the neck creates a barrier which protects pleural cavities against septic contamination from the neck. As in the comparative series reported by Segol and associates (37), anastomotic stenoses occurred more frequently in the neck than in the chest, whatever the mode of suturing and the type of esophageal substitute. Stenosis may result from chronic ischemia of the anastomotic site due to both external compression of the transplant by the sternal notch or the head of the clavicle [38] and to the inadequacy of the vascular network of the proximal part of the esophageal substitute [39]. Most of the cervical stenoses subsided after a few sessions of endoscopic dilatation.

There exists no all-purpose recipe for achieving a very low postoperative mortality after major esophageal operations and, as shown by a recent multivariate analysis of more than 150 perioperative parameters [40], preoperative estimation of the operative risk of an individual case remains a challenging problem. However, surgical principles which we applied to our routine practice contributed to minimizing the risk of postoperative death and severe complications. These principles were:

1. Accurate preoperative staging of the disease.
2. Detection of all risk factors on the basis of the medical history, the clinical examination and preoperative investigations.
3. Improvement of any preoperative condition that may predispose the patient to postoperative complications.
4. Choice of the most relevant surgical technique to address both the stage of the disease and the potential repercussion of the procedure on vital functions.
5. Systematic intraoperative checking of all technical points that are most critical in exposing the patient to postoperative complications.
6. Close perioperative metabolic monitoring.
7. Prompt and suitable management of any postoperative complication.
8. Great personal investment, permanent availability and rigorous work discipline of each member of the surgical team

(surgeons, anesthetists, intensive care physicians, nurses and physiotherapists).

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#### Résumé

De 1984 à 1989, 175 patients atteints de cancer de l'oesophage, 10 patients admis pour oesophagite caustique grave et un patient présentant un pyothorax dû à une perforation iatrogène de l'oesophage ont eu une résection ou un by-pass oesophagien. Cent soixante-huit oesophagectomies ont été réalisées chez 167 patients: 13 totales, 106 subtotaux et 49 distales. Dix-neuf transplants digestifs ont été montés au cou pour court-circuiter l'oesophage ou rétablir la continuité digestive après oesophagectomie faite ailleurs. Au total, la continuité digestive a été rétablie par un long transplant gastrique chez 120 patients, une coloplastie chez 17, une anse jéjunale chez 35 et un transplant gastrique court après oesophagogastrectomie polaire supérieure chez 14. La mortalité postopératoire à 30 jours a été nulle. La mortalité hospitalière a été de 1.2% après résection et 10.5% après by-pass ( $p = 0.048$ ). Les complications postopératoires non mortelles les plus fréquentes étaient 33 insuffisances respiratoires, 10 paralysies récurrentielles, 10 fistules et 18 sténoses anastomotiques. Les complications respiratoires sont survenues plus fréquemment après intervention pour cancer de l'oesophage thoracique (29/111) qu'après oesophagectomie distale pour cancer de la jonction oesogastrique (4/50) ( $p < 0.01$ ). Les sténoses anastomotiques cervicales (17/137) étaient plus fréquentes que les sténoses intrathoraciques (1/49) ( $p < 0.05$ ). Neuf patients ont dû être réopérés pour une complication technique: une hémorragie intra-abdominale, 2 plaies du canal thoracique, une cholécystite aiguë, 2 sténoses anastomotiques oesophagiennes serrées, 2 fistules anastomotiques jéuno-duodénales et un stridor lié à une paralysie récurrentielle. Une faible mortalité postopératoire peut être obtenue après chirurgie oesophagienne dans une population de sujets occidentaux peu sélectionnés. Cependant, le taux de complications postopératoires non mortelles indique qu'une résection ou un by-pass oesophagien demeure une opération majeure. Les principes chirurgicaux que nous avons appliqués pour minimiser le risque de décès postopératoires sont présentés et analysés.

#### Resumen

En el período 1984 a 1989, 175 pacientes con cáncer de esófago, 10 pacientes con severa esofagitis cáustica y uno con piotorax por perforación iatrogénica del esófago fueron sometidos a resección esofágica o a un procedimiento derivativo. Se realizaron 168 resecciones esofágicas en 167 pacientes: esofagectomía total en 13, subtotal en 106 y distal en 49. Diecinueve trasplantes digestivos fueron ascendidos al cuello para derivar el esófago o reestablecer la continuidad después de una esofagectomía practicada en otra institución. La continuidad del tracto digestivo fue restablecida mediante trasplante gástrico largo en 120 pacientes, mediante un segmento de colon en 17, mediante un asa yeyunal en 35 y mediante trasplante gástrico corto después de esofagogastrectomía limitada en 14. La mor-

