



## Original Article

# Experience and Development of the Video-Assisted Thoracic Surgery Lobectomy Technique: Comparative Study With Conventional Surgery in Stage I Non-Small Cell Lung Cancer<sup>☆</sup>

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## ARTICLE INFO

## Article history:

Received 10 February 2013

Accepted 22 May 2013

Available online 6 February 2014

## Keywords:

Video-assisted thoracic surgery

Thoracotomy

Non-small cell lung carcinoma

Surgery

## ABSTRACT

**Background:** Surgical treatment of stage I non-small cell lung cancer (NSCLC) can be performed either by thoracotomy or by employing video-assisted thoracic surgery (VATS). The aim of this study was to compare long- and short-term results of conventional surgery (CS) vs VATS lobectomy in the treatment of stage I NSCLC.

**Materials and methods:** We performed a retrospective, analytical study of patients undergoing surgery for stage I NSCLC during the period January 1993 to December 2005. The variables analysed were overall survival, recurrence, distant metastasis, morbidity, mortality and hospital stay. During this period, 256 anatomic lung resections were performed: 141 by CS and 115 by VATS.

**Results:** There were statistically significant differences in: (i) mean hospital stay in patients with no complications (VATS group: 4.3 days vs CS group: 8.7 days,  $P=0.0001$ ); (ii) mean hospital stay in patients with complications (VATS: 7.2 days vs CS: 13.7 days,  $P=0.0001$ ), and (iii) morbidity (VATS: 15.6% vs CS: 36.52%,  $P=0.0001$ ). No statistically significant differences were found in: (i) mortality (VATS: 2.17% vs CS: 1.7%,  $P=0.88$ ); (ii) 5-year overall survival (VATS: 68.1% vs CS: 63.8%), and (iii) local recurrence and distant metastasis ( $P=0.82$ ).

**Conclusions:** VATS lobectomy is a safe and effective approach, with a shorter hospital stay and lower morbidity than CS; no statistically significant differences were observed in survival in patients undergoing surgery for stage I NSCLC.

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## Experiencia y desarrollo de la técnica de lobectomía por cirugía torácica videoasistida: estudio comparativo con cirugía convencional en estadio I de cáncer de pulmón no microcítico

## RESUMEN

**Objetivo:** Analizar nuestra experiencia con la cirugía torácica videoasistida (VATS) y comparar sus resultados a corto y a largo plazo con la lobectomía por cirugía convencional (CPNM) en estadio I.

**Material y métodos:** Se realizó un estudio retrospectivo y analítico de los pacientes intervenidos de cáncer de pulmón no microcítico en estadio I durante el periodo de enero de 1993 a diciembre de 2005. Las variables analizadas fueron: supervivencia global, recidiva, metástasis a distancia, morbimortalidad y estancia hospitalaria. Durante este periodo se realizaron 256 resecciones pulmonares anatómicas: 141 por VATS y 115 por cirugía convencional.

**Resultados:** Se encontraron diferencias estadísticamente significativa en: a) estancia media postoperatoria en pacientes que no tuvieron complicaciones (grupo VATS: 4,3 días; grupo de cirugía convencional: 8,7 días;  $p=0,0001$ ); b) estancia media postoperatoria en pacientes que tuvieron complicaciones (VATS:

## Palabras clave:

Cirugía torácica videoasistida

Toracotomía

Carcinoma no microcítico de pulmón

Cirugía

<sup>☆</sup> Please cite this article as: Triviño A, Congregado M, Loscertales J, Jiménez-Merchán R, Pinos-Vélez N, Cózar F, et al. Experiencia y desarrollo de la técnica de lobectomía por cirugía torácica videoasistida: estudio comparativo con cirugía convencional en estadio I de cáncer de pulmón no microcítico. Arch Bronconeumol. 2014;50:57–61.

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7,2 días; cirugía convencional: 13,7 días;  $p = 0,0001$ ), y c) morbilidad (VATS: 15,6%; cirugía abierta: 36,52%;  $p = 0,0001$ ). No se encontraron diferencias estadísticamente significativas en: a) mortalidad (VATS: 2,17%; cirugía convencional: 1,7%;  $p = 0,88$ ); b) supervivencia global a 5 años (VATS: 68,1%; cirugía convencional: 63,8%); c) recidiva local y metástasis a distancia ( $p = 0,82$ ).

**Conclusiones:** La lobectomía VATS es una técnica segura y eficaz, con una menor estancia hospitalaria y morbilidad que la cirugía convencional, sin que se observen diferencias estadísticamente significativas en la supervivencia en pacientes intervenidos por cáncer de pulmón no microcítico en estadio I.

