



Surgical Outcomes of Cervical Esophageal Cancer: A Single-Center Experience

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Background: Cervical esophageal cancer is a rare malignancy that requires specialized care. While definitive chemoradiation is the standard treatment approach, surgery remains a valuable option for certain patients. This study examined the surgical outcomes of patients with cervical esophageal cancer.

Methods: The study involved a retrospective review and analysis of 24 patients with cervical esophageal cancer. These patients underwent surgical resection between September 1994 and December 2018.

Results: The mean age of the patients was 61.0 ± 10.2 years, and 22 (91.7%) of them were male. Furthermore, 21 patients (87.5%) had T3 or T4 tumors, and 11 (45.8%) exhibited lymph node metastasis. Gastric pull-up with esophagectomy was performed for 19 patients (79.2%), while 5 (20.8%) underwent free jejunal graft with cervical esophagectomy. The 30-day operative mortality rate was 8.3%. During the follow-up period, complications included leakage at the anastomotic site in 9 cases (37.5%) and graft necrosis of the gastric conduit in 1 case. Progression to oral feeding was achieved in 20 patients (83.3%). Fifteen patients (62.5%) displayed tumor recurrence. The median time from surgery to recurrence was 10.5 months, and the 1-year recurrence rate was 73.3%. The 1-year and 3-year survival rates were 75% and 33.3%, respectively, with a median survival period of 17 months.

Conclusion: Patients with cervical esophageal cancer who underwent surgical resection faced unfavorable outcomes and relatively poor survival. The selection of cases and decision to proceed with surgery should be made cautiously, considering the risk of severe complications.

Keywords: Cervical esophageal cancer, Gastric pull-up, Free jejunal graft

Introduction

Cervical esophageal cancer is a rare malignancy, accounting for under 5% of esophageal cancers [1,2], and requires specialized care and management. Historically, radical surgical resection has been the mainstay of cervical esophageal cancer treatment, but it presents substantial treatment challenges due to the proximity of this cancer to vital structures in the neck [3]. Pharyngolaryngoesophagectomy (PLE), a radical approach to treating cervical esophageal cancer, was introduced in 1960. However, this procedure has been associated with high in-hospital mortality

rates, exceeding 30% [4]. With advancements in surgical techniques and postoperative care, the mortality rate and anastomotic leakage rate after PLE have decreased from 30% to 5% and 23% to 9%, respectively. Despite these improvements, outcomes remain unsatisfactory [5]. Moreover, most patients treated with surgery must also undergo total laryngectomy, which adversely impacts their quality of life due to loss of the voice. In contrast, definitive chemoradiation therapy (CRT) has shown similar overall outcomes to surgical resection, but without the need for total laryngectomy [6]. Hence, current guidelines recommend definitive CRT as the standard treatment for cervical esophageal



cancer, rather than surgical resection [3,7,8]. However, locoregional recurrence rates after definitive CRT range from 27% to 83% [9], and high-dose radiotherapy can result in complications such as strictures. In cases requiring additional treatment, salvage surgery is the only available option.

Surgery may constitute a key treatment alternative for patients, even though it is not typically recommended for cervical esophageal cancer. However, few reports have been published on the outcomes of surgical resection for this type of cancer. This lack of data presents a meaningful challenge to surgeons when making treatment decisions. Therefore, the objective of the present study was to aid in clinical decision-making regarding cervical esophageal cancer by examining the outcomes of surgery. The focus was on the surgical approach, morbidity, mortality, and long-term survival.

Methods

Patients

This study involved a review of patients who underwent surgical resection for esophageal cancer at the Department of Thoracic Surgery of Samsung Medical Center between September 1994 and December 2018. The location of the esophageal cancer was determined based on the epicenter of the cancer, with cervical esophageal cancer defined as having an epicenter located between 15 and 20 cm from the incisors [10]. A retrospective review and analysis was performed of 24 patients with cervical esophageal cancer who underwent surgical resection.

IRB approval

The institutional review board (IRB) of Samsung Medical Center granted approval for this study and provided a waiver for the acquisition of informed consent (IRB approval no., 2023-05-007-001).

