Routine surgical videothoracoscopy as the first step of the planned resection for lung cancer

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Objectives: Notwithstanding preoperative staging, a number of procedures still end in an exploratory thoracotomy as a result of unexpected findings. The aim of this work is to evaluate the validity of routine videothoracoscopy, performed as the first step of every planned resection for non–small cell lung cancer, to assess tumor resectability and feasibility of the resection through thoracoscopy.

Methods and Results: From November 1991 to December 2007, in our department, 1306 patients with non–small cell lung cancer, judged operable at conventional staging, underwent videothoracoscopy before the operation. Thoracoscopy revealed inoperability in 58 (4.4%) patients, mostly owing to pleural dissemination (2.5%) or mediastinal infiltration (1.7%). In the remaining 1248 (95.6%), thoracoscopy did not reveal inoperability. Of these, 449 (34.4%) underwent thoracoscopic resection. The other 799 (61.2%) underwent thoracotomy: 767 underwent resection, but 32 (2.5%) had an exploratory thoracotomy. Thoracoscopy had suggested unresectability in 7 (0.5%) patients, had been incompletely carried out in 4 (0.3%), and was unfeasible in 21 (1.6%) owing to insurmountable technical reasons. In our previous series from 1980 to 1991 the exploratory thoracotomy rate had been 11.6%. In the present series, after the introduction of routine thoracoscopy in the staging process, the exploratory thoracotomy rate was 2.5%. Thoracoscopy was reliable in excluding unresectability (negative predictive value 0.97). The global percentage of correct staging was significantly better ($P < .0001$) by thoracoscopy (73.3%) than by computed tomography (48.7%). Considering T descriptor, video-assisted thoracic surgery correctly matched with final pathologic staging in 96.2% of patients.

Conclusions: Routine preliminary videothoracoscopy ensured assessment of tumor resectability and feasibility of the resection through thoracoscopy and limited unnecessary thoracotomies.

Notwithstanding recent improvement of conventional diagnostic tools and the introduction of new technologies of metabolic imaging (fluorodeoxyglucose positron emission tomography [FDG-PET] or positron emission tomography–computed tomography [PET-CT]), clinical staging is sometimes not confirmed by intraoperative findings. A considerable number of procedures still end in a mere exploratory thoracotomy, or distant metastases are unveiled only a few months after the operation.[1-7] A minimally traumatic method, such as thoracoscopy, could help in decreasing the number of exploratory thoracotomies, inasmuch as it ensures a direct view of the lesion and an adequate surgical exploration. In the past, preoperative thoracoscopy for staging was used only in selected cases of pleural effusion without malignant cells, to assess pleural involvement. After the initial experiences in 1991, we[8] decided to perform routine thoracoscopic exploration in every patient with non–small cell lung cancer (NSCLC) judged a candidate for pulmonary resection after conventional clinical staging.

The aim of this work is to present our experience with videothoracoscopic surgical staging for lung cancer, systematically carried out as the first step of the planned surgical procedure.

PATIENTS AND METHODS

From November 1991 to December 2007, 1761 patients were admitted with a diagnosis of lung cancer. The clinical charts of the patients have been retrospectively reviewed with particular attention to preoperative staging, surgical description, postoperative course, and histologic type. Data have been entered in a dedicated database and analyzed by SPSS 16.0 software (SPSS, Inc, Chicago, Ill). Fully informed consent to the planned surgical strategy and procedure, as well as authorization to use personal data for scientific purposes, had been obtained from each patient at hospital admission or immediately before the procedure.

Preoperative staging included chest radiographs, CT scan of the thorax, upper abdomen, and brain, and bronchoscopy. Mediastinoscopy was carried out in cases of suspected N3 disease or extracapsular N2 invasion. PET scanning has been easily available to us only since 2005 and has been

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Abbreviations and Acronyms

CT = computed tomography
FDG-PET = fluorodeoxyglucose positron emission tomography
NSCLC = non–small cell lung cancer
PET = positron emission tomography
VATS = video-assisted thoracic surgery

performed only on selected patients with mediastinal lymph node enlargement or patients with doubtful pulmonary or distant lesions.

Clinical evaluation ruled out cancer or revealed a medical condition precluding surgery in 210 patients. In another 245 patients with confirmed lung cancer, conventional staging found an unequivocal cause of inoperability. The remaining 1306 consecutive patients with lung cancer, candidates for curative surgery after conventional staging, were submitted to videothoracoscopic exploration immediately before the planned operation (Figure 1).