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## Introduction

During the last decade, lung cancer has been the principal cause of cancer death throughout the world and remains one of the respiratory diseases with the highest mortality rates: every year, 900 000 new cases are diagnosed in males and 330 000 in females. In the European Union, lung cancer accounts for 21% of all cancers in males and causes 29% of all cancer deaths in that gender.<sup>1</sup>

In 1993, Roviario et al.<sup>2</sup> reported the first successful lobectomy carried out with video-assisted thoracic surgery (VATS), demonstrating that lung cancer could be appropriately treated in this way while describing the surgical technique employed.

Since then, various authors have reported high numbers of both lobectomies and pneumonectomies performed using this technique,<sup>3–6</sup> with better immediate outcomes when compared to open surgery. Nevertheless, lobectomies by thoracotomy continue to be carried out in patients with early stage lung cancer. The primary aim of our study is to compare the two approaches for the surgical treatment of stage I non-small cell lung cancer and to evaluate their outcomes, with the aim of defining the real advantages of VATS.

## Materials and Methods

This was a comparative, retrospective study in our centre, analysing the short and long-term outcomes of patients with a diagnosis of stage I non-small cell lung cancer undergoing major anatomical lung resection with systematic lymph node dissection. The TNM classification (6th edition) for lung cancer was used in all cases. One hundred and sixty-one (161) major lung resections were performed using VATS and 142 were undertaken using conventional surgery. Twenty (12.4%) cases in the VATS group and 27 (19%) in the open surgery group were lost to follow-up.

The clinical variables studied were conversion rates, duration of the intervention, mortality, number of complications, hospital stay after surgery (complicated and non-complicated patients), local recurrence rates, distant metastases and 5-year survival. Pearson's  $\chi^2$ -test and the Mantel–Cox method were used for analysis, with a value of  $P < .05$  being considered statistically significant.

### Characteristics of the Two Groups

- VATS group (n=141 patients; 102 men and 39 women). Mean age was 60.4 years (range 34–79 years). Histological types are listed in Table 1, squamous cell carcinoma being the most common (45.2%). The mean tumour size was 3.1 cm (range 1.1–6.2 cm). One hundred and thirty-eight (138) lobectomies and 3 bilobectomies were performed (Table 2).
- Conventional surgery group (n=115 patients; 88 men and 27 women). Mean age was 62.6 years (range 37–83 years). As in the VATS group, the most common histological type was squamous cell carcinoma (50.7%) (Table 1). The mean tumour size was 3.6 cm (range 1.4–6.8 cm). One hundred and eight (108) lobectomies and 7 bilobectomies (Table 2) were performed.

**Table 1**  
Histological Types.

Histology	VATS (n=141)	Thoracotomy (n=115)
Squamous cell carcinoma	64	58
Adenocarcinoma	53	38
Large cell carcinoma	14	6
Adenosquamous carcinoma	3	4
Carcinosarcoma	1	–
Undifferentiated carcinoma	2	3
Mixed squamous and giant cell carcinoma	–	2
Undifferentiated carcinoma	3	4
Intermediate cell carcinoma	1	–

**Table 2**  
Lung Resections Performed in the Two Groups.

Lung resections	VATS (n=141)	Thoracotomy (n=115)
ULL	25	32
LLL	28	7
Bilobectomy	3	7
RUL	55	43
RLL	22	17
ML	8	9

Homogeneity between both groups was tested statistically with regard to sex, age, histological type, tumour size and resection type, using Snedecor's F distribution.

### Selection Criteria

**Inclusion criteria.** All patients with a diagnosis of stage I non-small cell lung cancer (NSCLC) resected between 1 January 1993 and 31 December 2005; thus, all patients would be in follow-up for a minimum of 5 years.

**Exclusion criteria.** Minor lung resections (atypical resection or segmentectomy) or major anatomical resection with pneumonectomy, sleeve lobectomy, bronchoplasty or broncho-angioplasty. Cases in the VATS group which required conversion to conventional surgery (24) once dissection had begun were also excluded.

**Selection of approach.** The choice of an open approach or VATS was a decision made individually by each surgeon after exploratory video-assisted thoracoscopy, although since that time the criteria in our department have been unified. For lung resection to be performed using VATS, the cases had to meet the following criteria:

1. Tumour <4 cm. This is the ideal size, although in our study, tumours of up to 6 cm were successfully resected, as there is usually no problem if the location is sufficiently peripheral.
2. The tumour had to be peripheral, and never in the lobar bronchi, or at least 2 cm from the interlobar carina.
3. Open fissure, although this is now in question. On the right side, the minor fissure does not present any problem in upper, mid and lower lobectomies, and fused major fissure is not a problem, neither for an upper lobectomy nor for a lower lobectomy, where the bronchus must be done before the artery. On the left side, the major fissure must be open, although in cases where the fissure

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