

# Bronchoscopic Staging of Squamous Cell Carcinoma of the Upper Thoracic Esophagus

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**Objective:** To identify bronchoscopic findings that predict resectability of squamous cell carcinoma of the upper thoracic esophagus.

**Design:** Tracheobronchoscopy was performed in patients with squamous cell carcinoma of the thoracic esophagus to assess the infiltration of the tracheobronchial tree by the tumor and predict the resectability. Bronchoscopic records were matched with clinical outcome and intraoperative findings.

**Setting:** University hospital, tertiary care referral center.

**Patients:** A total of 113 patients with supracarinal esophageal carcinoma underwent bronchoscopy as part of the preoperative staging. In 47 patients the bronchoscopy was repeated after a regimen of neoadjuvant chemotherapy.

**Intervention:** A total of 160 bronchoscopies performed by the same operator.

**Main Outcome Measures:** Bronchoscopic records matched with clinical outcome and intraoperative findings.

**Results:** Including patients before and after neoadjuvant chemotherapy, 27 of the 46 with no bronchoscopic abnormalities were operated on: in 24 (89%) of them radical surgical resection was possible. Among the 22 patients with a slight compression on the tracheobronchial tree admitted to surgery, a radical surgical resection was possible in 20 cases (91%). In none of the 5 patients with compression/deviation associated with fixation of the tracheobronchial tree but no mucosal infiltration who underwent surgery was a radical surgical resection possible because of tracheobronchial infiltration.

**Conclusions:** Compression of the tracheobronchial tree does not necessarily mean infiltration by esophageal carcinoma. If the compression is slight and the mobility of the tracheobronchial tree is normal, a radical esophagectomy is possible in 91% of patients.

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**B**ETWEEN 40% and 60% of esophageal carcinomas are unresectable at presentation.<sup>1,2</sup> A number of diagnostic tools such as barium swallow, upper gastrointestinal tract endoscopy, bronchoscopy, computed tomographic scan, magnetic resonance imaging, and endoscopic ultrasonography are available to stage the tumor and to establish the involvement of any of the surrounding mediastinal structures with the disease.<sup>3,4</sup> If involvement exists, a radical surgical resection is unlikely.

Bronchoscopy plays an important role in staging esophageal carcinoma by assessing whether the tumor involves the tracheobronchial tree. The Consensus Conference of the International Society for Diseases of the Esophagus held in Milan, Italy, in August 1995 suggested that all patients with squamous cell carcinoma of the supracarinal esophagus undergo bronchoscopy as part of the disease's staging.<sup>5</sup>

However, to our knowledge, very little has been written about the incidence and degree of bronchoscopic abnormalities in patients with esophageal carcinoma and how these findings relate to surgical resectability of the tumor and the patient's clinical outcome.<sup>1,3,6-8</sup> Our purpose was to present a classification of bronchoscopic findings that we found able to predict tumor resectability and patient outcome in patients with supracarinal esophageal carcinoma.

RESULTS

In 2 patients (1.8%) a synchronous bronchogenic carcinoma was found. The category of bronchoscopic abnormalities

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## PATIENTS, MATERIALS, AND METHODS

Between November 1, 1992, and May 31, 1997, 113 patients (97 men, 16 women; mean age, 59.8 years [age range, 19-80 years]) with supracarinal esophageal carcinoma underwent bronchoscopy as part of the preoperative staging that also included barium esophagogram, upper gastrointestinal tract endoscopy, and chest computed tomographic scan. In 47 patients, the bronchoscopy was repeated after a regimen of neoadjuvant chemotherapy (CHT). A total of 160 bronchoscopies were performed.

A flexible videobronchoscope (Olympus CV-200, Olympus Optical Co, Ltd, Tokyo, Japan) was used. The examination was performed under topical anesthesia by spraying 10 to 20 mL of 2% lidocaine. No systemic premedication was used. Pulse oximetry was performed in all patients. Supplemental oxygen was seldom necessary. All bronchoscopies were performed by the same operator (A.B.). The examination was always extended to the peripheral bronchial tree to exclude the presence of a synchronous bronchogenic carcinoma. No complications occurred.

Bronchoscopic findings were graded according to the following classification. Category I: no abnormalities. Category IIa: slight compression on the posterior wall of the trachea or left bronchus; normal mobility of the tracheobronchial wall; and parallel and regular longitudinal folds of the pars membranacea. Category IIb: impingement or deviation of the trachea or left bronchus or widening of the carina, with or without narrowing, associated with a reduction in mobility during breathing and coughing (ie, fixation of the involved tracheobronchial segment). The mucosa is still normal, but the longitudinal folds of the pars membranacea may be widened. Category III: mucosal irregularities or tracheoesophageal fistula. Mucosal brushing or biopsies were performed whenever mucosal abnormalities were suspected; a positive finding for cancer cells on specimens graded the patient as having a category III classification.