Surgical treatment

Patients were preoperatively and postoperatively staged based on the tumor, node, and metastasis (TNM) staging system of the American Joint Committee on Cancer. The TNM staging and clinical staging data reflected the 8th edition of these guidelines [11]. The surgical indication was determined at a multidisciplinary conference, considering each patient's cancer treatment history and disease severi-

ty. Generally, the primary treatment option tends to favor definitive chemoradiation therapy. However, the surgical approach, which may include neoadjuvant treatment, is considered the primary choice by certain individual surgeons. The extent of resection was determined by the location and extent of the primary tumor. If the esophageal cancer was confined to the cervical area without evidence of mediastinal lymph node metastasis, either the transhiatal approach or cervical esophagectomy with free jejunal graft was utilized. If the cervical esophageal cancer extended to the upper thoracic esophagus or presented along with evidence of mediastinal lymph node metastasis, cervical and thoracic esophagectomy was performed. The choice of conduit depended on the extent of esophagectomy. A free jejunal graft was considered in cases of cervical esophagectomy, while the stomach was selected as the primary conduit for other cases. The anastomosis site was created using a handsewn technique and was located on the left side of the neck.

Follow-up and data collection

The institution established a schedule for routine follow-up appointments: every 3 months for the first 2 years, then every 6 months for the subsequent 3 years. These follow-ups included a chest computed tomography scan and an endoscopic examination of the gastrointestinal tract. Information regarding recurrence was gathered from electronic medical records (EMRs). In cases of suspected recurrence, attempts were made to secure histologic confirmation whenever feasible. When histologic confirmation could not be obtained, equivocal radiological evidence was used to determine recurrence. Locoregional recurrence referred to recurrence at the anastomosis site or the previous operative field, while distant recurrence was that found at a distant solid organ. Survival status was confirmed in September 2022 by cross-referencing the EMRs and the death registry of Statistics Korea.

Statistical analysis

Descriptive statistics were employed to examine the patient characteristics. Overall survival was defined as the time span from the surgical procedure to the death of the patient, regardless of the cause. Recurrence-free survival was defined as the time interval from the surgical procedure to the identification of any sign of recurrence. The Kaplan-Meier method was utilized for survival analysis, which involved the calculation of actuarial survival using

R ver. 3.5.0 for Windows (R Foundation for Statistical Computing, Vienna, Austria) and Rex ver. 3.6.3 (Rex Soft Inc., Seoul, Korea).

Results

Patient characteristics

In this study, we analyzed data from 24 patients, with their characteristics detailed in Table 1. All patients had squamous cell carcinoma. The mean age of the patients was 61.0±10.2 years, and 22 (91.7%) of them were male. Within the study population, 5 patients (20.8%) had a history of cancer other than esophageal, including 1 patient with a previous diagnosis of rectal cancer and 4 patients with a history of head and neck cancer. Among these 4, 2 had been diagnosed with pharyngeal cancer, 1 with laryngeal cancer, and 1 with cricoid cartilage cancer. Each of these patients received treatment tailored to their specific cancer histories. Furthermore, 21 (87.5%) of the patients had T3 or T4 tumors, and 11 (45.8%) exhibited node metastasis. Detailed clinical staging according to surgical method was described in Supplementary Table 1. The locations of the cervical esophageal cancer are detailed in Table 2.

Table 1. Baseline characteristics

Characteristic	Value
Patient characteristics	
No. of patients	24
Age (yr)	61.0±10.19
Male	22 (91.7)
Body mass index (kg/m ²)	21.0±2.88
Previous cancer history	
Head and neck	4 (16.7)
Rectal	1 (4.2)
cT status	
T1	1 (4.2)
T2	2 (8.3)
T3	17 (70.8)
T4	4 (16.7)
cN status	
N0	13 (54.2)
N1	9 (37.5)
N2	2 (8.3)
Clinical staging	
I	1 (4.2)
II	11 (45.8)
III	8 (33.3)
IV	4 (16.7)

Values are presented as number, mean±standard deviation, or number (%).
c, clinical; T, tumor; N, node.

Only 15 (62.5%) of the lesions were confined to the cervical area, while the remaining 9 lesions either extended to the upper thoracic esophagus or were accompanied by separate lesions located in the middle or lower thoracic esophagus.