talidad a 30 días fue 0 en el grupo total. La tasa de mortalidad hospitalaria fue de 1.2% en el grupo sometido a resección y de 10.5% en el grupo sometido a derivación ( $p = 0.048$ ). Las complicaciones postoperatorias no letales más comunes fueron la dificultad respiratoria en 33 pacientes, parálisis del nervio laríngeo recurrente en 10, fistula anastomótica en 10 (cervical en 8, intratorácica en 2) y estenosis de la anastomosis en 18. Las complicaciones respiratorias aparecieron más frecuentes en pacientes con cáncer del esófago torácico (29/111) que en aquellos operados por cáncer ubicado en la unión gastroesofágica (4/50) ( $p < 0.01$ ). La estenosis anastomótica se presentó con mayor frecuencia en el cuello (17/137) que en el tórax (1/49) ( $p < 0.05$ ). Nueve pacientes fueron reoperados por complicaciones técnicas: hemorragia intra abdominal (1), lesión del canal torácico (2), colecistitis aguda (1), estenosis severa de la anastomosis esofágica (2), fistula de la anastomosis yeyuno-duodenal (2) o estridor relacionado con parálisis del laríngeo recurrente (1). Es posible lograr una baja mortalidad después de cirugía esofágica en una población caucásica no seleccionada. Sin embargo, las complicaciones no letales son indicativas de que una resección o una derivación del esófago siguen siendo procedimientos mayores. Se presentan los principios quirúrgicos que hemos utilizado para minimizar la mortalidad postoperatoria y las complicaciones graves.

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## Invited Commentary

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Dr. Collard and associates from Louvain report an extensive experience with esophageal surgery, primarily resection for carcinoma of the esophagus and cardia. Their 30 day mortality rate of 0 is extraordinary, as is the overall hospital mortality rate of 1.2%. This must represent the lowest mortality rate yet reported for surgery of this type and the authors are indeed to be congratulated. Conceivably their excellent results are due in part to the extensive pre-operative work up that they employ including cardiac catheterization, echocardiogram, and even coronary arteriogram in some cases, though this is difficult to substantiate.

On the other hand, a complication rate of 41% seems somewhat excessive in my opinion, and I was surprised at the number of patients who experienced damage to the recurrent nerve. Presumably these were patients undergoing transhiatal esophagogastrectomy. In my opinion, this injury is not related to retraction in the region of the trachoesophageal groove, but rather to failure to carefully mobilize and divide the vagus nerves in the chest distal to the origin of the recurrent nerves, particularly on the left. The incidence of anastomotic stricture also seems quite high and it is unusual for so many patients to require re-operation. However, as the authors point out, these events re-emphasize the fact that esophageal resection or bypass is indeed a major surgical undertaking.

The operability rate of 92% reported by the authors is unusually high but represents only patients referred for surgery and not the entire population of esophageal cancer patients in their hospital. My associates and I have also take a very aggressive approach to the management of this disease and our operability rate of 81% includes all patients with carcinoma of the esophagus or cardia seen at our institution, not just those seen by the thoracic surgeons. Both Dr. Collard's group and our group have also been able to carry out resection in over 90% of the patients who undergo operation and I believe this aggressive approach is justified, for even though a significant percentage of these operations may be palliative, in that not all malignant tissues can be removed, the relief of dysphagia obtained thereby at low risk justifies its performance. We too have experienced a much higher mortality rate following palliative

procedures to restore swallowing, such as bypass operations or insertion of plastic tubes, than has been the case when a resection is performed.

I share the authors preference for employing the stomach as an esophageal substitute, but was surprised at the high incidence of cervical anastomoses performed in their series, 137 as compared to only 49 anastomoses within the chest. The reasons for this are not entirely clear. The frequency with which the substernal route was employed is also a bit unusual, 61 times out of 186 operations, presumably using the stomach in each case. I personally have found the substernal route for the stomach less appealing than the posterior mediastinum as employed in a transhiatal resection. However, I share the authors preference for hand sewn anastomosis, though I prefer a two layer closure to a continuous single suture line.

In contrast to the authors experience with respiratory complications accounting for a high percentage of the postoperative complications, cardiovascular problems in my experience predominate among patients dying after operation or developing postoperative complications. This is in contrast to the reports of 20 or 30 years ago in which respiratory complications and anastomotic leakage accounted for the majority of deaths and/or complications.

Surgeons would do well to note the principles announced by the authors at the conclusion of their paper. Adherence to these principles will go far to help maintain low hospital mortality and complication rates that can clearly be achieved today in contrast to the situation that existed in earlier years. High operability and resectability rates coupled with low hospital mortality will lead to a significant increase in the 5 year survival rate when all patients, not just those referred to the surgeon, are included in the statistics. In the combined 40 year experience at the Mayo and the Lahey Clinics, the overall 5 year survival rate increased from 4% to 15% when all patients with the disease encountered in these two institutions were included [1]. The 5 year adjusted survival rate for those surviving curative resection was 23.3% [2]. It would be interesting to know the authors' long term survival statistics, but this issue is not addressed in their otherwise interesting article.

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