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## Factors affecting major morbidity after video-assisted thoracic surgery for lung cancer

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### ABSTRACT

**Background:** Video-assisted thoracic surgery (VATS) has been widely applied in the treatment of lung cancer. However, few studies have focused on the clinical factors predicting the major postoperative complications.

**Methods:** Clinical data from 525 patients who underwent resection of primary lung cancer with VATS from January 2007–August 2011 were retrospectively analyzed. Risk factors related to major postoperative complications were assessed by univariate and multivariate analyses with logistic regression.

**Results:** Major complications occurred in 36 (6.86%) patients, of which seven died (1.33%) within 30 d, postoperatively. Major complications included respiratory failure, hemothorax, myocardial infarction, heart failure, bronchial fistula, cerebral infarction, and pulmonary embolism. Univariate and multivariate logistic regression analyses demonstrated that age >70 y (odds ratio [OR], 2.105; 95% confidence interval [CI] 1.205–3.865), forced expiratory volume during the first second expressed as a percentage of predicted ≤70% (OR, 2.106; 95% CI 1.147–3.982) combined with coronary heart disease (OR, 2.257; 95% CI 1.209–4.123) were independent prognostic factors for major complications.

**Conclusions:** Age >70 and forced expiratory volume during the first second expressed as a percentage of predicted ≤70% combined with coronary heart disease are independent prognostic factors for postoperative major complications. Patients in these groups should undergo careful preoperative evaluation and perioperative management.

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## 1. Introduction

According to the statistical data released by the World Health Organization, the incidence and mortality rates for lung cancer are the highest of all malignant tumors [1–3], and continue to steadily increase. For patients with resectable lung cancer, surgery remains the most effective therapy [4,5]. In recent years, video-assisted thoracic surgery (VATS) has been widely applied in the treatment of lung cancer and has been shown to be associated with fewer postoperative complications, without its clinical efficacy being compromised [8–11]. However, postoperative complications still affect the outcome of VATS [6,7], and thus far, few studies have focused on its complications and risk factors in lung cancer. Therefore, to predict and prevent postoperative complications are worthy of further investigation.

We retrospectively reviewed the clinical data of 525 patients who underwent thoracoscopic surgery for lung cancer. Risk factors for postoperative complications were assessed by logistic regression analysis. We aimed to discover ways to lower the incidence of postoperative complications and to improve surgical outcomes.

## 2. Materials and methods

### 2.1. Study subjects

The study protocol was approved by the Ethics Committee of the Affiliated Hospital of Jiangnan University. All subjects provided written informed consent for the retrospective review of their medical records. The data of patients with lung cancer who presented to our institution between January 2007 and August 2011 were reviewed. A total of 1253 patients were selected; 569 (45.4%) patients who underwent VATS met the following selection criteria: (1) diagnosed with clinical stage I lung cancer; (2) operation performed by experienced surgeons who had completed 100 VATS cases for lung cancer; (3) no preoperative radiation or chemotherapy; and (4) no history of previous thoracic surgery or pleurodesis. Of the 569 cases, 44 (7.7%) were excluded due to conversion, resulting in 525 patients who were finally enrolled. Meanwhile, 684 (54.6%) patients who underwent thoracotomy met the following selection criteria: (1) diagnosed with clinical stage I, II, or IIIA lung cancer; (2) operation performed by experienced surgeons who had completed 100 thoracotomy cases for lung cancer; and (3) no preoperative radiation or chemotherapy. All patients also underwent the following routine preoperative testing: physical examination, blood tests, liver and kidney function, electrocardiography, pulmonary function testing, chest X-ray, chest computed tomography (CT), cranial magnetic resonance imaging, bone scintigraphy, ultrasound of the upper abdomen and adrenal glands, and fiberoptic bronchoscopy. According to the TNM staging system of the Union for International Cancer Control in 2009, preoperative staging identified 321 stage I cases and 204 stage II cases in the VATS group. Postoperative pathologic or cytologic diagnoses of lung cancer were obtained in 107 patients. Of the 525 VATS patients, 148 were combined with other diseases (28.2%) at the

time of admission and 43 (8.2%) had  $\geq 2$  concurrent diseases (Table 1).

### 2.2. Perioperative management

Patients underwent general anesthesia via double-lumen endotracheal intubation and single-lung ventilation. A 1.5 cm incision was made at the seventh or eighth rib at the midaxillary line. A Stryker 1088i Thoracoscope (30°; Kalamazoo, MI) was inserted for thoracoscopic inspection. A 3–5 cm manipulation incision was made at the fourth or fifth rib at the anterior axillary line. A 2 cm auxiliary incision was made at the seventh or eighth rib at the posterior axillary line. A coagulation hook, ultrasonic scalpel, dissecting forceps, and

**Table 1 – Patient characteristics correlated with early death and major complications.**

Variable	Number of patients (n, %)	Death $\leq 30$ d (n, %)	Major complications (n, %)
Total	525 (100.0)	7 (1.3)	36 (6.9)
Gender			
Female	236 (45.0)	3 (1.3)	17 (7.2)
Male	289 (55.0)	4 (1.4)	19 (6.6)
Age			
<70 y	396 (75.4)	4 (1.0)	21 (5.3)
$\geq 70$ y	129 (24.6)	3 (2.3)	15 (11.6)
Smoking history			
>20 pack-year	160 (30.5)	3 (1.9%)	17 (10.6%)
$\leq 20$ pack-year	58 (11.0)	1 (1.7%)	4 (6.9%)
Never	307 (58.5)	3 (1.0%)	15 (4.9%)
FEV <sub>1</sub> %			
> 70	433 (82.5)	3 (0.7)	23 (5.3)
$\leq 70$	92 (17.5)	4 (4.3)	11 (12.0)
CHD			
Yes	40 (7.6)	3 (7.5)	6 (15.0)
No	485 (92.4)	4 (0.8)	30 (6.2)
Diabetes			
Yes	44 (8.4)	1 (2.3)	5 (11.4)
No	481 (91.6)	6 (1.2)	31 (6.4)
Hypertension			
Yes	51 (9.7)	2 (3.9)	6 (11.8)
No	474 (90.3)	5 (1.1)	30 (6.3)
Chronic obstructive lung disease			
Yes	34 (6.5)	1 (2.9)	5 (14.7)
No	491 (93.5)	6 (1.2)	31 (6.3)
Stroke history			
Yes	23 (4.4)	1 (4.3)	4 (17.4)
No	502 (95.6)	6 (1.2)	32 (6.4)
Type of surgery			
Pneumonectomy	45 (8.6)	2 (4.4)	7 (16.6)
Lobectomy	394 (75.0)	4 (1.0)	24 (6.1)
Segmentectomy	80 (15.2)	1 (1.3)	5 (6.3)
+ wedge resection			
Explorative thoracoscopic	6 (1.1)	0 (0.0)	0 (0.0)
Operation time			
>3 h	126 (24.0)	2 (1.6)	13 (10.3)
$\leq 3$ h	399 (76.0)	5 (1.3)	23 (5.8)

FEV<sub>1</sub>% = forced expiratory volume in the first second expressed as a percent predicted.

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