ORIGINAL ARTICLE

Importance of Routine Mediastinal Staging in Women With Nonsmall Cell Lung Cancer

J.L. Martín de Nicolás, A. Gómez-Caro Andrés, F.J. Moradiellos Díez, V. Díaz-Hellín, O. Gigirey Castro, E. Larrú Cabrero, J.A. Pérez Antón, and C. Marrón Fernández

Servicio de Cirugía Torácica, Hospital Universitario 12 de Octubre, Madrid, Spain.

OBJECTIVE: To study the specific importance of mediastinal staging in women with nonsmall cell lung cancer.

PATIENTS AND METHODS: Between July 1981 and September 2003 we surgically staged 2172 patients with nonsmall cell lung cancer who met the inclusion criteria for resectability and operability. A subgroup of 108 women was studied. Cervical mediastinoscopy was performed in all cases, with the addition of anterior mediastinotomy in cases with left upper lobe involvement. All patients underwent a preoperative computed tomography chest scan.

RESULTS: Cervical mediastinoscopy was performed on all 108 patients, 26 of whom also underwent anterior mediastinotomy. Positive findings were recorded in 44 (40.7%) of the 108 cases: 39 of the 108 mediastinoscopies (36.1%), 9 of the 26 mediastinotomies (34.6%), and in 5 cases (19.2%) both mediastinoscopy and mediastinotomy. Nodal involvement was found in 13% of cases in clinical stage IA and 30.8% of cases in clinical stage IB. The percentage of positive findings was significantly higher for cases with adenocarcinoma or large cell carcinoma (p < 0.05).

We performed 67 thoracotomies: 46 patients underwent lobectomy (42.6% of the 108), 7 bilobectomy (6.5%), 9 pneumonectomy (8.3%), and 5 exploratory thoracotomy (4.6%). The agreement between clinical staging after mediastinoscopy and pathological staging after thoracotomy was 47% (stage IA) and 57% (stage IB).

CONCLUSIONS: Routine mediastinoscopy is indicated for all women with nonsmall cell lung cancer, regardless of clinical stage.

Key words: Mediastinoscopy. Women. Sex. Bronchogenic carcinoma.

Importancia de la estadificación mediastínica, sistemática en mujeres con carcinoma broncogénico, no microcítico

OBJETIVO: Investigar la importancia específica de la estadificación mediastínica de mujeres con carcinoma broncogénico, no microcítico.


RESULTADOS: Realizamos mediastinoscopia cervical en 108 casos y mediastinotomía anterior en 26. Fueron positivas 44 (40.7%) —39 (36,1%) mediastinoscopias, 9 (34,6%) mediastinotomías y en 5 (19,2%) casos ambas—. Se objetivó afectación ganglionar en un 13% de los casos en estadio IA y en un 30,8% en estadio IB. El porcentaje de positividad fue significativamente mayor en caso de adenocarcinoma o carcinoma de células grandes (p < 0,05). Realizamos 67 toracotomías: 46 (42,6%) lobectomías, 7 (6,5%) bilobectomías, 9 (8,3%) neumonectomías y 5 (4,6%) toracotomías exploradoras. La concordancia entre estadificación clínica y patológica posttoracotomía fue del 47% (IA) y del 57% (IB).

CONCLUSIONES: La mediastinoscopia sistemática está indicada en todas las mujeres con carcinoma broncogénico no microcítico independientemente del estadio clínico.


Introduction

Mediastinoscopy is an essential tool for mediastinal staging of lung cancer and, consequently, for later therapeutic interventions. Recent decades have seen an increase in the number of noninvasive techniques to assess the mediastinum. Examples are contrast-enhanced computed tomography (CT) of the chest and,
Patients and Methods

Between July 1981 and September 2003, 2172 surgical explorations of the mediastinum were performed at our unit in patients with nonsmall cell lung cancer who met the oncological and functional criteria for resectability. No patient received chemotherapy or radiotherapy prior to the mediastinal evaluation. For the subgroup of 108 (5%) women included in this study, we performed preoperative CT chest scans and staging based on history, symptoms, and standard laboratory workup. Clinical staging was performed according to the revised (1997) TNM system. Nodal stations were identified according to the mediastinal mapping system of the American Thoracic Society.10,11 All cases were subject to clinical, mediastinoscopy, and pathological staging.

Cervical mediastinoscopy was performed in all patients, with the addition of anterior mediastinotomy in patients with left upper lobe or left main bronchus involvement. Anterior mediastinotomy was also performed in certain patients with left lower lobe involvement and significantly enlarged nodes in the aortopulmonary window or anterior mediastinum. All explorations were carried out or supervised by a thoracic surgeon. The presence or absence of complications was studied retrospectively by reviewing the computer files and medical history of the patients. The mediastinal nodes biopsied were 2R, 2L, 4R, 4L, 7, 5, and 6. Bimanual palpation was used to examine the pulmonary hilum during anterior mediastinotomy. Findings were considered positive when pathological indications of a diseased mediastinal node station were present, with mediastinal invasion confirmed pathologically or with indirect indication that the tumor was highly likely to be nonresectable—such as in cases of aortic invasion or spread to the hilum.

