

Correlations between Preoperative Risk Factors and Postoperative Complications in Esophagectomy Patients

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Abstract

Background: Esophagectomy is associated with high operative risks, and the risk factors for esophageal cancer. The aim of this retrospective study was to clarify the correlations between preoperative risk factors and postoperative complications in patients undergoing esophagectomy for cancer.

Methods: The records of a total of 341 patients who underwent esophagectomy for esophageal cancer at our hospital between 1989 and 2009 were reviewed.

Results: Important factors contributing to postoperative complications were age, sex, staging, preoperative complications, and the amount of intraoperative bleeding. When the amount of bleeding exceeded 800 mL, it was associated with not only the incidence of postoperative complications but also the number of complications per patient and the severity of complications.

Conclusion: In the preoperative period, it is necessary to evaluate complications correctly and to treat them optimally. During the operation, the amount of bleeding must be reduced as much as possible. In the postoperative period, it is necessary to search for and treat complications promptly and to prevent multiple organ failure.

Keywords: Esophageal cancer; Preoperative risk factor; Postoperative complication

Background

Esophagectomy is associated with high operative risks, and the risk factors for esophageal cancer, such as smoking, alcohol, and aging, increase the incidence of preoperative complications [1]. Improvements in medical technology, such as operative technique and management of

the perioperative period, have increased the number of surgical candidates. Thus, the importance of managing the perioperative period is increasingly recognized [2]. The objective of this study was to establish safer management practices for the operative and perioperative periods by comparing the postoperative complications according to patient characteristics and operative procedure.

Patients and Methods

The records of a total of 341 patients who underwent esophagectomy for esophageal cancer at the Department of Surgery, Nagoya City University, between 1989 and 2009 were reviewed. These patients consisted of 282 men and 59 women with a median age of 63 years. Sixty-five patients during this period were excluded from the analysis for the following reasons: advanced cancer(T4) in 38 patients; severe preoperative complications, e.g., cardiovascular, respiratory disease, and/or liver cirrhosis in 19 patients; and failure to select operative treatment in 8 patients.

Preoperative risk factors that were evaluated included age, sex, tumor stage, smoking history, neoadjuvant therapy, preoperative complications (pulmonary, cardiovascular, hepatic, and renal disease, diabetes, and mental disorder), obesity, operative time and blood loss.

Postoperative complications that were evaluated included pneumonia(respiratory failure), cardiac events, liver dysfunction, renal dysfunction, vocal cord paralysis, anastomotic leak, mental disorder, surgical site infection, pleural effusion and ascites, and ileus. Serious postoperative

complications that were evaluated included the following: requirement for treatment in the intensive care unit for more than 5 days for breathing and circulation management; anastomotic leakage with difficult medical treatment; pleural effusion and ascites with difficult medical treatment; sepsis; and severe psychiatric disorders.

Statistical Analysis

Statistical analysis was performed using the Stat-View software package (Abacus Concepts, Berkeley, CA, USA). A P-value of less than 0.05 was considered to indicate statistical significance.

Results

The clinicopathological details of the 341 patients who underwent esophagectomy are presented in Table 1. The smoking rate was high: 261 of 341 patients (76.5 %) had a history of smoking. About 1/4 of the cases were treated with preoperative chemotherapy and/or radiotherapy. There were 17 cases of obesity in which the BMI exceeded 25 kg/m². Conversely, there were only 95 cases (27.9%) in which the BMI was less than 15 kg/m². About half the cases had preoperative comorbidities, of which cardiovascular comorbidities (28.1%) were the most numerous.

Table 1: Clinicopathological details of the 341 patients who underwent esophagectomy

Characteristics	No. of patients N=341	%
Gender		
Male	282	82.7
Female	59	17.3
Age (years)		
Median	63 (34-82)	
Smoking history		
Smokers	261	76.5
Nonsmokers	80	23.4
Prior treatments		
Chemotherapy	48	14.1
Radiotherapy	6	1.8
Chemoradiation therapy	37	10.9
BMI (kg/m²)		
>25	17	5
<18	95	27.9
Comorbidity		
All	172	50.4
Respiratory	33	9.7
Hepatic	44	12.9
Cardiovascular	96	28.1
Renal	9	2.6
Mental	14	4.1
Diabetes mellitus	28	8.2

As for the site of tumor, half the cases were in the middle thoracic esophagus (Table 2). The number of advanced

cases, more than stage 2, was 243 (71.3%). In almost all cases, the stomach was used for reconstruction. In our

hospital, retrosternal reconstruction with a gastric tube is the standard reconstruction method after esophagectomy. The gastric tube was selected in 306 patients, and retrosternal

reconstruction was selected in 192 patients. The average operative time and blood loss were 504 minutes and 561mL, respectively.

Table 2: Tumor characteristics and operative procedure

	No. of patients N=341	%
Location		
Ce	31	9.1
Ut	54	15.8
Mt	187	54.8
Lt	53	15.5
Ae	16	4.7
Stage		
0/1	98	28.7
2/3/4	243	71.3
Reconstruction		
Stomach	306	89.7
Colon	35	10.3
Operative time (min)	504 (155-1255)	
Blood loss (mL)	561 (107-2520)	

Preoperative complications occurred in 50.7% of the patients: cardiac disease, such as high blood pressure and arrhythmia, in about 30%, and respiratory and liver disorders in about 10% each. Two or more complications occurred in 14% of the patients, and the number of patients with preoperative complications increased with age.

