Surgical treatment of cancer of the esophagus is influenced by two issues: use of surgical resection within a multimodality treatment approach and selection of the correct surgical approach. Selecting the correct surgical approach should be individualized and determined by the intent of surgery (curative or palliative), the anatomic location of the tumor (cervical or thoracic), the preferred method of reconstruction (colonic interposition or gastric pull-up), and whether surgery is the only therapeutic modality to be used or will be combined with neoadjuvant chemotherapy and/or radiotherapy. A discussion of the efficacy of treatment within a multimodality setting and a description of the surgical approaches follow. (Chest 1993; 103:4105-14S)

There are two concurrent issues that are particularly important to the management of esophageal cancer: surgical resection within a multimodality treatment regimen and selection of the correct surgical approach for resection. Due to the anatomic features of the esophagus and the biology of the tumor, even the most aggressive surgical approach to esophageal cancer provides disappointing results in the vast majority of patients. The immediate hope, then, for long-term survival of patients with cancer of the esophagus seems to rest with a combined approach that includes chemotherapy (CTh), radiotherapy (RT), and complete surgical resection. Because of the small number of patients with potentially curable esophageal cancer, attempts at curative treatment should be part of a carefully constructed, controlled clinical trial.

The correct surgical approach to esophageal cancer should be individualized and determined by the following: (1) the intent (curative or palliative) of the procedure; (2) the anatomic location of the tumor (cervical or thoracic [upper, middle, or lower third of the esophagus]); (3) the preferred method of reconstruction (colonic interposition or gastric pull-up); and (4) whether surgery is the only therapeutic modality to be used or if it will be combined with neoadjuvant chemotherapy and/or radiotherapy.

**Current Evidence for the Efficacy of Multimodality Therapy**

Aggressive surgical management of a localized esophageal carcinoma was the last significant advance against this disease, and 5-year survival rates for patients undergoing complete surgical resection remain in the range of 15% to 35%. Two principal factors that affect long-term survival are tumor penetration through the wall of the esophagus and the presence or absence of involved regional lymph nodes of these patients. Radiotherapy, whether preoperative or postoperative, has been shown in multiple trials to provide only modest improvement, if any, in the resectability or survival of these patients; although a recent report from an uncontrolled study showed some improvement in certain patients.

The theoretic advantages of giving chemotherapy prior to definitive local treatment (either surgery or RT) have been described in several studies. In brief, they include laboratory evidence of an advantage of preoperative treatment in other tumor models; the possibility that treating preoperatively, when metastatic tumor burden is low, may minimize the probability of spontaneous drug resistance; and the practical advantages of increased resection rates and in vivo assessment of response in a given patient population.

Neoadjuvant studies in esophageal cancer can be divided into 2 groups: those involving neoadjuvant treatment prior to surgery, and those involving a nonsurgical approach (CTh plus RT). The rationale for the latter approach is that radiation as a single modality has moderate effectiveness against esophageal cancer, and a number of chemotherapeutic agents have both cytotoxic and radiosensitizing properties. Herskovic and his coinvestigators from the Radiation Therapy Oncology Group (RTOC) have recently verified the superiority of combined chemoradiation to RT alone in a nonsurgical protocol. It remains unclear whether neoadjuvant approaches involving surgery are superior to those involving chemotherapy with radiation not leading to resection.

A number of phase II studies of CTh followed by surgery have been performed. Overall, they demonstrate that cisplatin-based CTh given for 1 to 4 courses prior to definitive surgical resection (using a variety of techniques) is tolerable and does not increase operative morbidity or mortality as long as careful attention is paid to routine factors during the perioperative period. If standard measures are followed, operative mortality ranges from 5% to 15%, a rate that is not increased over series involving surgery alone, performed by surgeons with experience in both settings.

In addition to the phase II studies, 2 randomized trials have been reported. Roth and colleagues from the National Cancer Institute compared preoperative and postoperative cisplatin, vindesine, and bleomycin CTh vs surgery alone in 39 patients. Endpoints of the study were objective response to CTh, operative morbidity and mortality, and survival. The CTh response rate was 47%, similar to that reported in a pilot trial using the same CTh combination conducted at Memorial Sloan-Kettering Cancer Center (MSKCC). The resection rates were similar in the 2 arms of the trial, and there was no increase in operative morbidity or mortality in the CTh/surgery group compared to the group treated with surgery alone. In fact, operative morbidi-
ity was slightly higher among patients randomized to surgery alone. There was no difference in overall survival between the 2 groups. However, subgroup analysis revealed that patients who responded to CTh had a significantly improved survival compared to both nonresponders and those patients undergoing surgery alone.