Table 3 details the preoperative and postoperative treatments. Of the patients with cervical esophageal cancer, 2 underwent salvage surgery following definitive radiation therapy or CRT, while 8 received neoadjuvant treatment with doses of 4,400 to 5,000 cGy. Although not included in Table 3, 4 patients with previous head and neck cancers were treated with definitive radiotherapy: a dose of 7,000 cGy was used for pharyngeal cancer, and doses of 6,300 cGy and 5,000 cGy were used for laryngeal cancer. Detailed dosage data were unavailable for 1 patient. Of the 24 patients in the study, 13 received radiation therapy preoperatively, while 11 (45.8%) received no preoperative treatment.

Operative data

Table 4 summarizes the operative details. Of the 24 patients in the study, 19 (79.2%) underwent gastric pull-up as

Table 2. Tumor location (N=24)

Tumor location	No. (%)
Cervical only	
With hypopharyngeal extension	12 (50.0)
Without hypopharyngeal extension	3 (12.5)
Cervical, extending to upper thoracic ^{a)}	5 (20.8)
Cervical and middle thoracic ^{b)}	2 (8.3)
Cervical and lower thoracic ^{b)}	2 (8.3)

^{a)}Cervical esophageal cancer extended to the upper thoracic location in these cases. ^{b)}Synchronous double primary esophageal cancer.

Table 3. Perioperative treatment (N=24)

Perioperative treatment	No. (%)
Preoperative treatment for CEC	
Neoadjuvant setting	8 (33.3)
RT only	1 (4.2)
CCRT	7 (29.2)
Definitive setting	2 (8.3)
RT only	1 (4.2) ^{a)}
CCRT	1 (4.2)
Postoperative treatment for CEC	
Chemotherapy	5 (20.8)
RT	1 (4.2)

CEC, cervical esophageal cancer; RT, radiotherapy; CCRT, concurrent chemoradiation therapy.

^{a)}This patient was previously administered definitive treatment for head and neck cancer.

Table 4. Surgical procedure (N=24)

Surgical details	No. (%)
Esophagectomy	
Cervical	5 (20.8)
Transthoracic	15 (62.5)
Transhiatal	4 (16.7)
Conduit of reconstruction	
Stomach	19 (79.2)
Jejunum	5 (20.8)
Larynx-preserving surgery ^{a)}	12 (50.0)
Extent of LN dissection	
3-Field dissection	13 (54.2)
Neck+thorax	1 (4.2)
Neck+abdomen	2 (8.3)
Thorax+abdomen	2 (8.3)
Others ^{b)}	3 (12.5)
None	2 (8.3)
Resection margin	
R0	21 (87.5)
R1	1 (4.2)
R2	2 (8.3)

LN, lymph node.

^{a)}Initially, 12 patients underwent larynx-preserving surgery, but delayed total laryngectomy was performed for 1 additional patient due to severe aspiration. Ultimately, 13 patients underwent total laryngectomy. ^{b)}Others included neck-only, thorax-only, and abdomen-only dissection.

a reconstruction method. Transthoracic esophagectomy was performed for 15 (62.5%) of these patients, while transhiatal esophagectomy was utilized for 4 (16.7%). Free jejunal graft with cervical esophagectomy was employed for the remaining 5 patients (20.8%). Of the 24 patients, 12 received larynx-preserving surgery. However, 1 of these patients subsequently required total laryngectomy due to severe aspiration. Among the 12 patients who underwent larynx-preserving surgery, R0 resection was achieved for 10 (83.3%) and R2 resection for 2. The anastomosis was typically performed just below the upper esophageal sphincter level in cases of larynx-preserving surgery. All larynx-preserving surgical procedures in this series utilized a gastric conduit. The variability in the extent of node dissection can be attributed to the heterogeneity of patient characteristics. The primary approach was a 3-field node dissection. However, certain cases of cervical esophageal cancer, characterized by a lack of mediastinal extension or thoracic node metastasis, necessitated a transhiatal approach that excluded mediastinal node dissection. Additionally, abdominal node dissection was selectively omitted in some cases, based on surgeon preferences. Neck node dissection was also omitted in patients who had previously undergone neck node dissection for head and neck cancer, or in cases for which

Table 5. Postoperative complications (N=24)

Postoperative complications	No. (%)
In-hospital mortality ^{a)}	3 (12.5)
Anastomosis leakage	9 (37.5)
Graft necrosis	1 (4.2)
Reoperation due to anastomosis leakage	5 (20.8)
Failure of oral feeding	4 (16.7)
Pulmonary complications	
Pneumonia	3 (12.5)
Pleural effusion	2 (8.3)
Vocal cord palsy	9 (37.5) ^{b)}
Chyle leakage	2 (8.3)
Wound infection	6 (25)
Sepsis	1 (4.2)
Cardiovascular complications ^{c)}	2 (8.3)