A thoracotomy was performed a few days later if findings from the mediastinal exploration were negative. Patients with only 1 station with intracapsular involvement were given neoadjuvant treatment and surgery was ruled out for patients who had more than 1 affected node station or extranodal involvement. Anatomical lung resection was performed if no oncological or functional contraindication was present and staging was completed by systematic mediastinal sampling according to pulmonary lymphatic drainage.

Statistical Analysis

Statistical analysis was performed with the SPSS 11.0 Statistical Software Package (SPSS; Chicago, IL, USA). The χ² test and, when indicated, Fisher exact test were used to compare qualitative variables; all P values less than .05 were considered significant. The percent agreement of clinical staging and staging by mediastinoscopy in relation to pathologic classification was calculated by dividing the clinical or mediastinoscopy stage by the pathologist’s classification.12

Results

Cervical mediastinoscopy was performed on all 108 women, 26 of whom also underwent anterior mediastinotomy. The mean (SD) age was 59 (12.7) years (range: 31-83). Preoperative clinical staging is given in Table 1. The histologic cell types were as follows: 67 (62%) adenocarcinomas; 18 (16.7%) squamous cell carcinomas; 13 (12%) large-cell undifferentiated carcinomas, and 10 (9.3%) alveolar cell carcinomas (Table 2).

The mean hospital stay was 2.69 (1.64) days, operating time 32.6 (12.6) minutes, and lymph node stations biopsied per procedure 3.6 (1.4). No deaths occurred. The only complications were 1 (0.9%) case of intraoperative hemorrhage of the internal mammary artery and 1 (0.9%) case of recurrent laryngeal nerve paralysis. No conversions to thoracotomy or sternotomy

---

TABLE 1

<table>
<thead>
<tr>
<th>Stage</th>
<th>Negative Findings</th>
<th>Positive Findings</th>
<th>No. of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>25 (86.2%)</td>
<td>4 (13.8%)</td>
<td>29 (26.9%)</td>
</tr>
<tr>
<td>IB</td>
<td>27 (69.2%)</td>
<td>12 (30.8%)</td>
<td>39 (36.1%)</td>
</tr>
<tr>
<td>IIA</td>
<td>4 (24%)</td>
<td>2 (60%)</td>
<td>5 (4.6%)</td>
</tr>
<tr>
<td>IIB</td>
<td>7 (26.9%)</td>
<td>19 (73.1%)</td>
<td>26 (24.1%)</td>
</tr>
<tr>
<td>IIB</td>
<td>3 (28.6%)</td>
<td>5 (71.4%)</td>
<td>7 (6.5%)</td>
</tr>
<tr>
<td>IV</td>
<td>1 (50%)</td>
<td>1 (50%)</td>
<td>2 (1.9%)</td>
</tr>
</tbody>
</table>

TABLE 2

<table>
<thead>
<tr>
<th>Type of NSCLC</th>
<th>Negative Findings</th>
<th>Positive Findings</th>
<th>No. of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenocarcinoma</td>
<td>45 (67.2%)</td>
<td>22 (32.8%)</td>
<td>67 (62%)</td>
</tr>
<tr>
<td>Squamous cell carcinoma</td>
<td>9 (50%)</td>
<td>9 (50%)</td>
<td>18 (16.7%)</td>
</tr>
<tr>
<td>Large-cell undifferentiated carcinoma</td>
<td>3 (23.1%)</td>
<td>10 (76.9%)</td>
<td>13 (12%)</td>
</tr>
<tr>
<td>Alveolar cell carcinoma</td>
<td>7 (70%)</td>
<td>2 (30%)</td>
<td>10 (9.3%)</td>
</tr>
</tbody>
</table>

*NSCLC indicates nonsmall cell lung cancer.
due to hemorrhage or other causes were required in this subgroup. Findings were positive in 44 (40.7%) cases: 39 (36.1%) of the 108 cervical mediastinoscopies, 9 (34.6%) of the 26 anterior mediastinotomies, and in 5 (4.6%) cases both cervical mediastinoscopy and anterior mediastinoscopy were positive. Local T4 invasion occurred in 5 (4.6%) cases, only 1 of which could not be confirmed histologically, although hilar spread—indicative of a nonresectable tumor—was noted on bimanual palpation. Positive findings by clinical stage (Table 3) were significantly higher ($P<.005$) in advanced stages and in tumors larger than 3 cm ($P<.05$). The percentage of positive findings was significantly higher for cases with adenocarcinoma or large-cell undifferentiated carcinoma ($P<.05$). Nodal involvement detected by mediastinoscopy was significantly greater in cases with lymph nodes larger than 1 cm on the chest CT scan when compared to smaller nodes ($P<.0005$). Sixteen (14.8%) cases involved multiple lymph node stations and 10 (9.3%) had contralateral nodal involvement (N3).