Bronchoscopic records were matched with clinical outcome and intraoperative findings.

was related to the length of the tumor measured on the barium swallow; results of this test are reported in **Table 1**. The sites of tracheobronchial abnormalities are as follows:

Site of Lesion	No. (%) of Patients
Trachea carina	41 (25.6)
Left bronchus	41 (25.6)
Left bronchus + trachea	31 (19.3)
Right bronchus	1 (0.6)
Right bronchus + trachea	2 (1.2)
None	44 (27.5)

Bronchoscopic findings of the 113 patients with squamous cell carcinoma of the supracarinal thoracic esophagus who underwent bronchoscopy at first observation were graded according to the category classifica-

**Table 1. Length of the Esophageal Tumor and Category of Bronchoscopic Abnormalities**

Length, mm	Total No.	Category, No. (%)			
		I	IIa	IIb	III
≤50	75	30 (65)	23 (66)	20 (38)	2 (25)
>50	85	16 (35)	12 (34)	51 (72)	6 (75)

tion given in the "Patients, Materials, and Methods" section: 33 cases (30%) were in category I; 17 (15%), in category IIa; 57 (50%), in category IIb; and 6 (5%), in category III.

Bronchoscopic staging was related to clinical outcome (**Table 2**). Fifteen patients with the category I grade were operated on, and in 14 a radical resection was performed. Six patients with the category IIa grade underwent surgery, and in all a radical resection was possible. One patient with the category IIb grade underwent surgery; a nonradical resection was done because of tracheobronchial infiltration.

Forty-seven of the 113 patients underwent neoadjuvant CHT. After the treatment, patients again underwent bronchoscopy (**Table 3**). Thirteen of them were classified as having category I; 18, category IIa; 14, category IIb; and 2, category III grades (**Figure**). Twelve patients with a category I and 16 with a category IIa classification were operated on and in 10 and 14, respectively, a radical resection was possible. Four patients with a category IIb classification were operated on and in none was a radical resection possible.

On the whole, including patients before and after neoadjuvant CHT, 27 of the 46 staged as category I were operated on: in 24 (89%) of them, radical surgical resection was possible; in 3 (11%), a nonradical resection as a result of aortic infiltration was done. Among the 22 patients staged as having a category IIa grade who were admitted to surgery, a radical surgical resection was possible in 20 cases (91%), while a nonradical surgical resection was done in 2 (9%) because of aortic<sup>1</sup> or tracheobronchial<sup>1</sup> infiltration. In none of the 5 patients with a category IIb classification who underwent surgery was a radical surgical resection possible because of tracheobronchial infiltration.

### COMMENT

Bronchoscopy allows direct inside visualization of the tracheobronchial tree and plays a key role in evaluating its involvement by carcinoma of the thoracic esophagus.<sup>1,5,6</sup> In this report, we did not consider patients with infracarinal squamous cell carcinoma or adenocarcinoma because in these patients bronchoscopy is seldom performed.<sup>5</sup>

In 1984, Choi et al<sup>1</sup> proposed a classification of bronchoscopic findings in patients with esophageal carcinoma. This classification includes patients with no abnormalities in the category I, those with impingement and no mucosal changes in the category II, and those with mucosal invasion in the category III classifications.<sup>1,3</sup> There is no doubt as to the surgical

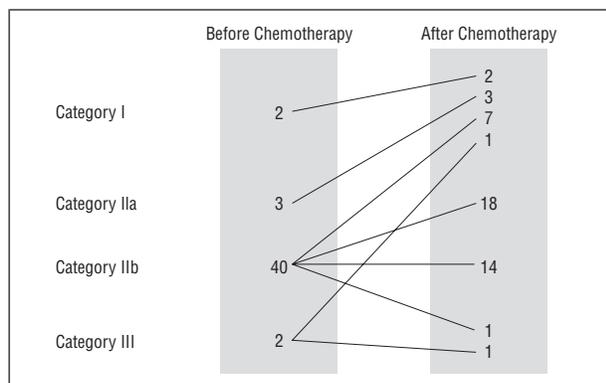
**Table 2. Bronchoscopic Staging Related to Clinical Outcome and Intraoperative Findings of Patients Who Underwent Bronchoscopy at First Observation for Squamous Cell Carcinoma of the Supracarinal Thoracic Esophagus**

Bronchoscopic Staging Category	Total No.	Not Operated on (Age or Poor General Condition)	Not Operated on (Local Advanced or Distant Metastases)	Not Operated on (Bronchial Carcinoma)	Neoadjuvant Chemotherapy	Radical Resection	Nonradical Resection (Aorta)	Nonradical Resection (Tracheobronchial)
I	33	12	3	1	2	14	1	0
Ila	17	4	3	0	4	6	0	0
Ilb	57	5	10	1	40	0	0	1
III	6	0	5	0	1	0	0	0