^{a)}Two of these patients represented 30-day mortality, while 1 patient expired 9 months after initial esophagectomy. ^{b)}A total of 12 patients underwent larynx-preserving surgery. Among them, vocal cord palsy was observed in 75%. ^{c)}The database used encompassed any cardiovascular events, including myocardial infarction, pulmonary thromboembolism, deep vein thrombosis, and arrhythmia. All complications reported in this series were temporary arrhythmias.

dissection was challenging due to prior chemoradiation treatment or advanced tumor stage.

Postoperative outcomes

Table 5 presents data concerning complications. In-hospital mortality was observed in 3 cases (12.5%). Two patients expired within the first 30 days following surgery. The primary causes of death identified within this 30-day mortality period were acute respiratory distress syndrome and sepsis, which resulted from pneumonia and graft failure. Another cause of death was cervical osteomyelitis, which occurred due to leakage at the anastomosis site. Despite undergoing repeated debridement, this patient expired 9 months after initial esophagectomy due to sepsis.

Leakage at the anastomosis site was observed in 9 cases (37.5%), and graft necrosis was identified in 1 patient who had a gastric conduit. Reoperation was necessitated by the anastomosis site in 5 instances, while the other patients received conservative treatment. Ultimately, oral feeding became feasible for 20 patients (83.3%). Delayed oral feeding was not possible for 11 cases (45.8%), and in 6 of these cases, the cause was aspiration. No pulmonary complications were noted in patients who had undergone total laryngectomy.

Of the 12 patients who underwent larynx-preserving surgery, 1 (8.3%) died within 30 postoperative days, 2 (16.7%) experienced feeding failure, 5 (41.7%) had delayed oral

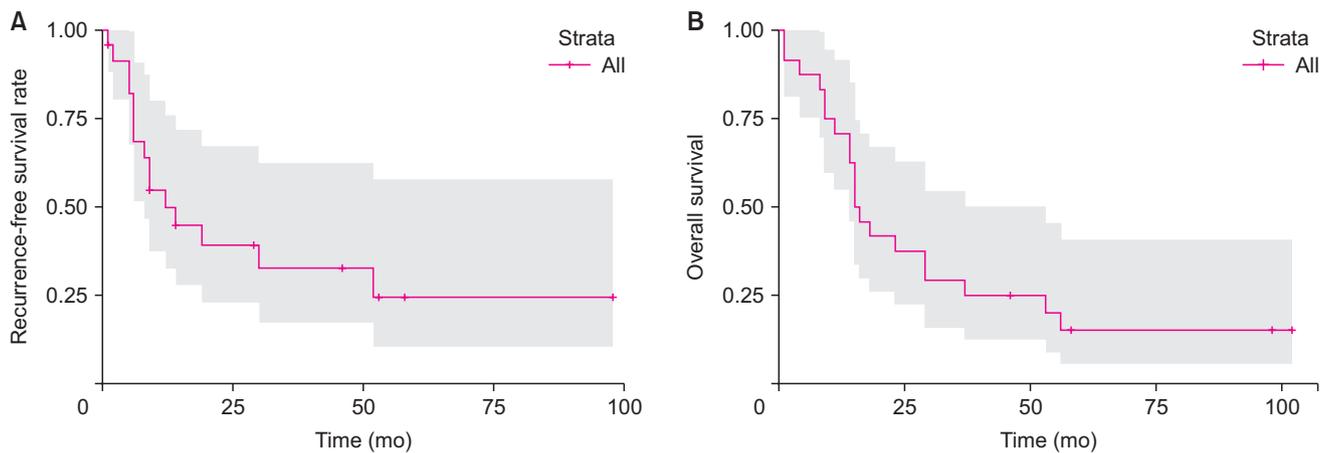


Fig. 1. (A) Recurrence-free survival. (B) Overall survival.

feeding, and 3 (25%) exhibited postoperative leakage at the anastomotic site. Vocal cord palsy was identified in 9 cases, which constituted 75% of the patients who had their larynx preserved. Of these, 3 patients who developed vocal cord palsy subsequently contracted pneumonia, leading to the deaths of 2 patients.