Comparing the preoperative complications and the patients' background revealed that the group with complications had a significantly older age (Table 6). Operative time was longer in the liver dysfunction group than in groups with other types of complications. There was a larger amount of bleeding in cases with respiratory, liver, and renal dysfunction than in those without ($P<0.05$).

Table 6: Changes in pre- and postoperative complications according to age and bleeding

	Preoperative complications	%	Postoperative complications	%	No. of complications (0/1/≥2)	ICU	%
Age (years)							
≤59(127)	49	38.6	78	61.4	49/43/61	11	8.7
60-69(132)	74	56.1	79	59.8	43/42/37	15	11.4
70-74(63)	34	54	40	63.5	23/30/10	13	20.6
≥75(19)	15	78.9*	13	68.4	6/6/7	3	15.8
Bleeding (mL)							
≤299(65)	29	44.6	32	49.2	33/18/14	7	10.8
300-499(74)	38	38	38	51.4	36/19/19	6	15.8
500-799(99)	50	51.4	57	57.6	42/37/20	4	4
≥800(103)	55	53.4	83	80.6*	20/34/49*	25	24.3*

* p<0.05

Postoperative complications occurred in about 60% of cases, and half had two or more complications (Table 3). Of the most common complications, pneumonia developed in about

30% of cases, followed by liver dysfunction, surgical site infection, and anastomotic leakage. There were 42 (12.3%) cases with serious complications.

Table 3: Postoperative complications

	No. of patients N=341	%
Postoperative complications		
0	131	38.4
1	108	31.7
2 or more	102	29.9
Kind of complications		
Respiratory	102	29.9
Hepatic	55	16.1
Cardiac	8	2.3
Renal	13	3.9
Mental	37	10.8

Leakage	45	13.2
Recurrent nerve paralysis	33	9.7
Surgical site infection	48	14.1
Sepsis	17	5

The incidence of postoperative complications, the number of complications per patient, and the rate of serious complications were compared for every patient's background. In elderly people aged 70 and over and in males, the rate of serious complications was high, and there were many complications in advanced cases (Table 4). Further, the incidence of postoperative complications, the number of complications per patient, and the rate of serious complications were compared for preoperative complications and operative time and bleeding. The rates of postoperative complications and serious complications were significantly higher in the cases with preoperative complications. According to the type of preoperative complications, the number of postoperative complications

was high in the cases with respiratory or liver disorders (Table 5). There was no difference in the incidence of postoperative complications associated with operative time. But the number of postoperative complications increased in the cases with large amounts of bleeding (Table 6). As age increased, the rate of preoperative complications also increased, but there was no difference in postoperative complications. The incidence of postoperative complications increased with the increase in the amount of bleeding. When the amount of bleeding exceeded 800 mL, the rate of postoperative complications also increased rapidly, reaching about 80%; additionally, the number of postoperative complications per patient and the rate of severe complications also increased.

Table 4: Clinicopathological details and postoperative complications

	Postoperative complications	%	No. of complications (0/1/≥2)	ICU	%
Age (years)					
≤69 (259)	157	60.6	102/85/72	26	10*
≥70 (82)	53	64.6	29/23/30	16	19.5*
Gender					
Male (282)	174	61.7	108/85/89	40	14.2*
Female (59)	36	61	23/23/13	2	3.3*
Stage					
0/1 (98)	52	53.1	46/21/31*	13	13.2
2/3/4 (243)	158	65	85/87/71*	29	11.9
Smoking					
- (80)	56	70	23/35/22	10	12.5
+(261)	154	59	108/73/80	32	12.3

Preoperative Therapy

- (250)	155	62	95/83/72	29	11.6
+(91)	55	60.4	36/25/30	13	14.2
BMI (kg/m²)					
>25(17)	10	58.8	7/5/5	1	5.9
<18(93)	59	63.4	36/23/36	14	15.1

* p<0.05

Table 5: Preoperative complications and postoperative complications

	Postoperative complications	%	No. of complications (0/1/≥2)	ICU	%
Preoperative comp					
+(173)	118	68.2*	55/55/63*	28	16.2*
-(168)	92	54.8*	76/53/39*	14	8.3*
Respiratory					
+(33)	25	75.8	8/5/20*	6	18.2
-(308)	185	60.1	123/104/8*0	36	11.7
Hepatic					
+(44)	33	75	11/16/17*	8	18.2
-(297)	177	59.6	120/92/85*	34	8.6
Cardiovascular					
+(96)	65	67.7	31/32/33	12	12.5
-(245)	145	59.2	100/76/69	30	12.2
Renal					
+(9)	7	77.8	2/2/5	4	44.4*
-(332)	203	61.1	129/106/97	38	11.4*
Mental					
+(14)	11	78.6	3/4/7	3	21.4
-(327)	199	60.9	128/104/95	39	11.9
Diabetes mellitus					
+(28)	18	64.3	10/8/10	7	25
-(313)	192	61.3	121/100/92	35	11.1
Bleeding (mL)					
≥500(139)	70	50.4	69/36/34*	13	9.3
<500(202)	140	69.3	62/69/71*	29	14.3
Operative time (min)					
≥500(183)	115	62.8	68/61/54	21	11.4
<500(158)	95	60.1	63/47/48	21	13.3