**Table 3. Bronchoscopic Staging Related to Clinical Outcome and Intraoperative Findings of Patients With Supracarinal Esophageal Carcinoma Who Underwent Bronchoscopy After a Neoadjuvant Chemotherapy Regimen**

Bronchoscopic Staging After Neoadjuvant Chemotherapy, Category	Total No.	Not Operated on (Age or Poor General Condition)	Not Operated on (Local Advanced or Distant Metastases)	Not Operated on (Bronchial Carcinoma)	Radical Resection	Nonradical Resection (Aorta)	Nonradical Resection (Tracheobronchial)
I	13	0	1	0	10	2	0
Ila	18	1	1	0	14	1	1
Ilb	14	0	10	0	0	0	4*
III	2	0	2	0	0	0	0

\*Two explorative thoracotomies.



Bronchoscopic findings in patients with squamous cell carcinoma before and after neoadjuvant chemotherapy.

indications in patients with category I and in those with category III classifications. Conversely, category II includes a large group of patients with evidence of impingement and no mucosal invasion. As stated by Choi et al<sup>1</sup> in their original article, the likelihood of performing a surgical radical resection in these patients is open to question because the impingement can be because of either a simple compression with no infiltration of the neoplastic mass that is adjacent to the tracheobronchial tree or early infiltration.<sup>1,3</sup> In the former instance, a surgical radical resection can be performed; in the latter, this is unlikely. Since 1992 we divided category II into 2 subcategories: IIa and IIb. In category IIa we included patients with simple compression and no tumorous infiltration of the tracheobronchial tree. This group of patients can be identified because the compression on the involved tracheobronchial tree is usually slight and its mobility is normal.

In category IIb we included those patients with compression in which the fixation of the tracheobronchial tree suggests tumorous invasion. Other abnormalities that classify patients as having the category IIb grade are widening of the carina and deviation of the trachea or bronchi, with or without narrowing.

To assess the value of this modified classification, we related bronchoscopic results to clinical outcome and to intraoperative findings of patients who underwent surgery. As expected, a radical resection was possible in most of the patients with a category I classification who underwent surgery. In those patients in whom a surgical radical resection was not feasible, it was because of infiltration of mediastinal structures other than the tracheobronchial tree. Also in patients with category IIa grade, the infiltration of the tracheobronchial tree at surgical exploration was very rare, thus demonstrating that in these patients esophageal carcinoma had compressed but not infiltrated the tracheobronchial tree, as suggested by its normal mobility. Conversely, only 5 patients with category IIb staging underwent surgery, and a surgical radical resection was never possible because of tracheobronchial infiltration. The indicators for surgery were findings seen on the computed tomographic scan or the young age of the patient.

According to our experience, category IIa identifies a subgroup of patients with fairly advanced tumor in which the tracheobronchial tree is not yet involved and a radical resection is possible. Their clinical outcome and intraoperative findings are similar to those of patients with no abnormalities at bronchoscopic examination (category I). It must be emphasized that only 17 of the 113 patients who underwent bronchoscopy at first observation were included in category IIa. Patients with a category IIa classification have been

seen more frequently as a result of downstaging after neoadjuvant CHT. In this latter group of patients, the chances of a surgical radical resection have been the same as in patients classified as having category IIa staging at first observation.

The length of the esophageal tumor seems poorly related to the category of bronchoscopic findings.<sup>6</sup> Some carcinomas have a tendency to infiltrate surrounding structures in the early stage of development, regardless of their overall length. As expected, the sites esophageal carcinoma most frequently involved have been the trachea and the left main bronchus.

The results of this study show that bronchoscopy is very useful in the tumor staging of patients with esophageal carcinoma. Compression of the tracheobronchial tree at bronchoscopic examination does not necessarily mean infiltration by esophageal carcinoma. There is a group of patients (those with a category IIa classification) in whom the tracheobronchial tree is only compressed and not infiltrated by the tumor, thus making a radical resection possible. Conversely, in patients with a category IIb classification, there is a frank infiltration of the tracheobronchial tree and a radical resection is unlikely. These patients can be downstaged by appropriate neoadjuvant CHT that would then make radical resection feasible. Accurate bronchoscopic examination with special attention to the mobility of the tracheobronchial tree allows the distinction to be made between patients with category IIa and those with category IIb classifications

with a high degree of accuracy, even after neoadjuvant CHT.

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## Announcement

**T**he *Archives of Surgery* will give priority review and early publication to seminal works. This policy will include basic science advancements in surgery and critically performed clinical research.