Curative resection (R0) was achieved in 62 (92.5%) of the 67 thoracotomies performed, of which 46 (68.5%) were lobectomies, 7 (10.4%) bilobectomies, 9 (13.4%) pneumonectomies, and 5 (7.5%) exploratory thoracotomies. The exploratory thoracotomies were carried out after observing pleural metastases within the surgical field (1 case), pericardial metastasis (1 case), invasion of the superior vena cava (1 case), and local mediastinal invasion (2 cases). There were no postoperative deaths. Unforeseen N2 disease, which would have been reached by cervical mediastinoscopy or anterior mediastinotomy, was found in 5 (4.6%) cases during thoracotomy; 2 (1.9%) of these cases were stage IA and 1 (0.9%) was stage IB. Table 4 shows the findings from clinical staging, staging by mediastinoscopy, and pathology, as well as the percent agreement between these staging techniques. Tables 5 and 6 show stage migration and the percentage of stage agreement between the clinical stage and mediastinoscopy stage after applying certainty criteria for classification to both.

**Discussion**

Cervical mediastinoscopy has the highest positive predictive value of all lung cancer staging techniques. Systematic mediastinoscopy—even for small tumors (<3 cm) and mediastinal lymph nodes whose smallest...
The high rate of positive findings from cervical mediastinoscopy and anterior mediastinotomy in this subgroup of women indicates a higher rate of positive findings overall—particularly in stages IA (13.8%) and IB (30.8%) and with significantly higher rates of adenocarcinoma and large-cell undifferentiated carcinoma (P < .05)—compared to series comprised predominately of men without differentiation of results by sex. If we take into account the 2 (1.8%) stage IA cases considered false negatives, mediastinal node involvement represents an even larger percentage. The incidence of alveolar cell carcinoma is also higher in women and in our study mediastinoscopy gave a positive finding in 3 out of 10 cases. For this reason, despite opinions to the contrary, we also perform systematic mediastinoscopy for this cell type—even though it is impossible to draw conclusions based on case series. Cervical mediastinoscopy can be performed on an outpatient basis, although at our unit we currently require a 1-day hospital stay.

The most common complication of cervical mediastinoscopy is dysphonia; in most cases this is transitory and caused by a lesion to the recurrent laryngeal nerve. To minimize the possibility of injuring the nerve, we do not use electrocautery in this anatomical region. In our series, we observed no cases of supraventricular tachycardia, which is often described in other studies. Anterior mediastinotomy is associated with mammary vessel hemorrhage and accidental incision of the pleura, although these complications are easy to resolve. Exploration of regions not accessible by cervical mediastinoscopy should be comprehensive—especially for hilar tumors and when mediastinal invasion is suspected—to avoid exploratory thoracotomies. We have no experience with extended cervical mediastinoscopy, although the results may be similar to those of anterior mediastinotomy in certain cases, such as nonhilar tumors and when the supraaortic trunks present no atheromatous vascular disease.

Staging agreement between mediastinoscopy and histology (Table 4) reveals a migration from stage IA to IB that may be related to the time delay between the diagnostic chest CT scan and thoracotomy; in certain cases, the delay was more than 3 months. Nonetheless, agreement for stage IIIA was 82.6%, with 17.4% of cases presenting metastatic nodes in early stages—2 (1.9%) in stage IA, 2 (3.8%) in IB, and 1 (0.9%) in IIB. Agreement between clinical staging and pathologic classification was much lower, especially in identifying patients at pathologic stage IIIA; agreement was 34% in stage IA and 43% in IB. As a result, we are unable to identify those patients who might benefit from complementary treatment. Stage migration has important prognostic and therapeutic implications and it is therefore important that staging agreement be as high as possible (Table 6). Mediastinoscopy for staging is very useful for detecting N2 disease prior to thoracotomy and, therefore, for identifying these patients for neoadjuvant treatment.

Systematic mediastinoscopy was indicated in more than 13% of the patients in this study with nodal involvement up to stage T1N0, even for cell types...
unlikely to spread to the lymph nodes, such as squamous cell or alveolar cell carcinoma. Recent studies have evaluated the relation between tumor size, serum levels of tumor markers, and cell type to determine if mediastinal explorations could be avoided; very high positive predictive values (greater than 90%) were found, but the number of patients was limited. In our study, the quality of the chest CT scan was not the same for all patients because this retrospective study took place over an extended time period and more sensitive radiological techniques were not available to earlier patients. Consequently, these factors may have skewed the results of the study.

We believe that the systematic use of prognostic mediastinoscopy in women is justified given the results achieved in this series, even for early stages of the disease.

Acknowledgments

The authors are indebted to Dr. A. López-Encuentra and Dr. F. Pozo of the Respiratory Medicine Department at the 12 de Octubre Hospital for their help with the scientific and statistical review of this manuscript.

REFERENCES