* p<0.05

For the 42 patients (12.3%) with severe postoperative complications, the cause is shown in Table7. Pneumonia was the most common cause followed by anastomotic leakage, surgical site infection, and hepatic failure. Among

these patients, 26 patients (62%) got worse because of infection. Moreover, hospital mortality occurred in 4patients (1.2%).

Table7: Causes of severe complications in 47 patients

	No. of patients
Pneumonia	13
Leakage	10
Surgical site infection	5
Liver failure	5
Heart failure	1
Enterocolitis (MRSA)	1
Hospital mortality	4

Discussion

Drinking and smoking are mentioned as factors predisposing to esophageal cancer, and it is supposed that both act synergistically. For example, if a patient smokes 25 cigarettes and drink 2.5 grams of sake every day for 40 years, there is a greater risk of esophageal cancer occurrence than in those who do not smoke or drink [3,4]. Moreover, both may reduce liver function and respiratory function so that they not only constitute carcinogenic factors but also become factors that increase perioperative complications. The respiratory postoperative complications mentioned in our study are thought to be caused by the thoracotomy and the mediastinal lymphnode dissection. And the influence of smoking on pulmonary emphysema and chronic bronchitis is also great. Alcohol consumption not only worsens liver function, but alcohol cessation may be associated with mental disorders; thus, the perioperative period management becomes difficult.

From this study, 65 esophageal cancer patients were excluded, 19 of whom could choose only medical treatment because of preoperative complications. The main complications were respiratory disease (n=7), liver disease (n=6), and cardiac disease (n=4). In the comparison according to age, there were 14 (over 70%) examples in

patients over 70 years old. On the other hand, the rate of preoperative complications increases with age, but a difference was not observed in the incidence of postoperative complications.

While examining patients with esophageal cancer, it is important to conduct a sufficient evaluation, including assessing their operability before surgery [5,6]. Regarding complications determined by these examinations, there are reversible ones and irreversible ones. It is an important point of management to improve a reversible disease as much as possible before surgery. On the other hand, esophageal cancer is one type of cancer that rapidly advances, and there may not be sufficient time for improving the patient's general state. For this reason, we perform a preoperative management plan obtaining the early cooperation of many occupations to achieve improvement of the respiratory tract system by smoking cessation, respiratory rehabilitation, and oral care, and to obtain psychiatry consultation. One study showed that preoperative respiratory muscle training may prevent postoperative pulmonary complications by increasing both inspiratory and expiratory muscle strength [1]. Also, regarding irreversible diseases, predicting the perioperative period complications is important for the early detection of postoperative complications so that their impact can be reduced. Thus, appropriate consultation is obtained before the operation.

Regarding postoperative complications, the rates are high for advanced cases, cases with preoperative complications, and cases with a large amount of operative bleeding. When restricted to severe postoperative complications, the rate in elderly male patients was high. Based on preoperative complications, the rate was high in renal disorder patients. According to the amount of bleeding, postoperative complications increase with the increase in the amount of bleeding. When 800 mL of blood loss was exceeded, the postoperative complication rate and the number of complications per patient also increased rapidly, and the severe complication cases also increased. In the severe complication cases, many got worse because of infection, such as those with pneumonia or anastomotic leakage. This result suggests the importance of infection control.

Since certain postoperative complications are observed in 60 percent or more of cases of esophageal cancer surgery, we think that complications mostly happen after the operation, and we perform careful postoperative management. There are many reports that age, sex, and the degree of advancement of the cancer participate in generating postoperative complications [7,8]. However, these factors are not controllable. And concerning age, coexisting disease has more impact on perioperative morbidity and mortality than age alone. Concerning the scoring system for esophagectomy, there is no good system available yet that can be used preoperatively in order to predict reliably the patient's morbidity and mortality.

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During the operation, we strive to lessen the amount of bleeding by full use of various devices. Thereby, operative time can also be shortened. In the postoperative period, we perform careful management especially one week after the operation, without also overlooking any slight change. For postoperative complications including infection, early detection and quick treatment are of primary importance in order to avoid serious complications.

In surgical care, weight is put on the operation itself in many cases. However, it is important to recognize that pre- and postoperative management influence the postoperative course more than the surgery in invasive operations such as an esophagectomy.

Conclusion

Age, sex, staging, preoperative complications, and the amount of intraoperative bleeding were found to be associated with postoperative complications. In the preoperative period, it is very important to evaluate complications, except irreversible ones, correctly and treat them as much as possible. During the operation, decreased bleeding was associated with a possible decrease in postoperative complications. In the postoperative period, it is most important to carry out early detection of the complications by careful observation.

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