In the second trial, Kelsen and coworkers at MSKCC\(^{19}\) compared preoperative CTh (2 cycles of cisplatin, vindesine, and bleomycin) and preoperative radiation (at a total dose of 55 Gy given over 5.5 to 6 weeks). Surgery was planned for week 8. A total of 96 patients were entered into the study. All patients had operable esophageal cancer, epidermoid subtype, at the start of treatment. There were no significant differences between the RT and CTh groups in terms of major response (CTh 55% vs RT 64%), operability (CTh 75% vs RT 77%), or resection (CTh 58% vs RT 65%) rates. Overall, operative mortality was slightly greater than anticipated at 12.5%. The CTh toxicity was exactly as anticipated. Unexpected RT pulmonary toxicity was noted, however, with a statistically significant drop in diffusing capacity (Dco) between pretreatment and postradiation pulmonary function tests. It was speculated that there was a synergistic interaction between RT and the high inspired oxygen concentrations frequently used during the operative and perioperative periods.

In this trial, site of first failure was determined clinically, and revealed that 20% of the patients who underwent resection (almost all of whom had received either preoperative or postoperative RT) had local recurrence as the first site of failure. An additional 12% of patients who underwent surgical exploration had unresectable disease. Therefore, failure to control local disease by surgery alone was seen in a total of 32% of all patients who underwent exploration. Survival exceeded 2 years in 20% of patients; this was twice that documented in historic control subjects.

Combined neoadjuvant multimodality therapy awaits prospective randomized clinical trials to confirm its efficacy in the treatment of esophageal carcinoma.\(^{13,17,18}\) Investigators from the University of Michigan\(^{19-21}\) have reported improved resectability rates and survivals in certain patients, and the RTOG intergroup trial is currently under way.

**Selection of Operative Approach**

The first factor in determining the surgical approach to esophageal cancer is defining the intent of the operative procedure, and the second is the anatomic location of the tumor; ie, whether it is cervical or in the upper, middle, or lower third of the thoracic esophagus. The next consideration is whether the intention is for colonic interposition or gastric pull-up in reconstruction, and finally it must be determined whether surgery is to be used alone or within a multimodality treatment program.\(^{1,22-25}\)

**Palliative Surgery**

If possible, we perform a transhiatal esophagectomy without thoracotomy in all instances of esophageal carcinoma where palliation is the clinical goal and life expectancy is reasonable (Fig 1).\(^{22}\) This approach, however, is contraindicated where there is evidence of tumor involvement of structures such as the trachea, bronchus, or major vascular structures that would prohibit blind removal of the tumor.

![Esophagectomy](https://example.com/esophagectomy.png)

**Figure 1.** Transhiatal esophagectomy: the entire esophagus has been mobilized via simultaneous approach from the neck and abdomen. Most if not all the dissection is carried out under direct vision avoiding blunt or avulsive maneuvers. Note the gastric conduit based on the right gastroepiploic vessels reaching easily to the cervical level via the posterior mediastinum. A pyloromyotomy is also depicted. Reprinted with permission from Stewart et al.\(^{23}\)

In these instances, a thoracotomy is performed to allow direct dissection of the mediastinum, or a bypass alone is performed. Other nonsurgical approaches, such as use of intraluminal stents, laser resections, or repeated dilatations must be used with care in selected clinical settings.

**Surgical Approach With Curative Intent: Attempt at Complete Resection**

When surgery alone is used for the treatment of esophageal cancer, the efficacy of extended resection with extensive mediastinal node dissection remains in dispute. However, current protocols for the treatment of esophageal cancer with anterior preoperative CTh and RT emphasize the need for "complete resection" of involved tissue. Theoretically, such up-front neoadjuvant therapy will downstage the primary tumor by eliminating micrometastases in the surround-
ing lymph nodes. The need for and efficacy of complete vs incomplete resection of a downstaged tumor has been demonstrated by recent reports of neoadjuvant CTh followed by resectional procedures in the treatment of stage III non-small-cell lung cancer. While the efficacy of these protocols requires further investigation in esophageal carcinoma, it appears logical to strive for a complete resection of all involved tissue in these patients; such intent dictates a transthoracic approach.