During the median follow-up period of 15.50 months (interquartile range, 10.5–39.3 months), tumor recurrence was identified in 15 patients (62.5%). Fig. 1A illustrates the recurrence-free survival of the study participants. The rate of recurrence within 1 year was 73.3%. Six patients experienced locoregional recurrence without distant metastasis, while recurrence at the anastomosis site was observed in 4 patients. Distant metastasis was also a common occurrence, identified in 9 patients (60%).

The 1-year and 3-year survival rates were 75% and 33.3%, respectively, within the follow-up period. The overall survival curve is illustrated in Fig. 1B. The primary cause of death was identified as esophageal cancer-related in 95% of all deaths. Of the 19 patients who died, mortality resulted from operative complications for 4, while disease progression was the cause for the remaining 15. A separate survival analysis was performed, in consideration of treatment modality. The data revealed that 10 patients underwent surgery only, without any preoperative treatment, while 14 patients received preoperative chemoradiation therapy for cervical esophageal cancer. The corresponding Kaplan-Meier curve is presented in Supplementary Fig. 1. Notably, patients who underwent multimodality treatment exhibited more favorable outcomes than those in the surgery-only group, although the difference did not reach statistical significance.

Discussion

The rarity of cervical esophageal cancer has resulted in limited data regarding the optimal treatment for this condition. Historically, radical surgical resection has been a key component of treatment for cervical esophageal cancer. However, due to the high mortality and morbidity rates associated with radical surgical resection (such as PLE) and its surgical complexities, current guidelines now recommend definitive CRT as the primary treatment [7,12]. Several studies have reported an overall survival rate of 30% for patients with cervical esophageal cancer who were treated with definitive CRT [13,14], a rate comparable to the outcomes of surgical treatment alone. Moreover, definitive CRT offers a less invasive method of preserving the larynx and esophagus, whereas laryngectomy was previously unavoidable in most cases of cervical esophageal cancer. Nevertheless, surgery remains an important treatment option for selected patients who do not respond to definitive CRT or who experience complications related to this approach. The rate of locoregional recurrence following definitive CRT ranges from 13% to 42% [3], and salvage surgery can be a beneficial option with favorable outcomes, provided the patient's general condition permits [9]. Furthermore, definitive CRT can lead to complications such as esophageal stricture and tumor rupture, necessitating salvage surgery [6]. Hence, the surgical outcomes for cervical esophageal cancer should be reviewed.

Our data shed light on the representative characteristics of patients with cervical esophageal cancer. This type of cancer is marked by an elevated risk of developing multiple primary cancers in the head and neck region. A prior study indicated that head and neck cancer ranks as the second

most common type of multiple primary cancer found in patients with esophageal cancer, accounting for 18.8% of cases in Korea [15]. The present study revealed that 4 (16.7%) of the 24 patients with cervical esophageal cancer had a history of head and neck cancer and had received definitive CRT. Two patients underwent a salvage operation following definitive treatment for cervical esophageal cancer. Additionally, 12 patients (50%) exhibited a hypopharyngeal extension of cervical esophageal cancer, and more than 80% of the patients had locally advanced (T3 or T4) disease. Half of the patients were administered definitive or neoadjuvant radiotherapy due to this advanced stage. This advanced stage of the disease and the patients' medical histories complicated the surgical resection of cervical esophageal cancer.

Our data revealed unfavorable survival outcomes for cervical esophageal cancer, even with surgical resection efforts. The existing literature cites 3-year survival rates of 18% and 35% for patients who have undergone surgery for this type of cancer [16-18]. Our study indicated 1-year and 3-year survival rates of 75% and 33.3%, respectively, with a median survival period of 17 months. These findings align with other reports. Both locoregional recurrence and distant metastasis were frequently observed in our study, underscoring the difficulties in managing cervical esophageal cancer. This study emphasizes the need for enhanced treatment strategies for cervical esophageal cancer to improve patient outcomes and decrease morbidity and mortality.