Technique

We[9] have already described the technical details of video-assisted thoracic surgical (VATS) exploration elsewhere. The patient, in the lateral decubitus position as for a conventional thoracotomy, is intubated with a double-lumen tube for selective lung ventilation. Three ports are inserted in the seventh intercostal space on the midaxillary line and in the fifth intercostal space, anteriorly and posteriorly, along the incision line of the possible thoracotomy. Reusable instruments are employed. Systematic exploration from the apex to the diaphragm requires the lysis of pleural adhesions and the complete mobilization of the lung by dividing the pulmonary ligament. Videothoracoscopic exploration, however, is not limited to a mere inspection of the lung and of the pleural cavity, but can also imply other more complex surgical maneuvers such as (1) exploration of the fissure to verify the feasibility of intrafissural vascular preparation,(2) opening the pericardium to verify the possibility of an intrapericardial ligature of the great vessels, or (3) thorough exploration of the mediastinum to dissect mediastinal lymph nodes. Exploration of the superior mediastinum can involve sectioning of the azygos arch.

At the end of the exploration, the surgeon decides whether the tumor is resectable and whether the resection can be accomplished by thoracoscopy or thoracotomy. Patients in whom video exploration is not possible or patients with doubtful findings are converted to thoracotomy exploration. The patients whose conditions are judged operable at thoracoscopy are submitted to formal resection under videothoracoscopy or thoracotomy immediately after thoracoscopy exploration.

RESULTS

Out of the present series of 1306 patients, VATS exploration revealed causes of inoperability in 58 (4.4%) patients, whereas in the remaining 1248 (95.6%) no sure causes of unresectability were found. Among the 58 patients declared inoperable, videothoracoscopy revealed a small-nodule pleural dissemination without pleural effusion in 32 (2.5%) and a mediastinal infiltration in 22 (1.7%). In another 4 (0.3%) patients in whom pneumonectomy would not have been tolerated, thoracoscopy detected the infiltration of the artery within the fissure. In the remaining 1248 patients, thoracoscopy did not reveal any cause of inoperability and the patients were submitted to surgical resection. In 449 (34.4 %) patients with stage I lung cancer, the resection was carried out thoracoscopically. Of these, 230 had a lobectomy with lymphadenectomy,

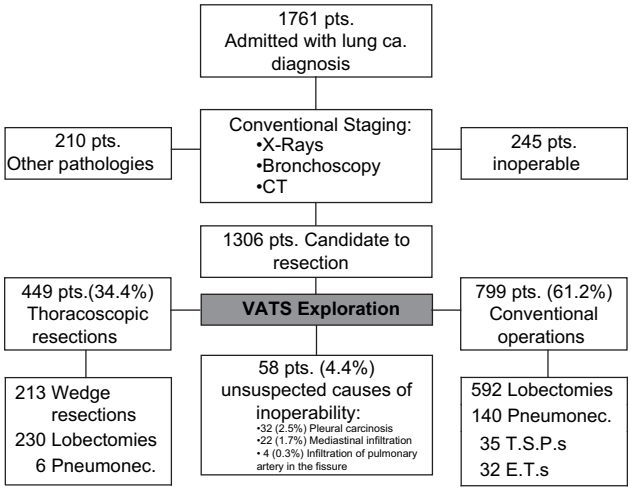

FIGURE 1. Personal experience of routine videothoracoscopic exploration carried out immediately before the planned resection from November 1991 to December 2007. *CT,* Computed tomography; *VATS,* video-assisted thoracic surgery; *TSPs,* tracheal sleeve pneumonectomies; *ETs,* exploratory thoracotomies.

6 had a video pneumonectomy, and 213 patients with poor clinical and cardiorespiratory function had a video wedge resection. The other 799 (61.2%) patients in whom VATS exploration had not revealed or confirmed inoperability underwent thoracotomy. Of these, 767 patients underwent lobectomy (n = 592), pneumonectomy (n = 140), and tracheal sleeve pneumonectomy (n = 35). In 32 (2.5%) patients, thoracotomy revealed inoperability. In 7 (0.5%) of them thoracoscopy had raised the suspicion of unresectability, but the impossibility of carrying out the resection had not been confirmed. In these cases unresectability was due to infiltration of the aorta (2 patients), intrapericardial invasion of the great vessels (2 patients), intrafissural involvement of the artery in 2 patients who would not have tolerated pneumonectomy, and, finally, intense peritumoral reaction in 1 young patient who had undergone neoadjuvant chemotherapy. In 21 (1.6%), videothoracoscopic staging was impossible for technical reasons (diffuse adhesions sealing the pleural cavity in 17 and incomplete lung collapses owing to bronchial obstruction in 4). In another 4 cases (0.3%), which occurred at the beginning of our experience, videoendoscopic assessment had been inadequately conducted, and thoracotomy revealed extracapsular mediastinal lymphadenopathy (3 patients) or intrafissural invasion of the artery in 1 patient, not amenable to pneumonectomy. Globally, video exploration was highly reliable in excluding conditions of unresectability with a negative predictive value of 0.97. Morbidity and mortality specifically referred to the preliminary video exploration has been absent.

With final pathologic staging used as the benchmark, the percentage of patients whose cancer was understaged, correctly staged, and overstaged by preoperative CT was 30.4%, 48.7%, and 20.9%, respectively (Figure 2). The global rate of understaging, correct staging, and overstaging