Esophagectomy without thoracotomy (Fig 1) has been shown to be a safe method for removing the entire intrathoracic esophagus. It does not involve mediastinal node dissection or the removal of contiguous nodes or other potentially resectable structures involved with the tumor. For this reason, we do not use esophagectomy without thoracotomy when a complete resection is felt to be advantageous or potentially curative.

Operative Approach to Tumors by Anatomic Location

The esophagus consists of a cervical and thoracic portion. The cervical esophagus extends from the cricopharyngeal muscle to the thoracic inlet.

The thoracic esophagus can anatomically be split into 3 major areas. The upper half of the thoracic esophagus extends from the thoracic inlet to the aortic arch; the middle third extends from the aortic arch to the inferior pulmonary vein; and finally, the lower third extends from the inferior vein to the cardia. Tumors of the esophagus are surrounded by

Figure 2. Transthoracic esophagectomy: a standard posterolateral right thoracotomy is shown. Excellent exposure of the entire thoracic esophagus affords the surgeon the best opportunity to resect the tumor en bloc with adjacent pleural, mediastinal, and nodal tissue while sparing the airways, heart, and great vessels. The azygous vein is divided and the thoracic duct is identified and ligated, precluding a postoperative chylothorax. Mobilization extends circumferentially at the diaphragm and up into the neck, facilitating the abdominal and cervical dissections. Reprinted with permission from Fisher et al.

Figure 3. Preparation of the gastric conduit: note the full mobilization of the greater gastric curve with the stomach based in the right gastroepiploic artery and the distal branches of the right gastric artery. Portions of the lesser curve can be resected with the specimen for lower third lesions. A generous Kocher maneuver allows the pylorus to reach the esophageal hiatus. A pyloroplasty (shown here) on a pyloromyotomy promotes better emptying of the neoesophagus. Reprinted with permission from Orringer and Sloan.

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different anatomic structures depending on their location within the esophagus. Therefore, rather than adopting a standard surgical approach to esophageal cancer, we choose the approach that best exposes the location of the specific tumor.

In the case of cervical esophageal carcinoma or a tumor of the upper third of the thoracic esophagus, we perform a right cervical incision, right anterior lateral thoracotomy, and midline laparotomy with gastric pull-up. For lesions of the extreme superior aspect of the cervical esophagus, the right anterior lateral thoracotomy is omitted.

If the tumor is located in the middle third of the thoracic esophagus, a full right thoracotomy (Fig 2) is performed, with mobilization of the tumor and surrounding tissues. Thoracotomy is then closed and followed by reprepping and draping for a left-neck incision and laparotomy, which allows for cervical resection and reconstruction using a gastric pull-up and cervical gastroesophageal anastomosis.

Finally, for esophageal tumors of the lower third of the thoracic esophagus and cardia, we perform a left, sixth interspace thoracotomy with minimal extension across the costal chondral junction. The diaphragm is taken down circumferentially 2 cm from the chest wall, and reconstruction via gastric pull-up and anastomosis in the high left chest or left neck is performed.

While some surgeons advocate the routine use of colonic interpositions, we routinely use gastric pull-up with the stomach pedicle based on the right gastric epiploic artery (Fig 3). We perform a cervical esophagogastrostomy whenever possible because we believe that this operative approach reduces morbidity of the anastomosis and leads to a superior functional result. Resection of the upper two thirds of the lesser curvature diffuses the argument that this method of reconstruction neglects resection of these nodal chains.

Although the data pertaining to this procedure are somewhat mixed, we routinely perform a pyloromyotomy or pyloroplasty, noting that the morbidity from the procedure is extremely low and that pyloric obstruction, particularly when it occurs postoperatively, can be a major cause of prolonged symptoms (Fig 4). We also routinely place a feeding jejunostomy prior to closure of the abdomen.

Conclusions

The correct operative approach to localized carcinoma of the esophagus should be determined by the intent of the surgical resection and the clinical setting in which the procedure is to be performed. A combination of neoadjuvant CT, RT, and surgery currently provides the best hope for long-term survival in patients presenting with localized carcinoma of the esophagus.

References

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