This study focused on the surgical approach to cervical esophageal cancer, specifically addressing the scope of resection and the selection of conduit. Conventionally, laryngectomy is recommended in surgery for cervical esophageal cancer. In the present study, however, efforts were made to perform larynx-preserving surgery in half of the cases, demonstrating its feasibility despite the technical challenges involved. Ensuring adequate surgical margins is a critical factor in larynx-preserving surgery, as the margin impacts the oncologic outcomes [19]. In our series, R0 resection with larynx-preserving surgery was achieved in 10 of 12 patients (83.3%), while 2 patients had R2 resection. Notably, both patients survived for more than 50 months, exceeding the median survival time after receiving adjuvant radiotherapy. This underscores the importance of preserving the larynx during surgery for cervical esophageal cancer, provided it is technically feasible. Furthermore, our data revealed that 75% of patients who underwent larynx-preserving surgery experienced vocal cord palsy, and one-third of them developed pneumonia, resulting in 2 in-hospital deaths. This suggests that while larynx-preserv-

ing surgery is feasible from an oncologic perspective, it does carry risks. A report on complications following larynx-preserving surgery highlighted an increase in pulmonary complications and all postoperative mortality in cervical esophageal cancer [20]. Conversely, another study comparing larynx preservation with laryngectomy found no significant difference in postoperative outcomes, although they performed the larynx-preserving procedure on patients with earlier T stages [21]. Therefore, it is crucial to note that vocal cord palsy could be fatal following larynx-preserving surgery, and both this condition and damage to the recurrent laryngeal nerve should be avoided during the procedure. Aggressive postoperative care, including empirical tracheostomy, should be considered following larynx-preserving surgery.

The selection of the conduit is another key aspect of the surgical approach. Our data revealed that patients who underwent reconstruction with a free jejunal graft also received concomitant laryngectomy. Previous research has indicated that the use of a free jejunal graft is associated with a higher rate of problems at the anastomotic site, with rates varying from 7% to 37%, compared to a gastric graft [16]. However, respiratory complications were less frequent. The surgical outcomes showed no instances of pulmonary complications in patients with jejunal grafts, which could be attributed to the use of total laryngectomy. Oral feeding was feasible during the follow-up period, although 60% (3 of 5) of the jejunal conduits displayed major or minor leakage problems. The rate of anastomosis site leakage in gastric conduits was approximately 42% (6 of 19), which is lower than that of free jejunal grafts, and the severity of anastomotic leakage was higher for the gastric conduits. This does not suggest that reconstruction with a free jejunal graft is safer than gastric reconstruction. In fact, gastric reconstruction following laryngectomy is typically reported to have a higher rate of anastomotic leakage than gastric reconstruction following esophagectomy.

This study had inherent limitations due to its single-center design and small sample size, which can be attributed to the rarity of cervical esophageal cancer. Hence, the generalizability of the findings to broader populations may be limited, and it was not feasible to conduct comprehensive analyses to identify prognostic factors or compare various treatment strategies. Nevertheless, the value of this report in providing valuable insights should be recognized, given the scarcity of information available on surgical outcomes in cervical esophageal cancer.

In conclusion, the prognosis of patients with cervical esophageal cancer who undergo surgery continues to be

unfavorable. Despite the use of multimodal treatment, these patients face high rates of morbidity, mortality, and recurrence. Surgery may serve as a rescue option for those who do not achieve a complete response with CRT, but it should be viewed as a final recourse. Surgical approaches, including larynx preservation, should be chosen judiciously, with patient selection considering the risk of severe complications. This study underscores the necessity for enhanced treatment strategies and the importance of patient selection in the management of cervical esophageal cancer. Surgical intervention for cervical esophageal cancer was associated with high morbidity and mortality rates, and survival following surgical resection was poor. Surgery may be viewed as a salvage option for those who have undergone prior treatment, but the selection of suitable cases and the decision to proceed with surgery must be made with great care, while considering the potential for serious complications. While larynx-preserving surgery may be attempted, the risk of pulmonary complications must be taken into consideration.

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Conflict of interest

Co-author Hong Kwan Kim, M.D., Ph.D, is associate editor of Journal of Chest Surgery and Junghee Lee, M.D, Ph.D, is on editorial board of Journal of Chest Surgery. Except for that, no potential conflict of interest relevant to

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Supplementary materials

Supplementary materials can be found via <https://doi.org/10.5090/jcs.23.085>. **Supplementary Table 1.** Clinical status of cervical esophageal cancer of patients according to surgical method. **Supplementary Figure 1.** Survival analysis according to preoperative treatment.

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